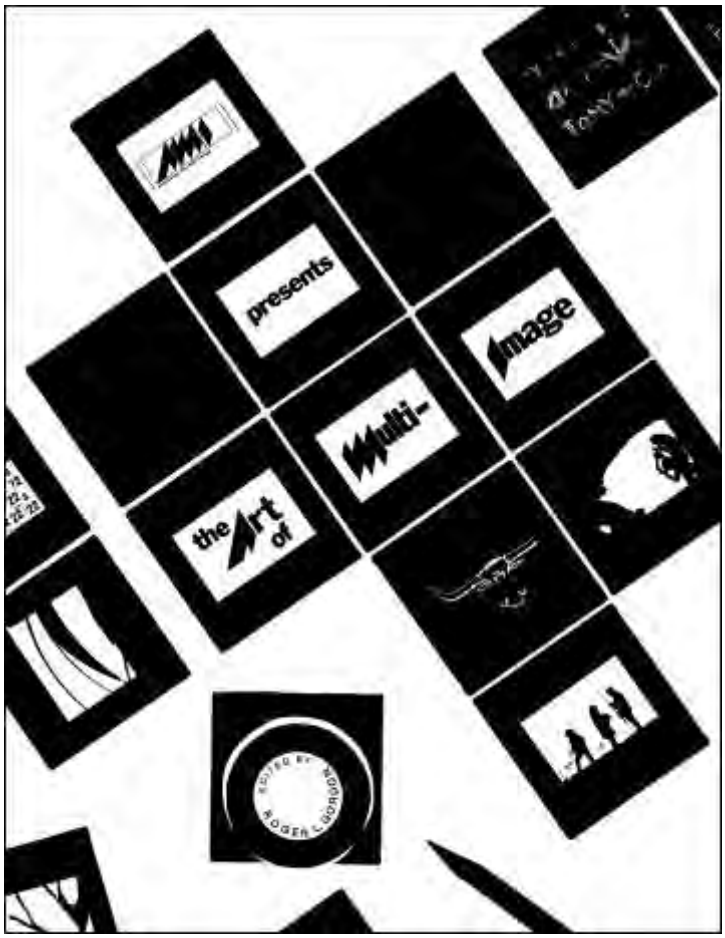


Book cover design by Bob Rowan, University of South Carolina.

The Art of Multi-Image

How to Make a Multi-Image Show | Edited by Roger Gordon

A collection of articles with directions and reference resources written by:
Carl Beckman, Ken Burke, JoNell Campbell, Palmer Dyer, Bernard Fradkin, Roger Gordon, James Hulfish, A. Arvo Leps, Donald Pasquella, Hans-Erik Wennberg, Ron Slawson, and Robert Wiseman

Including:

The Story of AMI | by Carl Beckman

Giclée Prepress—The Art of Giclée | Douglas Mesney

and

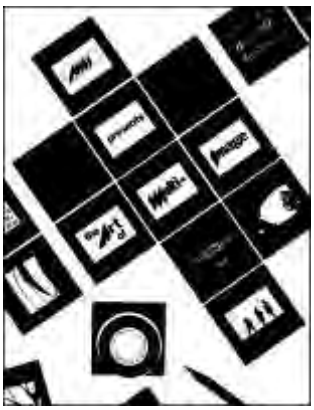
AVL Equipment Manuals

File Under: Historical Footnotes

Continued from

An Incredible Epic

Volume Eleven



The Art of Multi-Image

How to Make a Multi-Image Show | © Copyright 1978 AMI

Supplement to

An Incredible Epic

Memoir of A Multi-Image Maestro

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The author has researched the information contained in this book to check accuracy.
The opinions expressed in this book are solely based upon the author's own experience.
The author assumes no responsibility for errors and inaccuracies.
Resemblances to persons living or dead may be coincidental.
Some names may not be real.

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[1] In *The Trip to Echo Spring* by Olivia Laing, confabulation is described as "so-called 'honest lying' or false memories." I would add that, we remember (and edit) selectively what we like and repress what we don't. Wikipedia defines the term as: "… a memory error defined as the production of fabricated, distorted, or misinterpreted memories about oneself or the world, without the conscious intention to deceive."

Notes to Reader

- *An Incredible Epic* was started ten years ago, in 2015. It is a work in progress; being expanded and upgraded as new articles and pictures become available. New versions are periodically published. You can see your Edition Number on the title page (iii).

- Volume Nine is filled with pictures that relate to the first six volumes. Volume Eleven has even more, woven into a 1982 treatise called "Confessions of A Multi-Image Maniac"; that is a precursor to *An Incredible Epic* about how to produce multi-image shows. Volume Thirteen, currently in the works, is a 'catch all' for additional material being continually re-discovered in my archives.

- Videos of forty-one Incredible slide shows can be seen on Vimeo (search for 'Mesney') or www.imcredibleimages.com, threaded into an abbreviated biography. Additional shows by other producers have been restored and curated by Steve Michelsen and can be seen at www.youtube.com/@AV_archaeology/videos.

- As the Epic has evolved materially, so too has the refinement of its style(s). Please excuse the small inconsistencies you will encounter. And please don't fret about any spelling errors; they are elusive little buggers; but let me know about them, please.

- The original Epic was split into seven parts when the size of the single volume overwhelmed Microsoft Word (I should have used Adobe InDesign). The index (Volume Eight) could not be split and ceased being updated. Thus, the index is of limited usefulness, covering only the content in the original manuscript – about 80% of Volumes One through Seven.

- Although unable to contact every person or publisher about the reproduction of their likeness or work, this book is a non-profit treatise written for historical and educational purposes. [Under fair use, another author may make limited use of the original author's work without asking permission. Section 107 of the Copyright Act of 1986 (17 U.S. Code § 107) states that fair use of copyrighted material "for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research, is not an infringement of copyright."] I hope nobody is unduly offended for their contribution(s) to this confabulation.[1] Please notify me of discrepancies, inaccuracies, and/or omissions.

[1] Confabulation has been variously described as so-called 'honest lying' or false memories fabricated, distorted, or misinterpreted about oneself or the world, without the conscious intention to deceive. I would add that, we remember (and edit) selectively what we like and repress what we don't.

In memory of these mentors, colleagues, and friends, who departed during the production of *An Incredible Epic*:

Phillip Augustin
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Constantine Zacharious

With appreciation for their contributions
to my life and well-being.

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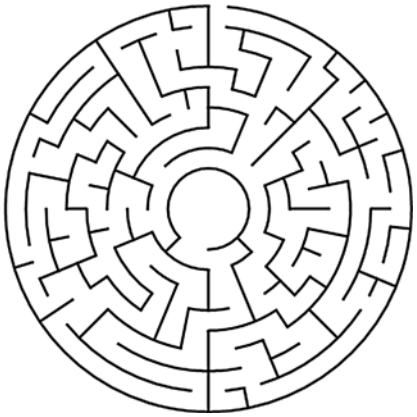

"You have to go where the story leads you."

Stephen King (PBS interview)

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- ShowPro VB digital, memory programmer
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PREFACE

What do they say, "Those who can, do; those who can't, teach"? That is not an unfair statement in this case; the writers of *The Art of Multi-Image* were educators. They were also the founders and first members of the Association for Multi-Image (AMI). The book was 'out of date' before it was printed. Maybe 'irrelevant' is a better word. The march of technology outpaced the educators who wrote about it.

The Art of Multi-Image is part "how to" and part reference. The 'style' of writing—an oxymoron in this case; it is a collection of 'essays' written by a dozen men—is pedantic, as might be expected of the college crowd. Parts are downright laughable; as if written for nincompoops. For example, there are detailed instructions about how to use slide sheets and light tables. (!)

The level of simplicity is breathtaking. Although started in 1976 and finished in 1978, the writers describe the kind of simple shows that I and others produced half a decade earlier without any instruction books. By 1978, 15- and even 30-projector shows were ubiquitous. AVL and TEAC had won the lion's share of the market, leaving behind the companies described in *The Art of Multi-Image*; companies like Wollensak, Bell & Howell, DuKane, et al; makers of the first slide-control gear.

That said, the book's reference materials are complete, scholarly, and impressive. For example, some thirty companies are listed as Manufacturers of Program Control Devices (and 'synchronizers'). Holy cow; I never knew there were so many—never heard of most. (That's what I mean about being irrelevant.)

From an historical perspective the book is a rare treasure; hard to find. It has been out of print for forty-five years. The copy loaned to me by Richard Allison had been discarded by a public library; he found it at Abe.books.com. It is not printed on the best paper and will disintegrate sooner or later. Thus, to preserve its contents for the sake of history, and with the blessings of Ken Burke, one of its creators (the rest are scattered to the wind), and Marilyn Kulp, the last AMI director, *The Art of Multi-Image* has been reproduced on the pages that follow. The digital facsimile does not do justice to the book's pictures; however, there is no justice to be done, really; the photos are lousy to begin with.

The Art of Multi-Image was launched at an inflection point in the history of AMI. In 1978, the Association for Multi-Image. AMI had about 500 members, they were all educators or students. Much of the book discusses the appropriateness and feasibility of using multi-image shows in classrooms; did they improve education in a cost-effective way? The discussions read like a justification for the college boys to have more fun with more toys.

1978 was also the year of the first Vail International Multi-Image Festival; an event held by and for commercial producers of multi-image shows, virtually none of whom were members of AMI. That caught the Association by surprise. Ensconced in the Halls of Academe, news of the commercial world never penetrated their bubble. They had no idea how many producers were out there; or about the penetration of multi-image into business communications and theater. Shortly after the second Vail Festival, that organization merged with AMI and the rest is history. From that point on, commercial producers dominated the Associations' membership and their shows ruled AMI Festivals [Read more in Volumes Three and Four; starting with *Rocky Mountain High*, page 487.]

SECTION ONE

THE STORY OF AMI | by Carl Beckman

Carl Beckman's history of AMI provides a necessary backstory to Roger *Gordon's Art of Multi-Image.* The Association for Multi-Image was founded by the same guys that contributed to that tome—Carl Beckman, Ken Burke, JoNell Campbell, Palmer Dyer, Bernard Fradkin, Roger Gordon, James Hulfish, A. Arvo Leps, Donald Pasquella, Hans-Erik Wennberg, Ron Slawson, and Robert Wiseman.

Personally, I never knew any of them, except Ken Burke; although it is likely I met Carl along the way at one AMI event or another; and Roger Gordon was on the Board of Directors of the Vail Festival, where I met him; but nothing about any of the others; and nothing about the roots of AMI. That is why Carl's article is, for me, real 'inside baseball' stuff; that happened before my time—or, more accurately—at the same time, in a parallel universe; another dimension

Participating in the Vail Festival as a director had to have been a real eye opener for Roger. In AMI circles, he was the proverbial big fish in a small pond. At Vail he was the lone representative for the Halls of Academe. The eleven other directors all represented commercial interests of one sort or another:

- Walt Blackwell; chairman | IBM (Boulder, Colorado)
- Vince Bonacci | DD&B Studios (Detroit, Michigan)
- Carl Faller | Wren Associates (Princeton, New Jersey)
- Yours Truly | Incredible Slidemakers (New York, NY)
- Rick Baker | Photo Communications Corp. (Jenkintown, Pennsylvania)
- Huib Broekman | Hollan Business AV (Lelystad, Holland)
- Sven Lidbeck | Audio Visual Centrum (Stockholm, Sweden)
- Brenda Cross | Kodak (Rochester, NY)
- Joe Ruggiero | Ethen Allen (Danbury, Connecticut)
- Marsha Gewirtzman | AT&T (Morristown, New Jersey)
- Paul Starzynski | International Communications Agency (Washington, DC)
- Roger Gordon | AMI

The goings on of the Board were organized and recorded by Sylvia Allen, a paid consultant. She was formerly with AT&T and then AVL, briefly. In short, another commercial player.

The business-related character of Vail's board would soon rub-off on AMI's. By the end of the 1970s, only Ken Burke remained active, along with the organization's director, Marylin Kulp, was with AMI from the very beginning.

The world that manifest AMI was simpler; more naïve, in an innocent way. It was a time when every smart home had a Kodak Carousel projector; when a two-projector dissolve was 'awesome.' Keep that in mind while perusing *The Story of AMI*.

The
Association for Multi-Image International

Carl Beckman Founder President

Roger Gordon Founder Executive Director

The Story of How AMI Began

By Carl Beckman

Forward

Carl Beckman called me a few weeks ago. He told me he was going to write the story of how he and Roger Gordon founded AMI 35 years ago. What a blast from the past! Could it have really been thirty-five years? My God, I was only 33 then! Carl drove down from the Orlando area to my home in Boynton Beach, FL and we had lunch together. Story after story was told. Nostalgia was flowing through that restaurant like a tidal wave. No doubt about it. AMI changed its members' lives and made communication history. AMI helped producers make a lot of money and created a professional social network that was astounding. It set off a revolution in the communications industry worldwide. Carl and Roger were true visionaries, but how many of you know them? But back to the lunch.

What a memory Carl has. I paid for lunch. "Albie, you paid for dinner the last time, in Boston. You took me to Schroeder's decades ago." AMI/New England members who are reading this will have already laughed. Schroeder's was one of Boston's finest restaurants, and a big client of mine. Our AMI/New England Chapter was partially subsidized by Schroeder's. And, for sure, national AMI would never have survived without Carl and Roger and Jack Daniels. I maintain that the best parties in the communications industry, by far, belonged to AMI, but I digress.

Most of us remember AMI International as exciting local Chapter meetings, many with large, yearly festivals and, of course, the week long annual AMI International festivals - extravaganzas in destinations like Phoenix, Dallas, Orlando, Philadelphia, and Los Angeles. (And let us not forget Ken Burke who remains the "Father of Judging" for those Festivals.) We had our association Magazine, *Multi-Images*, which became a slick, glossy magazine. Photographers competed to have their image grace the front cover. Need literature or AMI Focus Slides? Just call Executive Director Marilyn Kulp at our AMI International Headquarters in Tampa, FL. Want to show the cream of the crop in Multi-Image? Put your Chapter's name on the waiting list for one of the two AMI Gold Tours. It went on and on. As an AMI/New England Chapter President, and later an AMI Board of Director and then as President of AMI International, I was lucky to have discovered AMI when it was really taking off like a rocket. But that is not what Carl's story is all about. Most of the membership of AMI International probably never heard of Carl Beckman and Roger Gordon and AMI's early years.

And when Carl and Roger founded AMI, (Later the name was changed to The Association for Multi-Image International) they had no idea of what they were getting into. They started from ground zero, with nothing but the conviction that multi-image was going to be one of the great communication mediums. I knew Carl and Roger
through our first Chapter President of AMI/New England, Hans-Erik Wennberg. Hans was then the Assistant Director of the Audiovisual Department at Rhode Island College.

Hans was also one of the educators who was ahead of the curve. He served as an AMI Founding Board of Director. Hans and I have remained great friends since we met in 1981. Six out of the nine original individuals who served as AMI Founding Board of Directors were educators. And to this day, I think AMI International made a great mistake in not

making our organization more inclusive and recruiting more individuals from colleges and universities to honor and protect our educational heritage.

Roger Gordon

Roger Gordon enjoyed a wonderful teaching career at Temple University in Philadelphia. For 31 years he was Professor of Educational Technology and taught motion picture industry history. In addition to his teaching at Temple, he tours of educators throughout the world and into the Soviet Union as early as 1968, when things were quite cold in the cold war. Roger edited the classic multi-image textbook, *The Art of Multi-Image*, which promoted the multi-image industry for many years. He was AMI's non-paid first Executive Director for seven years.

Roger has many other interests. He is a Grand Sheik, a leader of a *tent*, in the Sons of the Desert. Sons of the Desert you say!? http://home.earthlink.net/~sons_secretary/ Are you getting the feeling that Roger is not your "average" Professor. Sons of the Desert is the name of the International Laurel and Hardy Society, devoted to keeping the lives and works of Stan Laurel and Oliver Hardy before the public, and to have a good time while doing it. Roger is also an Editor of the organization's magazine. He and his wife, Sharon, have traveled all over the world to Sons of the Desert conventions.

Roger, always the performer, comes to his love of comedy and film through his genes. His mother was a film actress and his father a film producer. During his 31 years at Temple Roger collected over 300 16 mm films that told the story of film history. Roger screens movies for friends and family in his home theatre, a replica of those great movie houses of the past with a black bordered screen, complete with a stage, motorized screen curtain, color lights that turned on when the film began and state of the art sound system. Roger donated a part of his collection to Cinekid, a local organization teaching young boys and girls' film production. http://www.cinekid.nl/
Roger says, "No one really retires." And after "retiring" from Temple University in 1996, he started a new career doing something he always wanted to do. Roger became a performing ventriloquist and played many venues in the east coast, as well as on cruise ships. And Roger still performs today. Wouldn't it be great to be on a cruise ship and watch Roger perform, followed by Todd Gipstein and his wife, Marcia, performing their magic act?

Roger and Carl became friends in 1972, when Carl traveled to Philadelphia to talk with Roger about holding a symposium on multi-image. At that time Roger was coordinating the multi-image festival for the Association for Education Communication and Technology (AECT).

Carl and Roger are still best buds and avid golfers. Carl will travel to Philadelphia to continue their pastime at one of the best courses in the country, at the Talamore Country Club where Roger is a member.

Carl Beckman

Carl began his career teaching art at a junior high school in Prince Georges County, Md. He then became a graphic artist in the same school system. Later he took a position as an Instructor at the University of Maryland, eventually founding and serving as the Director of the Instructional Design Center. He was also the Executive Producer of Instructional Television at the University for the School of Dentistry. Carl was the Owner/President of Beckman Associates, the Product Manager of Ringmaster Products for Bell & Howell, National Sales Manager for the Charles Bessler Company and a Vice President of Alan Sarfaty Associates where Carl was instrumental in the development of CD-ROM technology for the U.S Navy. Carl was given a lifetime achievement award by the U.S Geological Survey for his contributions to computer aided technology centered on CD-ROM.

Carl wrote two textbooks on *Sound Slide Production*, one for 3M Company and one for Bell& Howell. He held a contract with 3M for three years to put on workshops across America on *How to Produce Effective Sound Slide Shows*. He trained thousands of future in-house corporate producers, many of whom would become multi-image proponents.

Carl had tremendous industry contacts and knew what companies like Bell & Howell, Kodak, 3M, Arion, and others were contemplating. He knew what state-of-the-art was in AV, and more importantly, what people were planning for the future. He was the prophetic industry deal maker for AMI.

Two Visionaries

Carl Beckman and Roger Gordon are giants within the worldwide Communications Industry. Through them AMI developed into a true international organization enabling multi-image producers around the world to produce a one-of-kind communications message with astounding impact. For-profit and non-profit corporations tapped into billions of dollars of sales and donations. AMI producers made you laugh, made you cry (on cue, of course) motivated your sales force, explained your employee benefits, put the pizzazz into your sales meetings, launched your products, wowed your financial analysts, sold national commercials on sports networks, enhanced your Public Relations, made people vote for you, made people donate to non-profits, explained new concepts and also produced breathtaking art shows. On and on it went.

How did Carl and Roger have the vision to understand that multi-image would shortly come of age? The important point is that they saw it coming, ahead of the curve, and they ran with it. They were not afraid to plunge in. Multi-image was in a crude infancy when they founded AMI. They kept the concept of a professional organization, alive. They nurtured and grew AMI, and eventually multi-image became of age. When AMI and multi-image were strong enough, so that others could run the organization, these two educators went on their way to other things. No fanfare, no medals - pure satisfaction.

Bob Rowan, a great writer, photographer and multi-image producer sent an email to Carl a few days ago. Carl shared it with me:

" . . . And to be realistic, AMI was, in a way, a PERFECT STORM of technology and the need for good communication in education and industry, meeting a group of people who had a huge need to communicate in a very different way. It is my premise that you and Roger and an important handful of people took this PERFECT STORM and gave it a path. Once it was on that path, the medium gathered so much momentum that it ran (in many ways) on its own power for a while, with future board members, producers, clients, and manufacturers trying to contain it. When technology changed in the 90s, the storm ceased. . . . AMI was one of the best associations that ever came along for many of us. You and Roger should be on a plaque somewhere in the Communications Industry Hall of Fame for starting something that became an enigma. And I guess that is what perfect storms do. They begin small, get big, effect a lot of people, and then they go away. But unlike most perfect storms, this one left a very positive effect on the communications industry that evolved into other, smaller storms that would never have the impact that AMI did on so many people."

Ask any member of AMI International the effect AMI had on their lives. The answer always comes back, "AMI changed my life. What a wonderful medium; what a wonderful time!" Thank you Roger and Carl. Thank you Schroeder's and Jack Daniels.

Albie Walton
Past President, AMI International 1990-91
awalton@rcn.com
Boynton Beach, FL
May 12, 2009

Preface: As I look back I realize that Roger Gordon and I were to embark on a journey together into uncharted territory. It was an exciting adventure down a road filled with initial success and set backs, financial struggles and pitfalls. Along the way we were to develop a friendship that continues to this day. Over the next several years Roger and I were to meet many talented, hardworking and dedicated individuals, all of whom contributed in so many different ways to the success of a then fledgling professional society.

AMI would change the lives of many men and women, especially their career arch as well as alter the audio visual industry landscape. For some including me and Roger, AMI would be a significant part of our lives for many years. It took two men to set in motion a sequence of events that would lead to the creation of a professional society. Multi-image technology would for at least a decade dominate the audio visual industry. It would take many more men and women to insure AMI's initial success. Here is the story of how AMI began.

The Beginning

In 1973 I was the Director of the Instructional Design Center at the University of Maryland. Prior to this position I taught audio visual instruction and wrote courses of study for audio visual instruction at the Instructional Technology Center in the College of Education. During my tenure at the ITC Donald Perrin joined the faculty as Assistant Director. Don came from California State University. While at Cal State he was instrumental in the teaching of and the production of multi-image. Don had even invented a three slide projector control devise. It was a crude controller and not all that reliable. He used a box with relay switches connected to the slide projectors. Using a rotary phone dial, signals could be recorded on an audiotape recorder while using a separate track for the music. The net result was a multi-image slide show with slide projectors that would turn on and off. I like to think of these early multi-image shows as I would envision the first airplane taking flight.

While we were using this slide projector technology at the University; two companies Audio Visual Laboratories and Spindler & Sauppe' were developing a microchip programmer that would revolutionize multi-image. I should note that the state of the art technology for manufactured slide projector control at that time was the punch tape along with projector dissolve. AVL would win the race to introduce the microchip. Many more companies would of course manufacture slide projector control and dissolve products.

As I recall it was the fall of 1973 when I got the idea of conducting a symposium on the efficacy of multi-image as a communications medium. The logical venue for this symposium was the Association for Educational Communications and Technology, AECT. The membership of AECT is made up of audio visual media directors and instructors in public schools, colleges and universities. In conjunction with AECT's annual convention and tradeshow a multi-image festival was held. Colleges and universities from all over the country entered and screened their shows during the several days of the convention. I called Fred Wherlie, the program and convention coordinator of AECT and asked to be put on the program.

Fred informed me that the program was full but suggested that I contact Roger Gordon at Temple University. Roger was the Producer/Director of the AECT Mulit-Image Festival. Fred suggested that perhaps Roger could find space for me on the festival program. I called Roger and told him of my idea. He thought it was an excellent idea and invited me up to Philadelphia to meet and plan for the incorporation of the symposium in the festival. We met at the faculty club over lunch to discuss the length and content of the symposium. This initial meeting would be the beginning of a friendship that has lasted to this day. From the very beginning I knew that we would work well together. We did in fact develop a partnership that I believe was critical to the success of AMI.

In May of 1974 the AECT convention was held in Atlantic City, New Jersey. I conducted the symposium assisted by Roger. At the symposium I gave each attendee a questionnaire to fill out. I wish I had kept a copy because the details are lost to memory. After we tabulated the results of the survey we concluded that we had a huge success on our hands. One of the most important questions was, "Would you like to see the establishment of a special interest group – SIG -- within AECT?" One hundred percent said yes! Armed with the results Roger and I decided to request the establishment of a SIG from the AECT Board of Directors. The idea of forming an independent non-profit Association was not in our thinking at that time.

That summer Roger took the train from Philadelphia to Washington, D.C., head quarters for AECT. I had arranged a meeting for the both of us with Howard Hitchens, Executive Director of AECT. Hitch as he was called by his nickname informed us that the Board of Directors had decided to place a moratorium on the formation of anymore special interest groups. Hitch never informed me of this prior to our meeting. Roger and I were stunned. Roger returned to Philadelphia. After this disappointment we decided to go ahead and organize as an independent association. I believe and Roger would agree; that had Hitch allowed us to form a SIG, AMI would never have emerged as an independent association. We were both educators and AECT was our home.

The multi-image festivals would continue to be held independent of the Association for Multi-image at the AECT annual conventions until 1980.

This is speculation on my part but I believe that had AECT sanctioned a multi-image SIG AECT would have attracted the commercial producers. There was no organization or event, where commercial producers could gather and showcase their productions. Later another professional communications association would provide a venue for the commercial producers and I will get to that later in this story.

The Sugar Loaf Meeting: A small step forward

Once back in Philadelphia Roger and I exchanged phone calls over several weeks. We decided that we should move forward with the founding of AMI. Roger suggested that we contact several of our associates and meet at the Temple University Sugar Loaf Conference Center in Germantown. Part of the conference center was a large 19th century mansion willed to the university by a wealthy industrialist. We met for three days organizing the association. The founding Board of Directors was:

Carl Beckman
University of Maryland
Charter President (retired)

Bob Wiseman
Eastern Illinois University
Charter Vice President

Roger Gordon
Temple University
Charter Executive Director, Acting Secretary/Treasurer (retired)

Hans Wennberg
Rhode Island University
Now teaching at Elizabeth Town College

Norm Sauppe
Spindler & Sauppe
Los Angeles, California (retired)

Ron Slawson
Santa Fe Community College
Gainesville, Florida (retired)

Don Perrin
University of California later taught at the University of Maryland (retired)

Victor Edmonds
Last known working for AT&T

Carol Crew
Last known working at the Philadelphia Detention Center

Roger may disagree with me but I believe had we known how much time of ours it would take, including the tremendous effort and workload we would never have moved forward with the founding of AMI. I do know that Roger will agree with me that it was an exciting undertaking and yes, a lot of fun. The initial membership makeup of AMI was educators. Later at the multi-image festival in New Orleans commercial producers would join the association and take it to another level.

Prior to our initial meeting Roger sought out a firm that would help him process memberships. By default he was the ex-officio membership chairman of a non existent association! We were not officially incorporated until 1976. It was a leap of faith for many people to send Roger their membership dues. He found Bill Evans listed in the yellow Pages in Abington Pennsylvania; just down the road from his house. Bill owned and operated a company – Abington Association Management. He managed several small non- profit associations. Bill's services included maintaining membership records and dues. He provided an answering service, wrote correspondence, published newsletters, coordinated promotions as well as conference and tradeshow management. Bill provided all these services on a pro-rata basis. This business arrangement allowed us to operate on a shoestring budget for two years. It was touch and go financially and we almost did not make it. Bill attended our first organizational meeting at the Sugar Loaf and was instrumental in helping us write our Constitution and Bylaws.

At this point there needs to be some clarification of the role of Carl Beckman and Roger Gordon in the organization of AMI. The original board voted me as the President.
It was decided by their vote that I would serve as President for five years. The rationale was that the Association would need a continuity of leadership for at least that amount of time. Roger was appointed Secretary- Treasurer Later he would serve as the Executive Director – at that time a non paid position – He would serve as a non paid Executive Director of AMI for eight years.

The NAVA Multi-Image Festival: A big step forward

As I noted we struggled financially for two years. In 1975 I exchanged phone calls with Harry McGee, Executive Director of the National Audio Visual Association, (NAVA) now known as the International Communications Industries Association, (ICIA). Eventually I met with Harry to discuss the possibility of holding a multi-image festival in conjunction with NAVA's annual audio visual dealer conference and tradeshow. I went to this meeting with Harry hat in hand. I informed him that we did not have a lot money (actually we did not have any money). Harry was way ahead of me. He told me NAVA would provide the festival space rent free. NAVA would also underwrite the cost of promotional literature. All I had to do was get the staging hardware and projection equipment. In addition I had to provide the staging personnel and the projection grid. The success of the festival would decide the fate of AMI.

I called Norm Sauppe' and told him of my plans for the festival in New Orleans. Norm assured me that he would, at his expense, provide the projector controllers and dissolve equipment. Harry put me in touch with Irv Stapsy who owned Buhl Optical in Pittsburgh. Irv provided the lenses and the projectors. Bauer Audio Video provided the projector stands, screens and staging equipment.

Pete Mather, Coordinator of Media Development at Los Angles City College, brought five students along with their productions to New Orleans. I brought three of my graduate assistants and two shows that I had produced. Palmer Dyer from Ithaca College lectured on the 10 major strengths of multi-image. I have not kept records of all the shows that were screened nor did I keep copies of the two shows that I produced and I wish I had.

The festival space was allocated, was based on the predicted attendance for the two days that the festival would run. We planned on 50 for the Saturday show and 100 for the Sunday show. One hundred people attended the Saturday show and 300 people came to the Sunday show. It was standing room only. We had to pull back the curtains that enclosed the show to accommodate everyone. I did not anticipate the independent commercial producers of multi-image would be all that interested. It was a huge underestimation on my part. Word of the Saturday show got around the convention floor and the Sunday show as I noted was jam packed, including a large contingent of independent producers. We handed out the very first issue of the *AMI Multi-Image* Journal. Roger was the Editor. Our problem was that we did not bring enough copies and ran out at the Saturday show.

Two outspoken producers chided me for not including commercial producers in the festival; hey I was an educator, I lived and worked in the academia world. Two results of this show would change the direction of AMI and establish AMI as a force in the audio visual industry. Our net profit was $60,000! That does not seem like a lot of money today but keep in mind this was 1976. I assured the independent producers that AMI would make room for them and everyone would receive an issue of the Journal. The success of the Journal was critical to the success of AMI as was the income derived from the festival.

Bob Rowan's first cover as Journal Editor

I cannot understate how important the Journal was to the association. It Journal was to become the source of information as to what was going on in the multi-image industry. The

Journal became the place for manufacturers to advertise their products and was an excellent income producer for the association. Roger started the Journal and served as Editor. However his duties would increase as he took on more and more of a workload. Later Bob Rowan from the University of South Carolina took over as Editor/Art Director of the Journal. This was of course much to the relief of an overworked Roger Gordon. Bob would take the Journal to a new level of professionalism. Roger now had a tiger by the tail. Back home he had to process well over 200 new memberships, a daunting task.

Membership Growth

Over the next several years membership would continue to grow under the leadership of Hugh Gardner. Hugh was asked to "join" the Board of Directors by Roger. At that point in time board members were appointed not elected. Hugh was then a Professor at the University of Georgia and an active member of the AECT. He crafted a membership program that would eventually grow our membership to over 5,000 worldwide.

We continued to hold the festival in conjunction with NAVA for two more years. Harry had the vision and the business acumen to understand the importance of the relationship with AMI. That early and brief association would fuel the NAVA membership and multi-image manufacturers would commit to exhibit at the NAVA tradeshow. You may or may not know just how important trade shows are to a non-profit association. Tradeshows are the single biggest income producer. Tradeshows are vital to the financial health of an association. Working with Harry McGee was really "Association Management 101" for me. Roger and I discussed the need to stage and produce our own convention/ tradeshow. Our very first convention was held in Chicago at The O'Hare Airport Ramada Inn. Roger the showman would produce a spectacular conference and tradeshow; but I am getting ahead of myself.

Our First Convention: An even bigger step forward

Putting together a tradeshow and a conference is no easy thing even for a well established and well staffed organization; there are a thousand details to attend to as well as an enormous promotion effort. Roger was the detail man and I was the promotion man.
Prior to the AMI convention taking place, I had conversations with Clyde Harris, the Mincom Division Marketing Manager at 3M Company. Mincom manufactured slide control and dissolve control products under an OEM agreement with the Arion Company in Minneapolis. Clyde and I had met at the New Orleans festival. At that meeting in New Orleans, he expressed his interest in AMI and wanted to become a part of it. He offered to use 3M resources to support and promote AMI. Needless to say I was overjoyed. He had the AV industry prestige and the contacts. Later he would be influential in my decision to start my own business. I don't think I am alone in saying that AMI changed my career arch. It was a major decision and a scary one. Academia is a completely different world than the business and I was learning managerial and business skills. I mention all of this because the success of AMI was really the consequence of interpersonal relationships; not just mine or Roger's but many, many more AMI volunteers.

Clyde offered to chair the AMI tradeshow committee and the very first person he contacted was Dick Schievo at Eastman Kodak. Dick was the Audio Visual Marketing Manager at Kodak; talk about a heavy hitter! He would assemble his committee and the planning for the tradeshow would move forward. The stature of 3M and Eastman Kodak in the audio visual industry was such that their participation would insure many more exhibitors would participate in our tradeshow. Armed with the financial wherewithal from the NAVA festivals, Roger began the planning of the conference itself. Roger and I recruited a number of volunteers. Roger flew to Chicago with Clyde and they decided to hold the conference/tradeshow at the Ramada Inn at O'Hare Airport. Clyde a savvy guy, decided on the Ramada because of the Chicago unions. These unions were notorious for their unreasonable demands. One union in the early negotiations for a downtown location insisted that we have one man for every projector! We would have had twenty five bent nosed guys standing around for all the shows. With his industry influence Clyde sold out the exhibit space.

Roger -- ever the showman -- planned and produced a terrific conference. The early days of multi-image screening were fraught with failure. A show would start then stop. A frantic effort was made to rewind and re-cycle all the projectors. The show would once again stop and the re-start procedure would begin yet again. This could happen several times. Another problem was the length of time it took to set up the next show for screening. Roger had a brilliant solution to these two problems; violins and champagne.
He hired a trio of violinists dressed in tuxedoes to walk the festival floor between shows and to jump into action when a show failed and fail they did. Fortunately the audience was comprised of fellow producers who were for the most part sympathetic.

Now here is the brilliant part of his showmanship. During a pause in the screening or if a show failed and it took too much time to restart, the waiters would serve more champagne and the violinists would play. The festival was a major hit and the tradeshow was also successful to the degree that in the following year many more manufacturers would exhibit. As for me, I was excited, exhilarated and relieved. We had pulled off a major undertaking and at a huge financial risk. The bottom line was that the commercial producers found a home and the manufacturers another venue to promote their products.

The Last Big Step: and several more to follow:

Abington Associations: later original AMI headquarters

AMI was officially incorporated as a non-profit professional society in 1976.
Back at AMI headquarters now housed in Bill Evans' offices the workload on Bill's staff increased. At that point he decided to retire and we took over the building's lease and staff payroll. We now had an official headquarters address. Bill Evans died in 1978.
I want to stop right here in this story and write a little about Bill Evans. It has been said that "you can judge a man by the number of people attending his funeral." At Bill's funeral, it was standing room only. He had a lot of outstanding qualities; integrity and ethics were two of them. Both Roger and I came to rely heavily on his counsel. Before making any decisions I always ran the issue by him. In the very early days Bill believed in AMI while Roger and I had our doubts. There were times when we could not pay for his services and he carried us. Bill and Roger were to develop a close working relationship; but more critical to our success was his belief in Roger and me.

Roger, with Marilyn's assistance ran our association. He was a natural for this position. In short the association staff loved working for Roger. His demeanor and enthusiasm was infectious. I used to love to go to Abington for staff meetings because the staff was a joy to work with. The staff would take on any task and work hard.

Earlier Roger had begun work on editing the AMI textbook, The Art of Multi-Image. Bob Rowan designed the cover. I should note that Bill Evans advanced Roger the money to print the textbook. Several people contributed chapters to the book. One significant chapter was written by Ken Burke. This particular chapter was titled "Criticizing the Presentation". Later Ken would develop the criteria for judging the annual AMI awards.

As I said in the preface it took two men to found an association but many, many more men and women to make it work.

Local Chapter Growth:

At some point during my administration we began the formation of local chapters. Producers wanted to meet on a regular basis and the chapters provided that venue.
Local chapters would hold their own award festivals and conduct production workshops.
I cannot go into much detail here because chapter growth took place after my last stint on the Board of Directors.

The AMI Festival Award:

Photo by Todd Gipstein

Prior to holding our first award festival I worked with Norm Sauppe to design the award itself. Norm found a local crystal class- cutter in Los Angles. He shipped the prototype to me for approval. Roger liked it as did the Executive committee and we ordered several for the festival. The festival was to become a major event in AMI. If a producer could win an award he or she could use that achievement to solicit business. In fact many producers took their clients and prospective clients to the national festivals.

Earlier I noted that Ken Burke had contributed several chapters to the Art of Multi-Image.
Ken had begun the development of judging criteria for evaluating shows.
As an outgrowth of this early effort he would develop the criteria for the AMI awards. This was another significant contribution to AMI's stature in the audio visual industry. I am at some risk here in failing to mention some other individuals who contributed to the growth of AMI and for that I apologize.

Special Mention:

Ron Slawson

Ron taught audio visual instruction at Santa Fe Community College in Gainesville. He was an avid and passionate promoter and producer of multi-image. Aside from his participation at the AECT festivals; Ron held his own annual festival at SFCC. This particular festival would gain huge success in the entire state of Florida. Ron would then direct the Florida Association Media Educators annual multi-image festival. He was an inspiration to all the media educators' nation wide.

Hugh Gardner

Hugh taught at the University of Georgia. Hugh and Roger had worked together at the AECT multi-image festivals and Roger asked Hugh to join the AMI Board of Directors.
He took on the task of building membership and under his leadership AMI would grow to more than 5,000 member's world wide.

Bob Jones

Bob worked for Bob Rowan at the University of South Carolina. Bob volunteered to work on the stage crew and fell in love with staging. He would continue to manage the AMI festival staging for several years. As a result he went to work for Staging Techniques and open the Atlanta, Georgia office where Bob still works to this day.

Retirement

In 1979 I concluded my term of office as President and Pete Mather would assume the Presidency. I continued to serve on the board for two more years. After my term of office as President I turned my attention to my career. From 1981 on I had very little involvement in AMI as my career took me in another direction. Roger retired as Executive Director in 1981 at the AMI Board meeting in Minneapolis. A search was made for Roger's replacement. Several candidates were interviewed and Joe Codde was selected. However Joe's tenure with AMI was short and we would begin a new search for an Executive Director.

Our story ends here because Roger and I went back to our respective careers. Roger would retire as full Professor of Education at Temple University and I would close out my career with a sixteen year stint as an audio visual manufacturer's representative.

The torch is passed

Marilyn Kulp, Office manager of AMI was appointed interim Executive Director. She was a natural for the position due to her involvement in AMI from its inception. Aside from her managerial skills, she understood, and was comfortable with the AMI culture. Later the board would decide that Marilyn should be the permanent Executive Director. Under her leadership the annual awards festival became an international hit. The Gold Tour would continue to add stature to the association. Independent producers would vie to achieve an award and to be included in the Tour. Marilyn went on to guide and direct the association for another 15 years before AMI closed its doors in 1998.

In preparation for writing this story I have been corresponding with Ken Burke and Bob Rowan. Both Bob and Ken have been kind enough to encourage me in the process. Bob believes that AMI was the perfect storm. Bob believes that AMI had a major impact on the audiovisual industry and perhaps it did.

Before I conclude with this story I want to thank Marilyn Kulp who has been invaluable with the facts, the chronology and the time lines. I also thank her for encouraging me to write this story; I don't think I would have done it without her. I hope that one of you will be motivated to pick up the story of AMI. If you do I suggest you call it The Glory Years.

As I have been in the process of writing this story the memories have been flooding back. Roger and I had so many wonderful times together, memorable and unforgettable to say the very least. Our travels together across the United States, South America and Eastern Europe as a vivid to me as the days when they took place. It was so much fun that I would love to do it all over again and not change a thing.

The End (of the beginning)

A special thank you to Wally Harper, for editing and proofing this story. Wally was President of AMI 1986-87

Exhibits:

Group picture original Board of Directors 1974

AMI newsletter 1974

AMI Festival Pictures by Del Brown

Carl Beckman graybeard38@cfl.rr.com
Roger Gordon rogie2230@aol.com

multi-images

(No. 1, 2)

Journal of the Association for Multi-Image Volume I, No. 2 - Fall 1974

MULTI-IMAGE ASSOCIATION BEGINS

AECT OFFICIALLY RECOGNIZES AMI AS AN AFFILIATE

On Sunday, May 26, 1975 at 1:00 p.m., the Association for Multi-Image constitution was ratified by its new Board of Directors and at that moment, after a momentous weekend conference, the organization officially came into being.

The Association for Multi-Image - as it will be known - is a professional organization dedicated to the improvement of education through promotion of the art of multi-image as a medium for education and communications.

The conference, led by new President Carl Beckman (University of Maryland), was held at the Sugarloaf Conference Center at Temple University, Philadelphia, Pa., on May 24, 25, and 26, 1974. Present were the new officers of the association and its Board of Directors. The officers of the organization are:

President - CARL BECKMAN
University of Maryland

Vice President - ROBERT WISEMAN
Eastern Illinois University

Secretary - ROBERT L. GORDON
Treasurer Temple University

Board members are: VIC EDMONDS (Cleveland State University), DONALD PERRIN (University of Maryland), RONALD SLAWSON (Santa Fe Community College), HANS WENNBERG (Rhode Island College), NORMAN SAUPPE (Spindler & Sauppe, Inc.), and CAROLE CREW (Philadelphia Detention Center).

(l to r) C. Beckman, R. Gordon, V. Edmonds, D. Perrin, R. Wiseman, R. Slawson, H. Wenberg, N. Sauppe.

This picture was taken at the Temple University, Sugarloaf Conference Center

The AMI board at work

(l to r) C. Beckman, R. Gordon, R. Wiseman, D. Perrin, H. Wenberg, R. Pandolfi, V. Edmonds, R. Slawson, C. Crew.

AMI NEWSLETTER

Roger L. Gordon, Editor
MULTI-IMAGES JOURNAL
Ritter Hall Addition
Temple University
Philadelphia, Pa. 19122

The picture above was taken at the Temple University Sugarloaf Conference Center

Two weeks following the conference, the new constitution was presented to the Board of Directors of the Association for Educational Communications and Technology in Washington, D.C., and AMI officially became an affiliate of that organization.

Among other things accomplished at the conference was the planning of events for the 1975 AECT Convention in Dallas, Texas; election of officers named above, and planning of directions and goals for the organization - immediately and in the future; and the presentation of multi-image productions by Ron Slawson.

THE SKY's THE LIMIT!

[An Editorial] Things have begun to happen with the birth of AMI. The association is not six months in existence, but already we are planning participation in two large conventions, answering a large amount of correspondence, and putting out a number of publications.

Every day sees new letters from persons desiring membership in AMI. Others simply ask questions of us about the art of multi-image. A logical query at this time is 'why a large surge of interest in multi-image'?

Probably the interest has been there all along. As media presentations have become so sophisticated in step with modern technology, it is logical that the multi-image presentation mode would have emerged. What people are realizing is that it is not how many projectors or screens that you use, but rather how the presentation is produced in line with the objectives you wish to accomplish. Multi-image seems to have opened a new world of presentation possibilities, not only in education but in business and industry. This is all pointed out so graphically in Wilson Brydon's presentation titled "THIS THING CALLED MULTI-IMAGE" which has been shown at a number of conventions and meetings.

But, where do we go from here? How can our new professional association serve the needs of all who are interested in multi-image? We need to answer this question. It's one thing to initiate such an association, and quite another to keep it responsive to the needs of its membership. This is more of a challenge than might have been initially realized.

Interest in the multi-image festivals at the AECT Conventions within the past few years has been nothing short of unbelievable. It is safe to say that the multi-image festival is one of the big drawing attractions of the Convention. From all of this, and other efforts, has come AMI.

The sky's the limit for AMI. But it is a big sky. Only you can give us a compass setting and head us in the right direction.

NEW DEFINITIONS FOR THE FIELD

MULTI-IMAGE --- the use of simultaneous projected images to increase the effectiveness of slide and mixed-media presentations.

PRODUCER --- a person who designs and prepares the materials, sequences and synchronizes the media components.

AMI COMMENT

Dear Sirs - I have just heard about your new association. I would like to join, but I'm a member of so many other organizations that one more may just break me. Why can't you people pool your membership with some - or one other - organization and give us a break in the pocketbook.
Sincerely, ROBERT HARRIS (Denver)

Have you checked our joint membership with AECT?

Dear Dr. Gordon - I thoroughly enjoyed the last multi-image festival at the AECT Convention. Congratulations on putting together an exciting and interesting program. I'd be glad to subscribe to your newsletter, I am interested in any information.
Sincerely, EVERETT BABCOCK (Atlanta)

Thanks for the good words. All members of AMI automatically receive the newsletter.

Dear Roger - Does the new organization have a multi-image program explaining its activities in a nutshell? Also, do you send representatives to various parts of the country to make presentations?
My best, DICK BALDWIN (East Meadow,N.Y.)

AMI is planning just such a multi-image program which will initially be presented at the AECT Convention in Dallas, Texas in April 1975. As yet, we do not send out reps for presentations on multi-image, but we're planning to do so in the future.

°°SEND ALL FUTURE CORRESPONDENCE TO
AMI COMMENT: Roger L. Gordon, Editor
Multi-Images Journal
Ritter Hall Addition
Temple University
Philadelphia, Pa. 19122

IN THE IMAGE

°°°°°President Carl Beckman represented the Association for Multi-Image at the Denver, Colorado AECT Division and National Affiliate Presidents' Meeting, in September. The major purpose of the visit was to establish the Dallas Convention program, which will feature an AMI workshop and multi-image festival.

°°°°°The first annual AMI membership drive gets underway this fall. More on the plans in the next newsletter.

°°°°°President Carl Beckman recently met with Harry McGee, President of the National Audio Visual Association and his staff to discuss affiliation with this organization.

°°°°°The Multi-Image Festival at the AECT Convention in Dallas - April 1975 - is to be chaired this year by Roger L. Gordon of Temple University and Robert C. Wiseman of Eastern Illinois University. Roger will handle the special "Best of Multi-Image" portion of the program and Bob will handle the regular participation section.

°°°°°Norman Sauppe, AMI Board member,and President of Spindler and Sauppe' has volunteered to produce an AMI multi-image presentation for the AECT Dallas Convention. It will promote AMI, and be used at the multi-image festival.

°°°°°In answer to a request by AECT President Gerald Torkelson, President Carl Beckman composed a letter in August concerning the most immediate concerns of AMI:

1. building the membership,
2. establishing the Multi-Image Festival as a showcase,
3. offering a Multi-Image Workshop at the AECT Convention,
4. promoting professionalism throughout AMI membership in the production of multi-image, and
5. publication of the AMI Newsletter.

°°°A PRONOUNCIATION FOR MULTI-IMAGE°°°

Be it hereby resolved that the Association for Multi-Image recommends the pronounciation of the term multi-image in the Anglecized version. The French pronounciation is discouraged.

MULTI-IMAGE WORKSHOP PROPOSED FOR
1974 AECT NATIONAL CONVENTION -
DALLAS, TEXAS

The Association for Multi-Image, a National Affiliate of the AECT, is exploring the feasibility of offering a multi-image workshop course during the 1975 AECT Convention. Tentative plans are for a total length of fifteen (15) hours - spread over a two-day period (Sunday and Monday). The proposed audience would be instructors and media specialists who have had limited experience in media production. All participants will go through the basic steps and essential techniques for creating a multi-image production, including such things as:

°IDEA FORMATION °USE OF THE PLANNING BOARD °SOUND TRACKS, IMAGES, SLIDES, AND/OR FILM

°TIMING ON THE LIGHT TABLE °OPERATION OF THE MEDIA FOR THE PRESENTATION

The intent is for participants to produce a presentation for screening at the end of the workshop. Ronald Slawson, nationally recognized multi-image producer from Santa Fe Community College, has agreed to serve as coordinator and instructor for this activity. Plans call for a number of consultants from other educational institutions and commercial producers to join Mr. Slawson in working with small groups of workshop participants. Participants would be requested to bring the following materials:

°Four 80-slide-capacity Kodak Carousel slide trays.
°An idea for a short presentation (approx. 3-5 minutes), including a script already written, if possible.
°35mm or 2x2 slides that will be used for the production.
°An Exacto knife.

A limited number of slides - consisting of scenery, people, buildings, etc., will be available for those unable to bring their own. One reel of audiodisc tape will be provided to each participant.

Suggestions for changes and/or additions should be returned - along with the response form below - to:

RONALD SLAWSON
MULTI-MEDIA COMMUNICATIONS
SANTA FE COMMUNITY COLLEGE
3000 NW 83rd STREET
GAINESVILLE, FLORIDA 32601

A decision will be made, based on your response, in late November as to whether or not to proceed with the plans outlined above.

MULTI-IMAGE WORKSHOP

NAME _____

TITLE _____

ADDRESS _____

_____

[ ] I'm interested; send more information!

Scenes From AMI by Del Brown

Presidents of the Association for Multi-Image
(later known as the Association for Multi-Image International
then the Association for Multimedia International)

Founder: Carl Beckman 1974-79

Founder: Roger Gordon Executive Director 1974-81

Executive Director: Marilyn Kulp 1981-98

Presidents:

Pete Mather 1979-81

John Stokes 1981-82

Peter Zajichek 1982-83

John Slack 1983-84

Victor Lawrence 1984-85

Richard Sorgel 1985-86

Wally Harper 1986-87

James Lund 1987-88

Peter Ryan 1988-89

Ken Burke 1989-90

Albie Walton 1990-91

Mark Asteris 1991-92

Bengt Nygren 1992-93

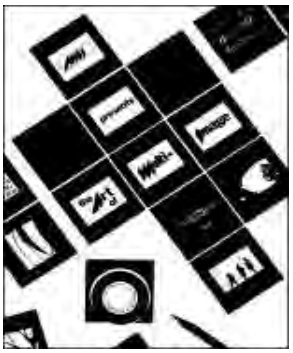
Denny Ducharme 1993-94

Jim Combs June-December 1996*

*Combs was elected president in June 1996, but AMI ceased operations in December of that year.

SECTION TWO

The Art of Multi-Image | Edited by Roger Gordon



Note to readers: The page numbers of *The Art of Multi-Image* are inconsistent with those of *An Incredible Epic*; because the 150 pages are pdfs made from a disassembled copy of the book graciously provided by Richard Allison.

The copy he found had been discarded by a library—is that a metaphor, or what?

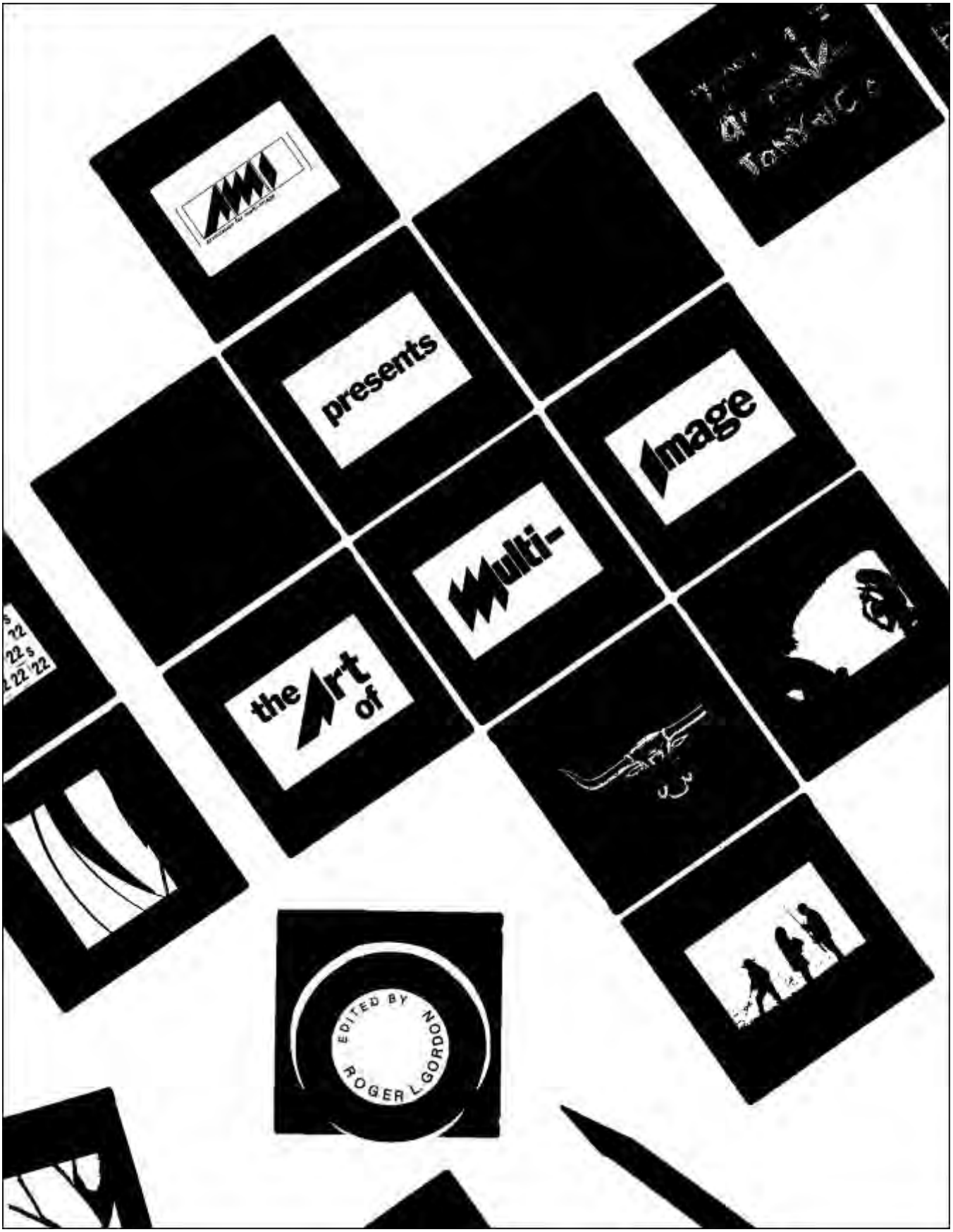
The major chapter-heading page numbers are listed below:

- What is the Multi-Image Presentation? | 1
- History, Theory and Research Related to Multi-Image | 6
- Why We Use Multi-Image Presentations | 17
- The Multi-Image Program Technique | 20
- Planning and Writing the Program | 31
- Producing The Visuals | 38
- Producing The Audio | 52
- Producing The Presentation | 65
- Presenting The Multi-Image Program | 73
- Criticizing The Presentation | 85
- Addenda & References | 106

There are a lot of lists; the index of them is all of four pages. Those are the kinds of things that make this work more scholarly than practical. OK; maybe those lists were useful for neophytes looking for gear or services.

To be fair; and because there are reasons why things are the way they are; maybe the book was written for classroom use—a 'curriculum,' I think they call it. Students come from all walks of life; all they would likely know of slides might be family happy snaps projected on the living room wall after Sunday dinner at Granny's apartment. This book certainly starts 'at the beginning.'

If you've read Volume Eleven – Confessions of A Multi-Image Maniac—you may recall my primary reason for writing it, back in 1982, was educational—because there was no other book that 'told it as it is.' That would have included this book: *The Art of Multi-Image*. You may also remember one of my favorite axioms: "A camel is a horse made by a committee."


presents
Image
Multi-
the Art of
EDITED BY
ROGER L. GORDON

The Art of Multi-Image

Edited by Roger L. Gordon

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Association for Multi-Image
1978

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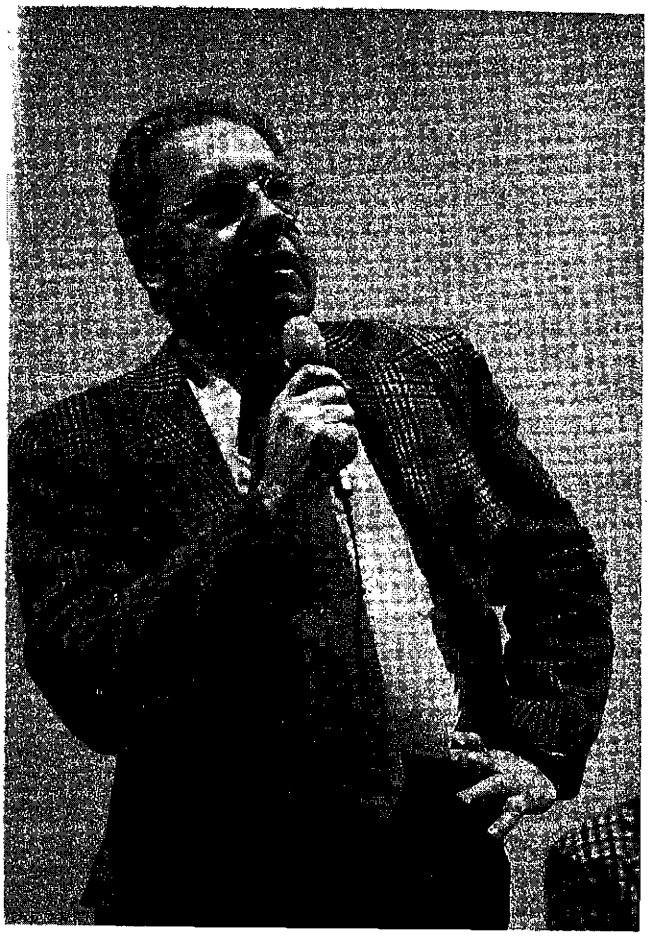
FOREWORD

by Wilson Brydon



Multi-Image, whether viewed as an art form or as a technology, is a medium with a future. It is however, a medium with a future only if we, who are a part of it, consider our primary contribution to be one of developing multi-image's own unique characteristics and capabilities; searching out and exploring its special potentialities. If, on the other hand, we are shortsighted enough to utilize its increasingly sophisticated technology merely to duplicate an existing medium (i.e. motion pictures), then we will end up only re-inventing what Mr. Edison and others have already made possible. I like to think that we are in the process of evolving a new medium, a new way of expression, a new way of reaching across the communication gap that still separates one human being from another. Let us, therefore, look forward, not backward, in our developing use of multi-image. If we do, then, like Columbus, we may have discovered more than a new way to an old world; we will, indeed, have come upon a whole new world.

Since the beginning of the Association for Multi-Image approximately five years ago, we, its officers, have been repeatedly asked to publish an all-inclusive book covering not only production techniques for multi-image presentations, but also information about research in multi-image, historical perspectives of the field and examples of successful utilization. The result is this book, which represents the work of many people who are members of the Association for Multi-Image. It has been in production for over two years.

As with any large project, we considered many possible procedures. We decided that our best approach would be to ask varied contributors to write specific chapters in their areas of greatest expertise. It is difficult to coordinate such work since there are varied approaches to the art of multi-image. But after considerable planning, correspondence and revision, a definite outline for the book was conceived and chapters were assigned to the authors. In every case, we searched for persons with experience in the specific areas of production, planning, and writing of multi-image programs, organization, technical areas, and historical and research perspectives. Overall editing and production responsibilities for the book fell into the hands of the editor.

The consumers of this book should be many. We hope that it can be used as a textbook in schools, colleges and universities where multi-image design and production courses are taught. We hope that the book can also be used as a reference tool for people with experience in multi-image. It could serve as a beginning resource for scholars doing research in the field. The book should also be helpful to producers in business and industry who have varied responsibilities for multi-image.

One of the greatest stumbling blocks for multi-image seems to lie in the absence of reproducible evidence about whether this medium can better teach information than alternative methods and whether it can do so efficiently. For this reason, most of the available specific research information has been included. This kind of research, while often cited in piecemeal fashion in journals and trade publications, has to our knowledge never been fully compiled, as it is in this publication. We expect that this kind of information will continue to grow as the discipline grows and that both more comprehensive as well as detailed research will be carried on and disseminated. This no doubt will be the emphasis of future publications by the Association for Multi-Image. We have also made every effort not to date the information in this book. Of course, inevitably, in this fast growing field, some dating will take place.

Chapter I sets the stage for what is to come. It defines the field generally and differentiates between the terms multi-media and multi-image. It describes the state of the art of multi-image today. This chapter has been jointly written by Roger L. Gordon, Professor of Educational Media at Temple University, Philadelphia, PA and Robert C. Wiseman, Chairperson, School Service Personnel, Eastern Illinois University, Charleston, Illinois.

Chapter II concerns the broad history of the field as well as an overview of the research that has been accomplished in the relatively short lifetime of multi-image. It has been written jointly by Ken Burke of Southern Methodist University, Dallas, Texas and Bernard Fradkin of Evergreen Valley College, San Jose, California.

Chapter III attempts to answer the question: why do we use multi-image presentations? It cites strengths of the medium, specific applications and audiences for multi-image and defines how these kinds of presentations can be utilized in education, business and industry. It has been jointly written by Palmer E. Dyer, Professor at the School of Communications, Ithaca College, Ithaca, New York and Ron Slawson, faculty member at Santa Fe Community College, Gainesville, Florida.

Chapter IV describes the elements of the multi-image program. It offers an overview of what will be covered in greater detail in the chapters that follow, pointing out how the audio and visual components work in concert in a multi-image production. The chapter also desctibes the physical arrangement of equipment and site for maximum utilization of the potentialities in the presentation and offers techniques for organizing the production. Part I of this chapter has been written by JoNell Campbell, Director of Media Productions at Southwest Missouri State University, Springfield, Missouri and the already mentioned Ron Slawson has written Part II.

Chapter V concerns the planning and writing of the multi-image program from the standpoint of design objectives, the actual scripting of the program, and the assemblage of the audio and visual portions of a storyboard. It has been written by Palmer E. Dyer, mentioned earlier.

Chapter VI offers both a detailed description of organizing the formats of the visuals as well as the actual production of the visuals. It covers the composition of images for the visual portion of the program as well as suggesting specific production techniques. This chapter has been written by A. Arvo Leps, a doctorial candidate in education at UCLA in Los Angeles, who also works as an independent producer/consultant, and by Hans-Erik Wennberg, Assistant Director, Audio Visual Department, Rhode Island College, Providence,

Rhode Island.

Chapter VII follows sequentially by covering the production techniques for the audio component of the program. It has been written by the previously mentioned Ken Burke. The next step in the production of a program is discussed in Chapter VIII which concerns the Programming of the Presentation. It describes the basic types of programmers, offers a historical background of the evolution of these devices, and helps the reader to choose what he or she needs. This chapter has been written by James W. Hulfish, Jr., Director of Marketing of the firm of Spindler & Sauppe' in North Hollywood, California.

Chapter IX describes the many challenges faced by multi-image producers in actually presenting a program. It covers the fixed installation within a building and warns us of the problems inherent in "road showing" a presentation. The author is Carl Beckman of the firm of Beckman Associates.

Chapter X is a somewhat philosophical study of methods for critically evaluating a multi-image presentation. It suggests various evaluation tools as well as explaining the impact of functional/ experiential criticism. It also has been written by Ken Burke.

The book contains a number of appendices concerning source lists for manufacturers of program control devices, audio recording and playback equipment, related equipment, and sources of information about multi-image. The general bibliography has been prepared by Donald Pasquella, Associate Professor at the Division of Broadcast-Film Art, Southern Methodist University, Dallas, Texas as well as Ken Burke.

Much of the critical reading, editing, as well as some revision of the manuscript has been done by A. Arvo Leps of Los Angeles, California, whose time consuming work has contributed substantially to this volume.

Other editing work has been done by Ken Burke whose overall contributions to this book are self-evident.

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Roger L. Gordon
Editor

THE ART OF MULTI-IMAGE

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CHAPTER I
WHAT IS THE MULTI-IMAGE PRESENTATION?

Robert C. Wiseman and Roger L. Gordon

You are about to enter the exciting and creative world of multi-image. This book has been carefully constructed not only to give you information about the production of multi-image presentations, but also to provide insights into the kinds of impact these programs can have in education, business, and industry.

The title of our initial chapter presents a question that is often asked. Just what is the multi-image presentation? Is it a mixture of still and motion pictures flashing on and off on a number of screens in a large dark auditorium? Is it a technique to mesmerize an audience? Is it a show? Does it entertain, and/or does it educate? Just what is it and what does it do?

The pages that follow should provide more than enough answers to these and other questions relating to the art of multi-image. But like anything else, the reader will have to make up his own mind on how multi-image presentations fit his individual objectives. Today advocates of this fast growing art form often raise many questions about how multi-image presentations can be produced and utilized. Quite often it seems that when any of these questions are answered, other questions regarding methods for distribution, storage and retrieval of programs crop up. No doubt, like during the early days of railroading when the optimum width for the track was being debated, future standards for multi-image presentations are a further concern for serious practitioners.

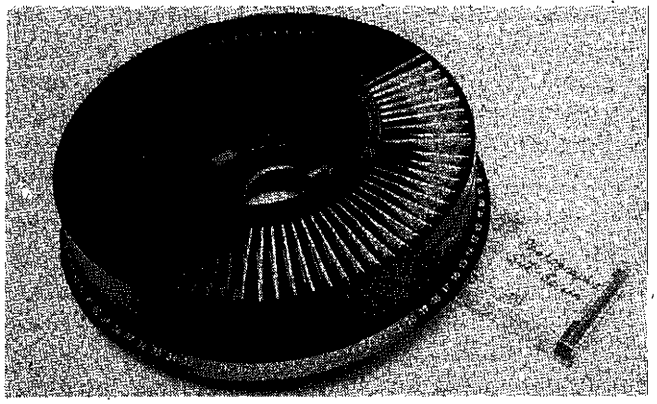
To begin to provide answers to these and other questions, as well as to promote the art of multi-image, has been the major emphasis of the Association for Multi-Image, (AMI). The association is a professional organization composed of people from education, business, and industry, as well as from other facets of our community who have joined together in an attempt to make use of the unlimited potential of this fast-growing art form.

Terminology

Multi-Media

One approach to the problem of defining the multi-image presentation should be the clarification of terminology. We read these days in the literature about multi-media, multi-image, and other related terms. We hear of programs being produced in various formats utilizing still and motion picture projection on one or more screens, and we utilize an endless array of hardware and software in a great many different formats. To some extent, this multiplicity is the essence of the nature of the field. These kinds of presentations will probably continue to be presented in ways most familiar or appealing to each producer and this does not necessarily set a bad precedent. Yet, from all this seeming chaos, some order is emerging.

The term multi-media seems most often to mean the coordinated use of more than one medium for the presentation of information. Most popular are the single screen slide and tape presentations with filmstrip-tape presentations following close behind.



Picture I-1

A typical multi-media packaged presentation featuring a carousel drum of 35mm slides and a pre-recorded casette tape.

Photo courtesy: Duane Troxel

The notion of multi-media comes from the combining of the visual medium of the projected

slides with the audible medium of recorded sound, operating in unison in a pre-packaged presentation.

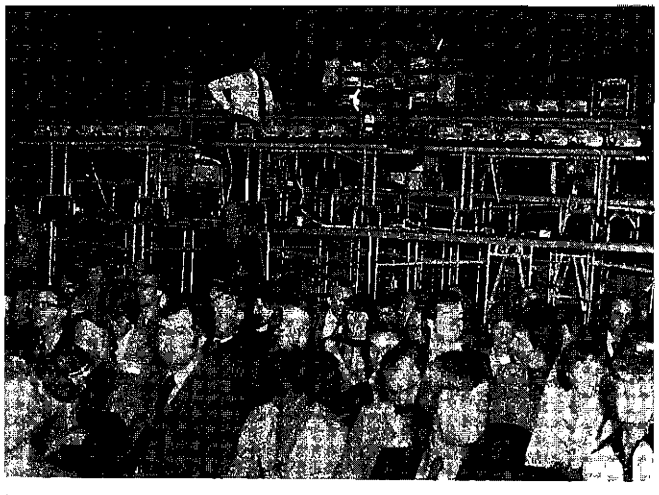
The possibilities for the presentation of ideas and concepts seem endless. Simple presentations can be done by manually advancing the slide projector along with a tape recorded message. (This is the usual approach with most filmstrip presentations.) Automation of this multi-media presentation can be easily introduced by utilizing special sound equipment which generates an electronic signal which is recorded along with the soundtrack on the tape. This signal is then used to control the projector. In other words, the producer need no longer attend the machine and advance (cycle) the slides manually. A further innovation has been the addition of the dissolve mode to the presentation. In this case, two slide projectors are focused on the same screen and are attached to a dissolve control and an audio playback machine. The slides are so sequenced in the two projectors that they alternately dissolve from one to the other without interjecting the abrupt dark period during the change (cycle) necessary when using only one projector. It becomes a matter of aesthetics and finances how one producer or another chooses. More important is the concern: what multi-media presentation method fits my ultimate objective? The beneficial possibilities for these kinds of presentations in education, in business and industry, and in entertainment have been aptly demonstrated. Today the pre-packaged multi-media presentation featuring slides or filmstrips along with casette tape recordings are widely utilized by teachers and students in schools. These kinds of presentations are often identified with individualized instruction. Many colleges and universities have individualized partial or complete courses utilizing slide-tape presentations used in individual study carrels located in learning centers and elsewhere. One of the best-known of these programs is the program of individualized mini courses in biology developed at Purdue University by Postlethwait. There are many other examples.

Textbook publishers have become highly interested in the packaged filmstrip-tape casette kit which often accompanies print materials which may include textbooks, workbooks, and manuals. The kits are usually packaged in attractive boxes which are then temptingly displayed on the shelves of libraries and instructional materials centers. Students can check out such multi-media kits for either individual use or small or even large class groups.

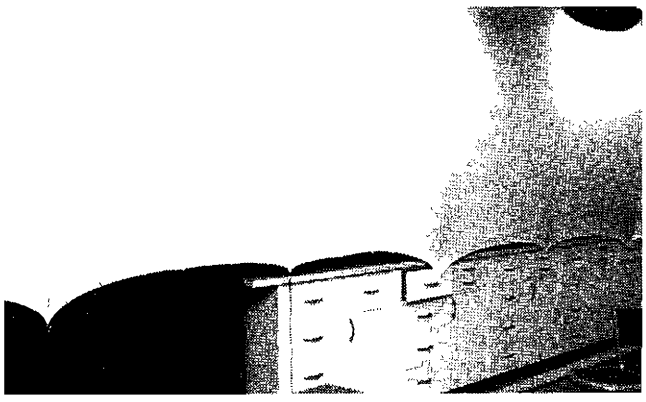
Business and industry have also made use of multi-media materials in both slide and filmstrip-tape formats. They have served aptly in various kinds of training situations for both new and in-service employees. In addition, multi-media programs have served well in the introduction of new products, orientation of potential customers toward various product lines, and a myriad of other uses.

Multi-Image

It might be stated that multi-image begins where the average multi-media presentation ends. The defining of multi-image as a three screen slide show with a synchronized sound track in comparison to the standard one screen multi-media program falls somewhat short of the true definition. To define multi-image in its true definition requires a much broader description. It is like a motion picture in that it may use cuts, dissolves, fades and special effects. It is unlike the motion picture in that its special effects are created during the presentation through the use of programmed electronic equipment rather than done beforehand in the laboratory. It is like a slide show in that it generally uses projected 2x2 slides. It is unlike the simple slide show in that it generally uses multiple slide projectors with multiple simultaneous images on the screen. The multi-image presentation is unique in that it almost demands that the viewer participate by actively following the communicative content of the message. The viewer is presented a series of changing images. The images may be a part of a larger whole or they may be individual images that make different statements about the primary topic. Thus, the viewer must select the primary image from among many by exercising his or her personal preference or by accepting direction cues given by the producer. This requires the viewer to carefully scrutinize the information that is presented and to select the primary image through personal decision making.



Picture I-2
A multi-image projection set up.
AMI Collection



Picture I-3
A multi-image screen.
Photo courtesy: Duane Troxel

Consideration of multi-image, in terms of its position with respect to other art forms also concerned with visual imagery and audio reproduction, brings us to the realization that it is a very broad form of art. Multi-image presentations are capable of mixing all of these art forms into a unified whole. It offers a level of viewer participation that approaches that which is obtained with the theatre. Just as the viewer must visually follow the actor-performer as he or she moves and dances on the stage, the multi-image audience must follow the images as they move and "dance" on the screen.

In a final definition, it can be said that the multi-image presentation is largely coming into its own as a product of the revolution in solid state electronics. Through the use of micro-processers and other electronic controls, recorded sound, still and motion picture images, and projection equipment, the multi-image presentation is restricted only by the bounds set by the imagination of the producer. It is a presentation that generally uses the "ideal" number of three projected images (but is not necessarily limited to three), an electronic programmer, and sound reproducing equipment. The equipment, when made to work with the vivid imagination of a creative producer, provides us with the multi-image presentation.

The Aesthetics of Multi-Image

The multi-image presentation, perhaps more than any other means of communication offers opportunities for artistic expression. The broad sweep of the images moving and tempting the viewer in various ways along with the almost unlimited combinations of sound can convey ideas and concepts very effectively. The viewer can thus be influenced by an endless series of progressions. Research into the effects of these techniques is only beginning. The high regard in which multi-image presentations are held is demonstrated constantly by the large number of presentations that business and industry have commissioned for both orientation and promotional purposes. Many of the chambers of commerce of large U. S. cities use multi-image presentations for their visitor introduction programs. During the 1976 bi-centennial year, exhibit centers throughout the country featured multi-image presentations. As producers become more informed about the impact and aesthetic value of the multi-image presentation, and as equipment becomes even more sophisticated, endless possibilities appear for this art form.

It is often said that making multi-image presentations requires much time and effort. Critics further point out that multi-image presentations are a costly way of saying on a number of screens what can be communicated equally well on one screen. The logic and logistics of multi-image presentations for school and college use have been questioned. Many of these concerns seem justified in light of cost and manpower commitment. The important factor lies with the attitude and dedication of the producer. What does he wish to say and how does he wish to say it? There is justification for the use of multi-image when the objectives seem to call for this kind of presentation. Much of this book will explain how and why multi-image presentations can best be utilized.

In various areas of education, the multi-image presentation offers a unique method for communicating information. In a day when the economics of individualized instruction are often being questioned, multi-image provides a further flexible alternative along with other traditional means of large group instruction. Whether and how this medium can contribute to the solution of specific classroom teaching/learning problems needs further research.

The State of the Art

The growth of the multi-image concept has been phenomenal within the past decade. Growing numbers of producers in almost every walk of life are becoming aware of its potential. Multi-image festivals and workshops are becoming numerous. Architects and facilities planners are including large-group, multi-image projection areas in their blueprints for schools and colleges. The terminology of the field has become more universally understood. There seems to be a growing acceptance of multi-image as an entirely new art form. Both the business and educational communities are becoming aware that multi-image may indeed have advantages for communication beyond

that available through the more traditional media of film and television.

This communication potential seems to manifest itself best when there is simultaneous projection on three screens. Interest is not only sustained better but can be held and influenced in novel ways. While television and film could be thought of as being the more static media, limited to a single viewing area, the concept of multi-image affords the viewer a number of viewing areas. The further mixture of sound adds an additional dimension.

Manufacturers of hardware for multi-image generally keep pace with or even lead the growing field. There are almost 30 manufacturers of electronic programming devices alone, and an equal number of manufacturers of dissolve controls and other related equipment. Manufacturers of audio recording and playback equipment are equally numerous due to their alternative markets. A source of growth potential as well as a problem within the field has been the almost constantly evolving electronic knowhow. Just when producers have learned to fully exploit the features of one kind of programmer and its related equipment, a new and more sophisticated one often comes along. A similar growth is seen for audio recording and playback equipment. Working to keep pace with the manufacturers of multi-image equipment are the practitioners of the art form. Over 20 colleges and universities offer courses in multi-image in one

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Picture I-4
A college workshop brochure on multi-image.
AMI Collection

form or another. There are numerous additional community colleges, vocational-technical schools, and other schools where courses in multi-image are taught. The list grows every year.

The Association for Educational Communications and Technology, a professional group of educators from schools, colleges, and other professional segments, has grown increasingly aware of the concept of multi-image. In addition to a number of articles in its magazine, *Audiovisual Instruction*, within the past few years, significant research abstracts on multi-image have been featured in its scholarly journal *Audiovisual Communication Review*. In addition, a number of general sessions at the annual AECT Convention have been done in multi-image as well as numerous smaller sessions. A multi-image festival is now featured every year. The Association for Multi-Image, which is affiliated with the Association for Educational Communications and Technology, began in 1974. Today it enlists over 500 members located throughout this country and the world. AMI's activities are many-faceted, including not only the publishing of this book, but workshops, symposiums, a regular seasonal magazine, a newsletter, and its own national conference and exposition.

Picture I-5
Brochures for multi-image workshops which were presented at large conventions.
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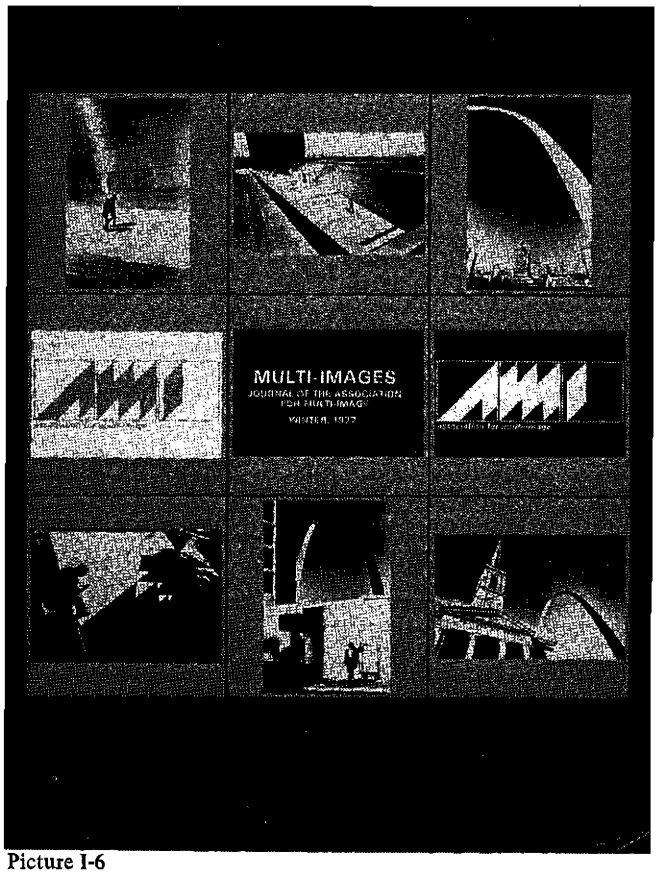

Picture I-6

Front page of MULTI-IMAGES, magazine for the Association for Multi-Image.

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The National Audiovisual Association (NAVA), an organization of manufacturers and business-people, has also recognized the potential of this artform. Along with the Association for Multi-Image, they have for the past few years sponsored a two-day symposium on multi-image for both producers and other interested persons. In addition to the previously mentioned professional associations, there are numerous other business and industrial groups who have an interest in multi-image. There is little doubt that the decade of the 80's will see further movement in this direction.

Some of the major problems facing the field today include:

1. The need for further acceptance of multi-image on the part of teachers, administrators, other educators, and the business community.
2. Standardization of some of the common functional characteristics of the hardware used for multi-image presentations.
3. A central depository for ready-prepared multi-image programs and the development of methods for the cataloging, storage, and distribution of multi-image programs across this country and the world.
4. There is an obvious need for further research and experimentation into how multi-image presentations can teach, motivate, and communicate most effectively.

With leadership from the Association for Multi-Image and with greater awareness and interest on the part of other professional organizations, the future of multi-image looks bright. Like other means of communication, it remains for individual producers and researchers to bring out the unseen potential of multi-image as well as to extend what we already know to be its strongest set of capabilities.

CHAPTER II
HISTORY, THEORY, AND RESEARCH RELATED TO MULTI-IMAGE

Ken Burke and Bernard Fradkin

Self-contained multi-image presentations apparently began with a spectacular lecture on "Communication" done at the University of Georgia in early 1953 by Charles Eames, George Nelson, and Alexander Girard. Related avante-garde mixtures known as Intermedia began in the summer of 1952 with an untitled lecture/performance by John Cage at Black Mountain College in North Carolina. Both of these forms of communication are dependent upon modern electronic technology to provide such elements as projected multiple images. Older forms of communication also employed multi-imagery and complex mixtures of components.

Mixed media combinations of performers, music, song, dance, costume, and scenery have been used for centuries in the performing arts. Experimental theatre works and sculptural environments, as developed in the 20th century through Intermedia, have had an even more direct influence on producers of multi-image programs. Further elaboration on the history of Intermedia may be found in Burke (1972), Kirby (1965, 1969), Kostelanetz (1968), Renan (1967), and Youngblood (1970). In addition to this theatrical influence on modern multi-imagery, there is a long history of multiple imagery in the visual arts.

Visual Arts

As noted in Janson (1962) the use of multiple image has been found in Ancient, Classical, Medieval, and Renaissance civilizations. Multiple layers of figures involved in related activities are part of the earliest cave paintings, such as those at Altamira in Spain and Lascaux in France. These record the last stages of the Paleolithic Period, 20,000 years ago. Images of animals are often superimposed with the further addition of spears and arrows, hinting at stories of hunting. In the Lascaux cave, bison, deer and horses are massed on the wall and ceiling, producing a multi-visual effect encompassing the viewer. Later, multiple registers of figures and symbols were common in the tomb and temple decorations of the ancient Mesopotamian, Egyptian, Indian, and Oriental cultures.

Multiple images are also distinct components of the record left from Classical times. There are hundreds of surviving ornamental panels, paintings, and building and vase decorations that document the Greek and Roman acceptance of simultaneous viewpoints and activities. One outstanding example is the column of Trajan, erected in 106-113 AD, to celebrate Trajan's victory in the Dacian Wars. A continuous band of relief sculpture winds up and around the column, thus forcing the viewer to circle it again and again to capture the progression of events. The viewer also has the opportunity to compare and contrast past and future events at a glance since there are 150 scenes depicted. Similarly, the Byzantine and early Christian periods contributed imposing examples of multiple image, shifting spacial and temporal viewpoints, and interrelated history and theology. Domed mosaics, mosaic floors, murals, and sarcophagi provided numerous opportunities to visualize themes in religious art.

The Medieval civilizations further refined and elaborated on multiple image, adding even greater scale and complexity to the visual message. The revival of stone sculpture during the Romanesque Period (ca. 1000-1200) produced dramatic illustrations of complex religious motifs, as evidenced by works such as the Mission of the Apostles (Ste.-Madeleine, Vezelay, France, 1120-32) and the Last Judgment (Autun Cathedral, France, 1130-35). The evolution of art and design in the Gothic period resulted in multi-image stained glass window paintings. These masterpieces complemented Gothic architecture and projected multi-colored images onto the floors of the great cathedrals. Altar-piece paintings, such as Matthias Grunewald's three-level triptych of the Crucifixion and Life of Christ (1515), were additional multiple image presentations to the Gothic society. The total

experience of the Gothic cathedral, as described by Hugo (1831), can be seen as contributing to the history of multiple imagery with its combination of:

> the three receding pointing doorways, the decorated and indented band of the twenty-eight royal niches, the vast central circular window, flanked by the two lateral ones . . . harmonious parts of one magnificent whole . . . unfold themselves to the eye, in combination unconfused, with the innumerable details of statuary, sculpture, and carving in powerful alliance with the tranquil grandeur of the whole.

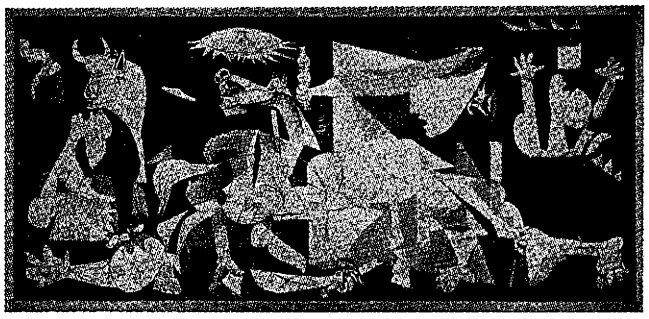
Although the art of the Renaissance turned Western visual attention to single image and the depiction of linear perspective, there were still some notable multiple images depicting simultaneous viewpoints and activities. Among the most dramatic examples of Renaissance multi-image is the Sistine Chapel ceiling mural, painted by Michelangelo. In this masterwork, events from the Book of Genesis are interwoven with figures from biblical and mythological literature. Some of the more elaborate churches and palace halls of the Baroque and Rococo periods also retained lavish multi-image decorations, uniting painting, sculpture and architecture into dazzling illusions of perspective.

Until our modern period, easel painting and pedestal sculpture became more focused on photographic depictions of single images. However, multiple image in the form of multiple perspective was reemphasized in the early 20th century by Picasso and Braque. Media analyst Marshall McLuhan (1964) describes the visual transformation this way:

Picture II-1
Michelangelo. GOD Separating Day From Night, Sistine Chapel, Vatican, Rome.

Photo courtesy: The Vatican, Rome.

> . . . cubism, by giving the inside and outside, the top, bottom, back, and front and the rest, in two dimensions, drops the illusion of perspective in favor of instant sensory awareness of the whole.



Picture II-2
Picasso. Guernica.
Photo courtesy: Metropolitan Museum of Art, New York.

Following Cubism, multi-image in the visual arts developed in several directions, especially: (1) the large-format, total-field compositions of painters Jackson Pollack, Franz Kline, Ellsworth Kelly, Kenneth Noland, and Frank Stella; (2) the large-scale multiple image of "pop artists" Andy Warhol and James Rosenquist; and (3) the multiple meanings of Robert Rauschenberg's painting/sculpture combinations. Illustrations of the works of all these artists may be found in sources such as Arnason (1968). Multiple images can also be found in the modern popular arts, as in the photojournalistic essays in *Life* and similar magazines. Layout rules were developed for one- and two-page arrangements of photographs as this style of storytelling became a mainstay of reporting. Current layout standards in news magazines and advertising pages reveal a continued concern for interactions of line, shape, size, and color between separate pictorial elements.

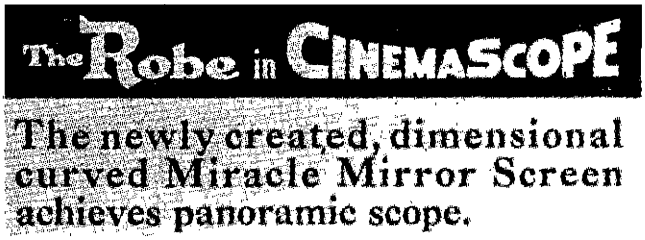
Multi-Image Cinema

The cinema was also a direct predecessor of modern electronic multi-image programs. The difference between these early multi-screen films and current multi-image programs is more in purpose than in technology. Multi-image films, except for a few avante-garde experiments, were simple attempts to extend the environment shown in single screen films. As detailed in Burke (1972), the first public multi-screen film was the Cineorama display of the 1900 Paris Exhibition. Compared to modern World's Fair presentation techniques, this production was still quite impressive. Images filmed during a balloon excursion over Europe were projected on a circular system of screens 30 feet high and 330 feet around. Viewers in a mock balloon in the center were given the feeling of actually flying across Europe. This 360° presentation technique has been a popular inclusion at every international exposition since the Brussels Fair in 1958. Some educational institutions have incorporated this technique into a permanent facility, such as the 12-screen, 26-projector "Egg" which opened in 1975 at the University of Texas at Austin. This elaborate system is normally used for special presentations rather than regular classroom instruction; however, one study (Carmichael, 1974) has investigated successful affective learning in such a total media environment.

In 1926 in Paris Abel Gance released the first commercial multi-screen film, *Napoleon*. Gance used the traditional form of the triptych to contain his dynamic cinema experiment. Single images were expanded to wide screen panoramas, as in Cineorama, but separate multi-images were used as well to show juxtapositions and various points in time. Gance's technique was ahead of his technology and his audience; however, in 1952, both problems were conquered by Fred Waller's three-screen spectacular, Cinerama. After successful panoramas were achieved in *This Is Cinerama*,

Picture II-3
This Is Cinerama with Gathering of the Clans in Scotland.
Photo courtesy: Golden Press, New York, N.Y.

multiple projection was soon replaced by anamorphic lenses and wider frames of film. Thus, the development of multi-screen cinema might have been completely reabsorbed into single image, had it not been for creators such as Charles Eames and Josef Svoboda.



Picture II-4
Advertisement for The Robe in Cinemascope from 20th Century.
From the book, The American Movies Reference Book by Paul Michael, 1969. Published by Prentice-Hall, Inc., Englewood Cliffs, NJ

Modern Multi-Image Programs

As mentioned before, Eames seems to be the first to transfer the multi-image technique to education from its specialized uses in artistic embellishment, cinematic experimentation, and aviation training (see Waller, 1953). The 1953 Eames-Nelson lecture, developed for undergraduate art students, used the media of film, slides, and audio tape – plus canned aromas – to interpret the content material to the viewers. The use of a live lecturer was eliminated illustrating the fullest potential of the media to communicate the message. The program included a 10-minute film on the Shannon-Weaver communication model, 8 minutes of triptych slide/tape montages illustrating the concept of abstraction, and a 10-minute film on ancient Egypt as a dead civilization which transmits live messages.

Eames was also responsible for two impressive multi-image presentations at World's Fairs. His 6-screen "House of Science" in Seattle in 1962 and 21-screen "Think" for IBM at the 1964 New York Fair were both highly acclaimed. Public attention drawn to these Fair extravaganzas, plus the documented success of instructional multi-image programs in the early 1960s, provided the basis for further acceptance and use of multi-image.

Certainly public attention to World's Fair multi-imagery was increased by the spectaculars of Josef Svoboda. Perhaps Svoboda is best remembered for perfecting Erwin Piscator's media-oriented Epic Theatre into the wonders of Laterna Magika (Burian, 1971), but he was also responsible for sophisticated multi-image programs as well. His Polyekran, presented at the 1958 Brussels Fair, was an 8-screen slide/tape/film montage about the Prague Music Festival. As with the Eames-Nelson lecture, no narrator interrupted the flow of the media presentation. Among the more popular effects in this presentation was the "jumping" of a ballerina from screen to screen and the "freezing" of her motion as the presentation shifted from film to slides. Svoboda provided another World's Fair triumph in Montreal in 1967 with his Diapolyekran display. This mammoth 15-minute multi-screen slide/tape show took 5 million electronic commands to complete, and in some way was reminiscent of the prehistoric cave paintings. Images changed continuously on the 110 screens, building up spatial and temporal ambiguities unknown in the more utilitarian uses of multi-imagery.

Following the Eames-Nelson lecture of 1953 and the Svoboda performances of 1958, the Tele-Prompter Corporation produced multi-image systems and programs for various business, industry, and government groups, especially for military briefing rooms. These displays were known as Telemation and consisted of 3- or 5-screen, rear projection, automated slide/tape/film systems. One of the early Telemation programs was the 5-screen show made for the U. S. Departments of State, Agriculture, and Commerce, presented at the World Agricultural Fair in New Delhi, December 1959-February 1960. After visiting the installation, Dr. John Guy Fawlkes commissioned a Telemation instructional system for the University of Wisconsin's School of Education. This Multimedia Instructional Laboratory, first directed by Dr. Richard Hubbard, provided a 100-seat multi-image auditorium and required a support staff of designers, artists, photographers, engineers and programmers. A permanent staff proved to be the key factor in the success of the facility, since the average multi-image lecture took 120 man hours of preparation, not including the work of the instructor in researching and organizing the lecture. Pre-planning was essential as 6 to 8 weeks were necessary to organize a 50-minute presentation. Dr. Gerald F. McVey (1966), director of the Multi-image Instructional Laboratory (M.I.L.) 1965-1973, estimated the cost of an average lecture to be about $300 excluding the time of the staff in preparing the materials. Certainly there have been quality lectures which cost less, but the Wisconsin series are particularly sophisticated.

The M.I.L. featured a triptych (one large square screen on the left and two stacked horizontals on the right) which permitted display of 35mm slides, film, 3¼"x4" lantern slides, opaque projection, and video. Another screen in the classroom allowed overhead projection as well. Audio equipment consisted of microphone, phonograph, and stereo tape. Although the system was fully automated, there was override control by the instructor through a remote connection from the lectern. This permitted much greater flexibility for instructional use since interaction between teacher and students could then be incorporated into the flow of the lecture. All programmed activities were controlled by punched paper cards fed into a reader; cards were advanced by a cue button in the semi-automatic mode and by taped electronic signals in the automatic mode. Manual operation was accomplished through a series of controls both at the lectern and backstage. All modern programmed systems are some variation on these two original Telemation methods – those being either audio tones or punched paper tape. Both systems enable one to handle a great deal of complexity, but are subject to occasional playback difficulties. A recent promising technological breakthrough is the introduction of digital program storage, recall, and command through the use of

Picture II-5
The Multimedia Instructional Laboratory at the University of Wisconsin, Madison.
Photo courtesy: Don Didcoct

microprocessors (i.e. "mini-computers"). Possibly this approach will become the standard programming system of the future.

The first lecture presented at the M.I.L. was on January 30, 1961, by Dr. Michael B. Petrovich for a course in Russian History. Supportive response from students and other faculty led to regular use of the installation for courses in Art Survey, Human Abilities and Learning, History of the Theatre, History of Motion Pictures, and others. Success of the M.I.L. and similar facilities at other campuses, coupled with public awareness resulting from publicity in educational journals, led to a great increase of multi-image facilities in education, business, government, and industry. Another factor that helped spread multi-image was the natural dispersion of students and faculty from multi-image centers, such as the University of Wisconsin. Another major center for multi-image was the University of Southern California, where Dr. James Finn initiated a graduate multi-image production course in 1963. This followed a very successful 3-screen presentation at the Division of Audio Visual Instruction (DAVI, now AECT) convention by Finn and Dr. Robert Hall in Kansas City, March 1962.

Multi-image became popular throughout the 1960s in public displays, theatrical entertainment, art galleries, and avante-garde performances. The most lavish displays were at the 1964 New York Fair, Expo '67 at Montreal, and Expo '70 at Osaka. Josef Svoboda developed the most successful uses of multi-image in the legitimate theatre; an excellent example was *Intoleranza* done in Boston in 1965, utilizing live, remote broadcast, and time-delayed video. Stan Vanderbeek and the USCO group were the primary exponents of experimental multi-image. At the New Cinema I Festival in New York City in late 1965, for example, Vanderbeek presented "Move Movies." Information on these events and many others is available in the sources cited at the beginning of this chapter.

Indicative of the continually growing use of multi-image communication techniques is the Multi-Image Festival held each year as a feature of the AECT convention. This annual festival quickly became the primary outlet for the demonstration of "state of the art" multi-image programs. Growth and success of both the multi-image technique and the national festival led to the formation of the Association for Multi-Image in 1974. As the history of the field continues to be written, the configuration and ease of technical operations continues to be refined. Through the medium of both publications and dialogue, producers have come to accept more conventional definitions and formats, become skilled with the use of less expensive equipment, and are showing greater flexibility in their productions and presentations. An increasing awareness of multi-image history has shifted attention from "what to do" to "how best to do it."

11 a.m. to 4:30 p.m. Multimage Festival

Coliseum, Fountain

Room Coordinator: Perala NESTOR, IMC coordinator. Parkrose Thompson School, Portland

In Charge: Dennis D. WILLIAMS and Rick CARLSON, Title VIB Institute Fellows, University of Southern California

11:00—"Click, Whirr"—produced by Dale Baker. Billy R. Lawson, and Fred Wist. A fresh look at the computer ogre.

11:45—"The Happy Art of Home Winemaking"—produced by Larry Fraley. Frivolous fermentation. Informative how-to-do-it.

1:30—"Los Angeles 1976 Summer Olympic Bid"—produced by Wilson Brydon. Won for Los Angeles the U.S. selection as the site for the 1976 Summer Olympics.

2:00—"Se Puede"—produced by Wilson Brydon. Pre-career motivation in the area of reading and math for low-achieving disadvantaged students.

2:40—"The Sun is But a Setting Star"—produced by Joe Daccurso, William Dannevik, Sue Lang, and George Rawalt. In the promised land, man fouled his own nest.

3:15—"Fresh Garbage"—produced by F. Roy Carlson, Sam Cockins, James Durham, Dennis Williams, Lafayette Young, USC. Look beneath your lids a moment. See those things you didn't quite consume. The world's a can for your fresh garbage. Traces the history and development of popular. rock music and the underlying social significance of this "electric" communications medium, the language of our students, the NOW generation

4:00—"The Liberal Tradition of Ron Cobb"—produced by Nancy Carter. Philosophy and outlook of the Los Angeles underground press.

Picture II-6

Part of the program for the first multi-image festival presented at the DAVI (AECT) Convention, Portland, Oregon, 1969.
Courtesy: AECT, Washington, D.C.

Research and Theory

Producers of multi-image programs are constantly faced with innumerable decisions in designing presentations for their audiences. When does the medium begin to compete with the message? What is the effect of compressing visual information? How much redundancy is necessary? How much cross-cueing of related information is necessary? How important is the audio channel? How does the human perceptual system operate in accepting large quantities of information? Questions like these and others need answers if we are to use the characteristics and flexibilities of multiple image presentations to their best advantage.

Occasional failure in the proper use of multi-image has resulted in some scathing negative criticism such as:

> Multi-media has become a buzz-phrase; a term often given to a bunch of unrelated slides on three screens with noisy music and some philosophical statements from the people who put it together.
>
> (Buckland, 1971)

> In sharp contrast to orchestration, the multi-media faddists throw raw unordered data out at students. This unhappy consequence of instant culture, this pursuit of simultaneous chaos is only an extreme for reductionism.
>
> (John Silber in *Fresques*, 1971)

It appears that many of the critics of multi-image have but a limited understanding of the available supporting research that is woven into good multi-image programs. Findings supporting the effectiveness of the multi-image technique are drawn from research in several disciplines, notably psychology, education, and communications. Until the field of multi-image develops its own body of supportive evidence, it is important to apply whatever theories and results seem appropriate from a variety of existing models.

Early Research

Most studies on the effectiveness of multi-image programs have been done on instructional programs. Dr. Donald Perrin (1969), in his theory of multi-image presentations, says that simultaneous images on a large screen – or adjacent screens – create a pattern of information comparison and simultaneous visual montage. These visually-rich displays increase information density and facilitate certain types of learning. When Perrin made this hypothesis, he based it on the available knowledge from existing research. At that time there were five studies that dealt directly with multi-image; in addition, there was a related body of literature concerning the effectiveness of audiovisual redundancy.

Conclusive statements about the effective use of multi-image can only be based on a large body of consistent research. The scarcity of studies on the characteristics of multi-image programs prevents any such definite conclusions. Nevertheless, trends can be seen to emerge from the existing research. Studies conducted during the 1950s and 1960s indicate that levels of cognitive recall are higher after multi-image presentations than after single-image presentations of the same material. These results, taken from the work of Roshka (1958), Malandin (undated), and Allen and Cooney (1964), are valid, however, only with children of 6th grade level and below. Information retention and image recall procedures apparently develop in human minds by about age 12. These mental operations seem to cancel previous gains brought about by the use of multiple image. Another study from this period, done by Lombard (1969), confirmed that with older learners only low-achieving females showed better recall with multiple images when compared to a single image presentation of similar material.

Related to the above research is the indication from Hartman (1961) and Hsia (1968) that audio presentations work best with simple educational material, especially when the learners are young children or illiterates. Print versions of the same material or more complex material bring better results from older children and literate adults. Thus, there seems to be clear support for using audio tapes, multi-image program, or other media that provide the temporal organization for the learner when the learners are either young or "slow." Arguments for using such media with older, normal learners were more difficult to support.

Research from the 1960s on multiple channel information processing implies support for multi-image programs. Admittedly, the results of this particular research are not directly applicable to multi-image since "multiple channel" in these studies refers only to the stimulation of two senses with a single medium such as a sound film. Nevertheless, there is support for directing message elements simultaneously to the learner's eyes and ears. Audio and print redundancy (when projected to the slides) often yielded more cognitive recall than either audio or print used alone. Further, the research of Hartman (1961) and Severin (1967) showed the audio/pictorial combinations to be the

most effective instructional use of media. Anderson's (1969) study indicates that learners have negative reactions to all audio, print and pictorial combinations *except* pictorial/spoken, which is perceived as clear, easy and complete.

From the above information, it is clear that Perrin had reason to be optimistic concerning the use of multiple image. He had no specific evidence, however, that multi-image is more effective for learners above the 6th grade level. Nevertheless, he and other educators of the 1960s such as Roberts and Crawford (1964) were confident that multi-image programs would be useful for attracting attention, showing comparisons and contrasts, adding supplementary material to a central concept, maintaining continuity through successive steps of a process, maintaining long interest spans and high motivation levels, and keeping the learners oriented on the subject. However, some research of the early 1970s – by Bollman (1970), Atherton (1971), and Didcoct (1972) – continued to show no significant difference between the effects of single image and multiple image programs. Didcoct's study confirmed our suspicions that a multi-image program with poor technical qualities would be detrimental to learning. The recall level with such a program was lower than with a good single image presentation. Another study, done by Fradkin (1971), shows better cognitive recall with a single image presentation. Fradkin's study is unique in that he compared four unrelated films presented in 1-, 2-, and 4-screen formats. The lack of relevant cues among the images resulted in information overload and lower levels of recall with the multi-screen formats.

Current Trends

Recent studies – Reid (1970), Ingli (1972), Brydon (1974), and Ausburn (1975) – show significant gains when comparing multi-image programs to single image programs. Whereas earlier researchers had found no cognitive differences in adults when comparing these presentation styles, Ingli showed superior results with a 3-screen program. Further, affective differences between the two methods had not previously been found, but Reid's 3-screen film was more affectively successful. Brydon's results were the most conclusive of all for multi-image. He found multi-image to be both cognitively superior (with industrial mechanical workers) and affectively superior (with high school students). Ausburn's study showed multiple imagery to be superior in aiding with visual location tasks; further, multi-image proved very successful in aiding students with a noted preference for the sense of touch (haptic learners) with their tasks. As with Lombard's study, multi-image is shown to be an instructional equalizer for certain types of learners, and even "normal" learners benefit from multi-image as shown by Reid, Ingli, and Brydon. No explanation is clearly evident here as to why these recent findings show success from multi-image used with older learners. However, there is a possibility that recent designers of multi-image programs have learned to accommodate the "certain types of learning situations" noted by Perrin.

The interaction pattern of seeing several images in the same visual field produces a unique visual language problem. Depending on the placement of the images, the viewer may gain additional insights, become totally confused, or simply become bored by an overdose of visual redundancy. In theory and practice, the designer of a multi-image program should be operating within the *cue summation* theory. As explained by Hartman and Severin (1967), more learning occurs when relevant cues (bits of information) are combined across the channels of transmission. For example, more information can be added to the audio by using related, not redundant, pictures. This should increase the understanding of the message and provide a more pleasing informational package than is offered by redundancy. Of course, some redundancy may be necessary when the information is new or complex. In such cases, the added reinforcement will aid retention of the unfamiliar material.

Two recent studies have specifically investigated the use of multiple image cue summation to its greatest advantage. This represents an important evolution in multi-image research since several of the older studies simply compared single and multiple versions of the *same* images. It would seem that the most progressive use of multi-image would be to use the expanded format for *additions* to a single-image concept. Details, comparisons, contrasts, reference points, recurring themes, ironic comments and the like should be used to enhance the multi-image format through cue summation. Presumably, this would result in better response and learning than would a multi-image format that just followed a linear progression. Tam and Reeve (1971) researched the effect of various methods of organizing and accumulating images in audiovisual presentations about geography. Recall scores from their 10th grade subjects were higher with multi-image programs and highest with formats that related images *conceptually* rather than *sequentially*. However, none of the results were statistically significant. Fradkin and Meyrowitz (1975) performed a similar study, again with no

significant differences between single and multiple image programs; nevertheless, for cognitive recall their subjects recorded significantly more learning when the multi-image program was conceptually organized. This evidence suggests that the design of a multi-image program should follow the principle of cue summation in supporting the presentation's defined objectives.

All subject material may not lend itself to the types of visualization suggested in this chapter. Perhaps the use of simultaneous imagery should be reserved for those kinds of tasks requiring such complexity (conceptual relationships, motivating slow learners). The producer or designer of an instructional multi-image program should carefully consider the characteristics and advantages of multiple image techniques when organizing the presentation. In addition, the positioning of visuals and sequencing of images should be a basic consideration in program design. *Sequential* triptychs are 3-screen versions of 1-screen programs and cannot be expected to provide much improvement. The *conceptual* triptych, as tested by Didcoct, Tam, Reeve, Fradkin, and Meyrowitz, uses sequential material but relates it internally for greatest clarity and impact. Presumably, the most effective triptychs would be the *conceptual-expanded*, as tested by Reid, where additional, supportive material is added to the sequential framework. Lombard and Bollman did limited versions of this by repeating or retaining sequential slides at length, but this limited conceptual expansion is really no improvement over sequential or conceptual triptychs since the program material is not enlarged. Reid made the most positive use of conceptual-expanded imagery by enlarging his content from one to five screens without reducing the length of his program. He showed successfully that multi-image should be regarded as a unique medium with its own rules, conventions and devices. Using it properly may require different strategies and techniques than would a comparable film or videotape.

FIGURE II-1

A Comparison of Multi-Image Research
(All presentations were slide/tape with identical material unless otherwise noted.)

Study	Factor Measured	Subjects	Result
Malandin (no date)	simultaneous images in patterns of 2, 4 and 5; cog.	children	simultaneous images effective for 9-11 year olds
Roshka (1958)	sequential vs. simultaneous images; cognitive	children	simultaneous better for younger children
Allen and Cooney (1964)	1 screen vs. 3; linear vs. conceptual material; cog.	6th and 8th grade	for 6th, 3 better for mix of factual/conceptual; for 8th, both equal
Lombard (1969)	1 screen vs. 3; similar material; cognitive	10th grade	equal, 3 better for low-achieving females
Reid (1970)	1 vs. 5 screen film; similar material; affective	churchgoers	5 screen better in 2 of 3 parishes
Bollman (1970)	1 screen vs. 3; similar material; affective	undergrads	equal
Atherton (1971)	1 screen film vs. 3 screen slide/tape; cog. & aff.	undergrads	equal
Fradkin (1971)	1 vs. 2, 1 vs. 4; retention of unrelated visuals	10th grade	1 better than either 2 or 4
Tam and Reeve (1971)	1 vs. 2, 1 vs. 3, and sequential 3 vs. conceptual 3	undergrads	equal, higher trend for conceptual 3
Didcoct (1972)	1 vs. 3, 2 separate tests; cognitive and affective	undergrads	test 1, equal; test 2, 1 better for cog.
Ingli (1972)	1 screen vs. 3; cognitive; entire semester's course	undergrads	in 1 of 3 classes, 3 screen better
Yolles (1972)*	sequential 3 vs. conceptual 3; effects of narrator's age; cognitive	4th, 5th, 6th grade	sequential better for 4th and 6th; narrator, no difference
Brydon (1974)	1 vs. 3; cog. & aff.; 2 tests; 2nd, similar material	1-workers, 2-10th grade	3 screen better for everything tested
Meyrowitz and Fradkin (1975)	1 vs. 3; sequential 3 vs. conceptual 3	undergrads	1 and 3 equal, conceptual 3 better
Ausburn (1975)**	1 screen vs. 3; visual vs. haptic learners	undergrads	3 better, haptics do better with 3
Jodoin (1976)	1 vs. 3; cognitive and affective	undergrads	equal, except 3 better for delayed cog. retention

*This study confirms earlier ones that young children have better cognitive recall with a 3-screen program.

**This study confirms earlier ones that sequential triptychs are no improvement over single-image programs.

Information Processing

The literature supporting cue summation offers a strong argument for the necessity to plant relevant cues among simultaneous visuals. If multiple image is to survive and grow as a viable instructional technique, it must incorporate such research evidence. However, without a fundamental realization of basic information processing, further multi-image research and design would be invalid. Results from Hsia (1968) suggest that audiovisual presentations have distinct advantages over single channel presentations (that is, those addressing only one sense at a time, i.e. vision alone or hearing alone) provided that the learner is given an "optimal" level of information. Such a level refers to the maximum input capacity of the learner, assuming that no information overload occurs.

Travers (1967) refers to the problems of multiple sensory inputs and suggests that a multi-channel presentation is likely to be of value only when the rate of presentation is slow. Unfortunately, the compounding effects of multi-image presentations develop a continuous flow of information which quickly floods the human information processing system. Thus, designers of multi-image presentations should concentrate on the specific message and try to eliminate "noise" in the program. The producer may find that redundancy, simpler visuals, straight-forward audio or slower pacing are all needed to clarify certain program segments. In addition, the producer must decide if design and timing allow the learner to successfully alternate attention among the screens and soundtrack while still processing the flow of information.

As reported by Goldstein (1975), there are few studies that have explored the perception of multi-image programs. Meyers (1972), Nelson (1972), and others have measured eye movements in response to specific multi-image arrangements. Perrin considers the notions of selectivity and organization as "crucial" elements in the design of multi-image. A viewer given an obscure or complex stimulus with insufficient time for processing will have difficulty in locating and responding to the relevant information. Jones (1969) has shown that competing audio messages cannot be retained. McFee (1969) presents the same case for visuals:

> Visual ordering makes messages of content easier. Much of our responding is so fast that we are unaware of the processing we do. One of the tasks of the message designer is to make the visual sorting process easier; he selects and organizes visual information so that it is easier for the viewer to assimilate.

One of the prevalent theories of perception is the Broadbent model of information processing. This model assumes that one stimulus at a time gains access to the central nervous system, with additional stimuli kept in a temporary holding pattern. Such a system suggests that multiplicity and redundancy serve no function in successful media design. Fortunately for defenders of multi-image, Hsia (1971) has offered an alternative interpretation of the Broadbent model. He reminds us that what is important is the *total* information capacity of the central nervous system at any given second. Hsia says that if attention can be maintained and interference can be minimized we are capable of processing five to nine separate bits of information per second. Thus, multiple stimuli – such as volume, word content, shape, color and visual content – can be comprehended and retained. The important factor is the total complexity of any given portion of the program at any specific moment. Of course, further research is needed into the interaction of the audio and visual stimuli in terms of compounded complexity. Guidelines must be determined to help producers estimate what factors (line, size, color, direction, etc.) tend to merge into a single compound bit of information. Then, other guidelines must be sought about how such informational complexity increases as audio and visuals are brought together. The proper use of such guidelines would help multi-image designers avoid unwanted information overload.

We can see that multi-image has its advantages. The next step is to research more fully the proper design of such programs to insure maximum perceptual clarity, comprehension, and learning. Once better design principles have become known and accepted, research will be able to explore more fully what the potentials, advantages, and limitations are in this modern media mixture.

CHAPTER III
WHY WE USE MULTI-IMAGE PRESENTATIONS

Part I Palmer E. Dyer

Before we decide to produce any multi-image program, we must first satisfactorily answer the question of WHY we chose this format. Is it because we are searching for merely another way of presenting information? If our audience is young, is it because we realize that children today are more visually aware than any previous generation of learners? Or, is it because we feel that an impact derives from multi-image programming that cannot be obtained with any other form of message transmission? This question must be answered, especially since multi-image presentations require considerably more time, effort and expense than would normally be committed to a sequentially organized program.

The Basic Reasons

The valid reasons for choosing a multi-image format range from its impact in emotional appeal to its hoped-for effectiveness as an aid in instruction. Perhaps the foremost reason why many producers choose this format is its uniqueness. The impact of the multi-screen visuals literally galvanizes the viewer's attention. Thus, many programs are developed solely to take advantage of this uniqueness . . . this involvement of the audience. No behavioral objectives are identified, no follow-up evaluation is planned, and there are no results to be analyzed. The success of the program is measured in terms of supposed audience approval. Such a program may be developed to present a feeling, to visually stimulate the viewer, to arouse the audience through sight and sound.

Satisfying such a simple desire to stimulate the audience is, however, not the full scope of possibilities available through the format. Multi-image presentations can do more than just offer visual fireworks. These also must be considered by every producer before committing himself to this way of offering the message to the audience.

Thus it is helpful to identify a group of attributes in addition to the attention getting ability of multi-image or even the aesthetic preferences of the producer when selecting multi-image programming. Thus we find many pedagogically sound reasons for making use of this form of communication.

Ten Strengths of Multi-Image

Ten major strengths of multi-image have been identified. Obviously, these ten "strengths" can not be considered all-inclusive or even definitive; rather, they serve as a handy listing to stimulate additional dialogue and as a preliminary checklist for those considering the merits of this format. These ten strengths are:

(1) *Comparison:* The viewer attempts to identify the commonalities or similarities among several visuals. This is much easier when several visuals are presented simultaneously.

(2) *Contrast:* The viewer can more easily attempt to identify the differences when several visuals can be referred to simultaneously.

(3) *Multiple Perspective:* The same scene can be available from different points of view. Such changes of camera angle may dramatically alter the viewer's perception of a scene.

(4) *Sequence:* One can emphasize the flow or continuity of the visuals if they are progressively dissolved on and off the screens – especially if motion is simulated.

(5) *Juxtaposition:* By positioning images simultaneously next to one another multiple relationships among them can be made more obvious than would be possible if one needed to remember preceding visuals. This term implies the varying of size, shape, and screen position of any visual.

(6) *Direct Emphasis:* The viewers' attention can be focused upon specific visuals by organizing the composition of multiple visuals.

(7) *Sustain Emphasis:* A single, static reference visual may be presented and held on one screen while varying aspects of the same theme may be sequenced on the other viewing areas.
(8) *Motion Effect:* Motion may be simulated through the use of an animated series of rapidly changing still visuals.
(9) *Combining Motion and Still Pictures:* Motion pictures may be projected on one or more screens while still visuals of the same or different scenes can be presented on the other viewing areas. The two effects may be interspersed in unlimited combinations.
(10) *Panorama:* A wide angle composite view of a single scene may be presented across some or all the viewing areas. The extreme breadth of the panorama can make it very dramatic.

Although it may not matter to the producer who is interested in simply arousing an audience's attention, other producers should weigh their reasons before committing themselves to the multi-image approach. If it is the producer's intention to inform or to indoctrinate an audience, then it is important to know whether some of the listed "strengths" of multi-image presentations can be brought to bear in obtaining a better solution to the problem. If they pertain, then the deliberate design and planning of the program should systematically incorporate these approaches. If such effects do not seem to be required, a less involved and less expensive alternative may well suit the producer's needs.

SOME SPECIFIC CONSIDERATIONS
Part II
Ron Slawson

As an example of how multi-image programs are justified in educational settings – specifically in the two year public community college – let us examine the experience of Santa Fe Community College in Florida.

At Santa Fe Community College, the original idea was that if multi-image presentations could present information in an exciting and informative way to an audience in a shorter amount of time (as has been demonstrated by large corporations at various trade fairs) then one should try to adopt this technique in education.

In order to sell the idea of teaching using multi-image presentations to students and faculty, the first step was to offer a presentation. It was the late 1960's and a multi-image presentation titled "Times are Changing" (which was being prepared to keynote the American Association for Community, Junior Colleges Fiftieth Convention in Hawaii) was shown to the administration and faculty of Santa Fe College.

Since this presentation was judged as highly successful, the next step was to plan a two-year program that would not only inform students about all forms of media, but would also use media to provide them with well-rounded instruction. This instruction was in such areas as public relations, speech, salesmanship, drama as well as the required subjects, such as science, math, and history.

The use of multi-image presentations is succeeding at Santa Fe Community College. This special program was approved in the early 1970's and each term more students apply than can be accepted. The program has grown tremendously. It began in a hallway on the old campus, limited to a four-foot projection distance, four slide projectors, a dissolve unit, and a stereo tape recorder. The facilities have greatly expanded since then.

Students were provided with a standard, such as "How to Prepare a Multi-Image Presentation." They learned how to set up a flow chart, use a planning board, and put a program in the drums. At the end of the term a final film festival was held and the community was invited.

Picture III-1
Showing students how to insert slides in a drum.
AMI Collection

Today, in the introductory course, the student has a multi-image presentation ready by mid-term, and participates in a mini-festival. Then students re-work their presentations and present them at the final festival in the 360 seat auditorium which has three 16x16 foot screens that lower from the ceiling. Each student manually controls the buttons in the control booth for his own

presentation; superior presentations are "digicued" (programmed) to show to future class sessions.

Picture III-2
Showing students how to sort and organize slides.
AMI Collection

The facilities now include three sets of equipment that are available for use at all times. One is in the media lab that seats 40 people; another is permanently set up in the auditorium that seats 360 people, and the third is taken "on the road" to share students' presentations with the community.

Educational Presentations

Since the early 1970's at Santa Fe Community College, 10,000 presentations have been shown to 160,000 people. There have been over 400 extra class sessions for instructors at Santa Fe Community College. Presentations have been shown for all the local high schools and middle schools, and many of the local churches. The college has participated in the Florida Association of Media in Education Convention each year. The first AMI (Association for Multi-Image) "How to Prepare a Multi-Image Presentation" Workshop was held at Santa Fe Community College.

Two hundred presentations are kept on hand for classes, for use in teacher in-service training programs, and for use at state and national conventions. A Santa Fe Community College student has won the State Media Award for each of the four years the award has been given.

Many of the presentations are used for regular teaching areas such as in history: "Civil War," "Never to Go to War," and "Flight"; or in the humanities: "Dali," "Michelangelo," "Vincent," and "Norman Rockwell."

The advanced students working with multi-image, schedule and program the presentations for various classes that attend each week. They also participate in the film festival and the traveling presentations, thereby gaining more experience in the use of multi-image equipment. The multi-image students are prepared for this from the "hands-on" sessions in the introductory course.

Picture III-3
A student programs a multi-image presentation.
AMI Collection

Business and Industrial Presentations

Multi-image is a most important and exciting form of communication. We can look to the examples of business and industry who have spent millions using multi-image presentations to get their messages across. Montsanto's multi-screen, "America the Beautiful," at Disneyworld and Disneyland is an excellent example . . . it uses ten film projectors with a complete circle screen to tell a patriotic story in pictures of America to the accompaniment of an appropriate musical soundtrack. Other examples are: telephone companies telling their stories in multi-image, as well as the use of multi-image by the military and corporations (such as Kodak) who use multi-image to introduce their new equipment.

We are seeing more multi-image than ever before. The significance attributed to the use of multi-image is evidenced by the number of conventions that appropriate funds for use in multi-image "kick-off presentations."

Multi-image is a lot of hard work. At Santa Fe Community College we do not have any staff to help execute the programs, so we use advanced students. It is worth the extra work because we are graduating students each semester and placing them at educational institutions to assist faculty and media specialists – to utilize multi-image effectively.

When you prepare and present a multi-image presentation to an audience and realize the effect it has on them, you will at that time have the answer to why we use multi-image presentations.

CHAPTER IV
THE MULTI-IMAGE PROGRAM TECHNIQUE WHAT TO USE

Part I JoNell Campbell

The multi-image technique relies at its most basic level on the combining of the best of aural and visual communications to reach the selected audience and achieve the desired objectives. All of the finest, most expensive, most sophisticated multi-image hardware available is only as good as the "soft-ware" it displays. The multi-image technique has the advantage of combining motion and still visualization and the advantage of using multiple images to convey information and increase aesthetic impact. In this chapter, attention will be given to (a) the creative process involved in developing the audio, (b) visual conceptualizing, and (c) the physical arrangement necessary to "get the show on the screen." It should be noted that the multi-image technique has certain basic steps any producer must perform; however, technique also involves style. Just as two novelists writing the same story will produce distinctively different pieces of fiction, two multi-image producers dealing with the same subject will ultimately incorporate different techniques in achieving the goals they desired.

The following, then, offers general guidelines, and is hopefully, a springboard to individual creativity.

The Audio

The audio track lies at the heart of any multi-image production, whether it be a simple one screen production of a few minutes duration, or a multi-screen extravaganza on the grand scale of *The New York Experience*. If the newcomer to the art of multi-image does not fully appreciate the importance of audio, he or she should try watching television without sound. Reverse the experiment and try listening without watching the picture. It should become clear at this point that communication relies most heavily on what is heard rather than on what is seen. In producing the sound track for a multi-image presentation there are four basic arrangements of sound elements: 1) the music only production, 2) the fully narrated production, 3) the documentary approach, 4) the combination of the above. (Since one entire chapter of this book is devoted to audio production, the technical aspects of recording will not be dealt with here in any detail.)

Music must be carefully selected. Music is the key to establishing mood, developing pace and molding the production into an entity with introduction, transitions, and conclusions. Music is often "borrowed" from pre-recorded sources. In addition to the individually purchased album, radio stations are sometimes sources for recordings. When using music from discs, care in handling the record cannot be over-emphasized. According to audio engineers, the high frequencies on a disc are lost with the first few needle drops. It is a good idea to get the music on reel-to-reel tape the first time a record is played, and then use the tape as a source for actual audio mixing.

Original music recording may not be as prohibitively expensive as it might sound. Effective original music can be obtained by "keeping it simple." Look for original compositions from "local" talent – students; folk musicians; hungry, struggling rock groups, etc. Try single instrument recording: a flute has many moods when played without accompaniment or orchestration; a solo banjo or guitar is hard to beat if it fits the overall tone of the production; a drum or drum set can provide excellent rhythm tracks; try voices a cappella. If, of course, budget is no object, seek out services of a near-by recording studio for a full treatment of original sound.

Always keep the visuals in mind during the music selection process. Sometimes certain pictures dictate exactly the type of music needed; sometimes the discovery of a piece of music will trigger new visual ideas – be flexible and devote adequate time to the selection of this very important audio element.

Picture IV-1
A commercial long playing record
Photo courtesy: Duane Troxel

Picture IV-2
A reel-to-reel tape
Photo courtesy: Duane Troxel

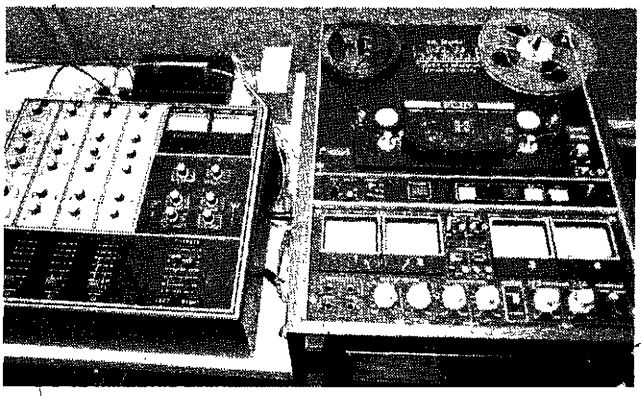
A fully narrated program is very cost effective. It has the advantage of simple production and advance planning; however, without a well written script and good delivery on the part of the narrator, it risks possible loss of audience attention, particularly in the case of longer productions. When selecting a "voice" for narration, keep the audience uppermost in mind. A student audience may be "turned off" by an authoritative "older" voice and vice versa. Try to record the narrator in a studio or spot isolated from extraneous noise that won't fit with the total program. Use a good microphone. Be willing to re-record until the desired effect is achieved. Seriously consider the use of several voices used in a pseudo dialogue. The alternation of voice character helps to retain attention.

The documentary approach is one of the most powerful audio communication techniques. This involves location recording for authentic sounds; it involves getting away from formal scripting and letting the subjects speak for themselves – in their own way, in their own vernacular. It also involves a great deal of production time and often a great deal of editing. If the time and equipment are available, in this producer's opinion, the end result is well worth the effort involved. It helps if the reel-to-reel recorder can be battery powered, although line power will be available in most recording situations. Cassettes can be used, but this requires a dub to reel-to-reel for editing and tends to mean reduced audio quality in the final mix. Always use professional quality recording tape of 1.5 mil thickness for superior sound and ease in editing.

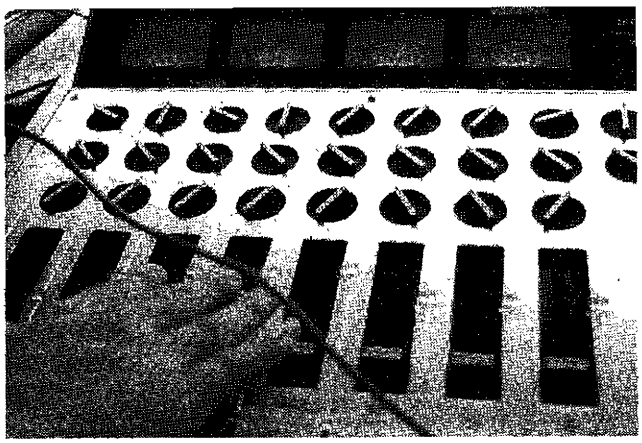
A producer using a documentary approach will do well to develop the required interviewing skills and to learn to use the editing block and razor blade. A typewritten transcript of interview or commentary tapes is to use along with the audio track also extremely helpful when editing.

The documentary approach is extremely valuable in productions with the purpose of persuading or gaining action from an audience. It provides an authentic credibility that is difficult to achieve in straight narration. However, since not all programs a producer makes are documentary in nature its application is by no means universal.

Combining the above audio techniques will almost surely require the assistance of an audio engineer and/or audio production facility. The ability to combine sound from several sources (e.g., a person talking, a music transition, a sound effect, etc.) requires a mixing board which can bring together these various sounds with proper volume control and get the desired effect onto the master tape. Some sophisticated tape decks have mixing capability, but it is usually best to locate a recording studio in the area, a radio station which will do production, or find an "audio freak" hobbyist who may be equipped to handle relatively complex mixing.



Picture IV-3
An audio mixing set-up
Photo courtesy: Duane Troxel



Picture IV-4
An audio mixing panel
Photo courtesy: Duane Troxel

An audio track that has been mixed offers variety and tends to "hold" an audience better than audio which uses only one technique. The end result is *usually* worth the extra costs involved. It should be noted that a producer who goes to the mixing session totally prepared with all preliminary editing done and all sound segments timed and clearly labeled *and* with a readable audio cue script will save money and nerves during the actual mix. [See Sample Audio Script]

Audio is vitally important. Audiences today have come to expect quality sound. They have been raised from the cradle with the best, most professional listening money can buy. Don't let a good visual production without quality audio techniques brand a presentation as "amateurish."

Sample Audio Cue Script

Program: "Getting Down to Grass Roots"
Client: Mid America Dairymen, Inc.
Producer: JoNell Campbell
Page: 1

Music Intro: "Run Johnny Run" Side 1 Cut 4 Music Tape II

Music begins up – hold for :35, then fade and hold under voice

Voice Tape #1, Cut 1:

I've milked cows ever since I can remember. Back years ago we run an old cow out in the lot and set down and milked 'er wherever she stopped. That's just how long I've been in.

Music: ("Run Johnny Run" con't.)

Up for :15 then fade out under following voice

Voice Tape #1, Cut 2:

I believe dairying is it and if I didn't I wouldn't be building that new barn. (Sound effect)

Intercut Sound Effect: Cement Mixer

Of course, that's my boy Jim's. He's done a better job of dairying than I did. Jim's a pretty good dairyman. I'm just a pretty good cow milker.

Sound Effect: Cow mooing

Music: "Tomato Vendetta" Side 2, Cut 1 Music Tape XV

Music up for :25 then fade out under next voice

Voice Tape #1, Cut 3:

I was about 35 when I really started thinking about coming back to the farm . . . .

The Visual Technique

How many screens? How can one screen be multi-image? If one is good, three must be better and nine would really blow their minds! Now . . . can't you figure out a way to put the whole thing on video tape?

The question of screen configuration figures prominently in any discussion of multi-image techniques. It is a question the standards committee of the Association for Multi-Image has been wrestling with throughout its short history of hosting festivals. In this writer's opinion, the question of how many screens of images and their arrangement demands thoughtful consideration on the part of the producer in two areas: 1) the purpose of the production and the physical consideration of the eventual viewing area(s); and 2) the possible screening of the production at national and regional festivals such as those hosted by A.M.I. and at the conventions of NAVA and AECT.

Purpose and Physical Considerations: As a general rule of thumb, it is best to never use more screens than one unless there is a real reason for doing so. For most productions, the one screen format is not only adequate but desirable. How can one screen programs be realistically called "Multi-Image" . . . by use of multiple projectors on the one screen area. This is accomplished with two or more projectors in combination with a dissolve system which alternately turns projector lamps on and off in a prescribed – usually programmable –

sequence. (The technique of dissolve and superimposition will be dealt with more fully, later in this chapter.)

One screen shows are advantageous when portability is a consideration; it simply requires less equipment, less know-how, less time to set up than multiple screen programs. One screen shows are also of greater advantage when the viewing area is known to be limited in size. *AND* one screen shows can be every bit as good and as powerful as can three screens *IF* the creative software that goes on the one screen is good. A one screen show can also be cheaper to produce (as a general rule), faster to produce, and is a good place for the inexperienced producer to begin. If the subject demands a multiscreen format for full impact, it is recommended by the Association for Multi-Image and by the experience of countless multi-image producers that no more than three image areas be used. There are several reasons for this: 1) Most viewing facilities are not built to accommodate "World's Fair-type" extravaganzas. 2) The three screen technique makes for very "viewable" presentations. The eye can easily take in three screens of information — more than three seems to distract from good communication and becomes only effect for the sake of effect. Wilson Brydon, a pioneer in multi-image production, poses the theory in his presentation *This Thing Called Multi-Image* (presented at a number of AECT Conventions) that the three screen format has historical continuity stemming from the triptychs (three image panels) of Medieval and Renaissance religious art. Whatever its historical justification, the artistic effectiveness of the three screen format seems to be widely accepted by producers and audiences alike. 3) The three screen technique lends itself well to visualizing steps in a process and therefore has strong educational value. 4) The three screen technique is good for dramatizing comparisons and contrast. 5) Finally, the three screen configuration is "a natural" for the powerful impact of the panorama — a single vista stretched across all screens. (How to shoot the panorama photographically will be dealt with in the chapter on "Producing the Visuals.")

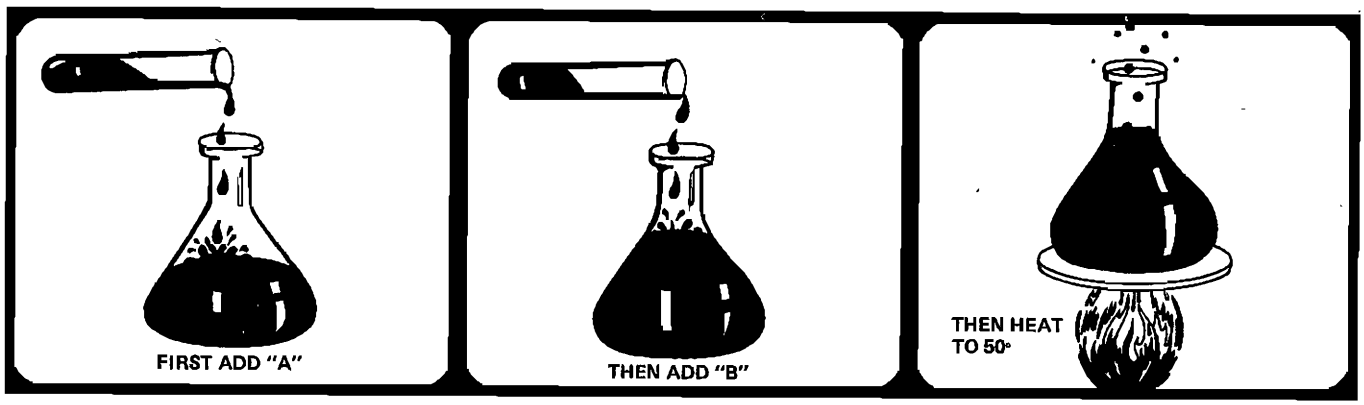


Illustration IV-1
Steps in a process

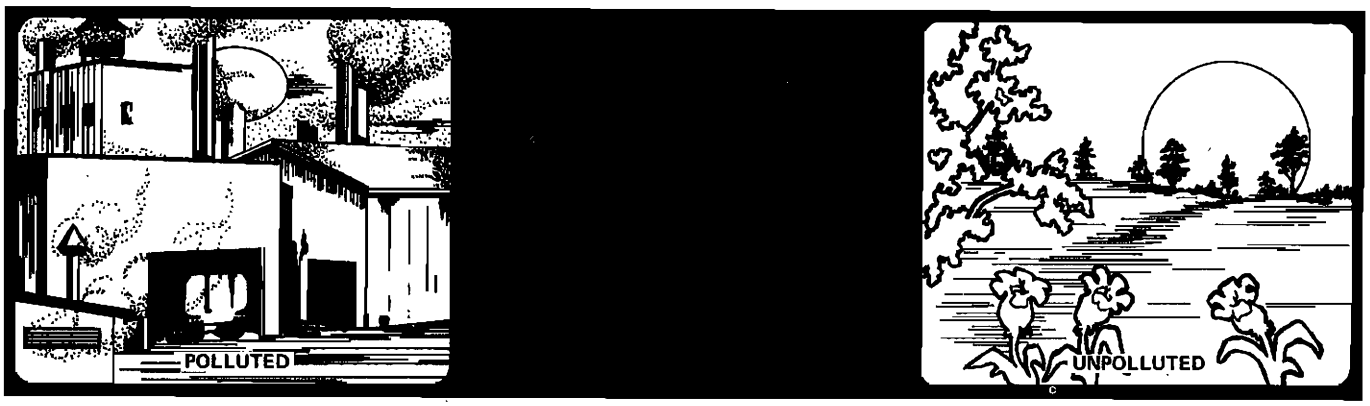


Illustration IV-2
Comparison and contrast

Illustration IV-3
The Panorama

In dealing with individual, single purpose productions, the producer may occasionally find a need for a format other than the two previously discussed. If an alternate format meets the purpose and fits the viewing facility, then the creative judgement of the producer should be exercised. A personal experience of the writer might serve here as an illustration. The purpose of one of our particular assignments was to communicate the University's need for the funding of an agricultural research station to a group of selected legislators. The room for viewing was quite small. We were specifically instructed not to overwhelm the limited space with several screens; *however,* the production needed to convey the many activities that took place simultaneously at the research station. It was decided that one screen would be used along with six projectors. Two of the projectors were attached to a dissolve and lens were used on these two projectors so that a full screen-size image was obtained. The remaining four projectors were fitted with lens which would project smaller images and were aimed at the four quadrants of the screen. [See Illustration]

The desired effect was thus achieved within the given space limitations. The above example is included to demonstrate that the multi-image technique can be creative even in the arrangement of image areas; however, this example is illustrative of a "non-standard" format. It was suitable for one particular purpose only; non-standard formats are discouraged as a general practice for a reason – and that reason involves the growth of the multi-image art form and the proliferation of producers and productions which brought about the formation of the Association for Multi-Image.

The Festival Format: In its hosting of festivals, the Association for Multi-Image seeks to fulfill the philosophy that programs once produced should have a screening place beyond the locality of the production. A.M.I. endeavors to provide a forum for the sharing of the creative efforts of many producers. Hopefully, the future will hold even greater extension of this philosophy as a "clearinghouse" for program exchange is established. The problems of showing many productions in a single area in a limited amount of time, and the hope for sharing multi-image programs as easily

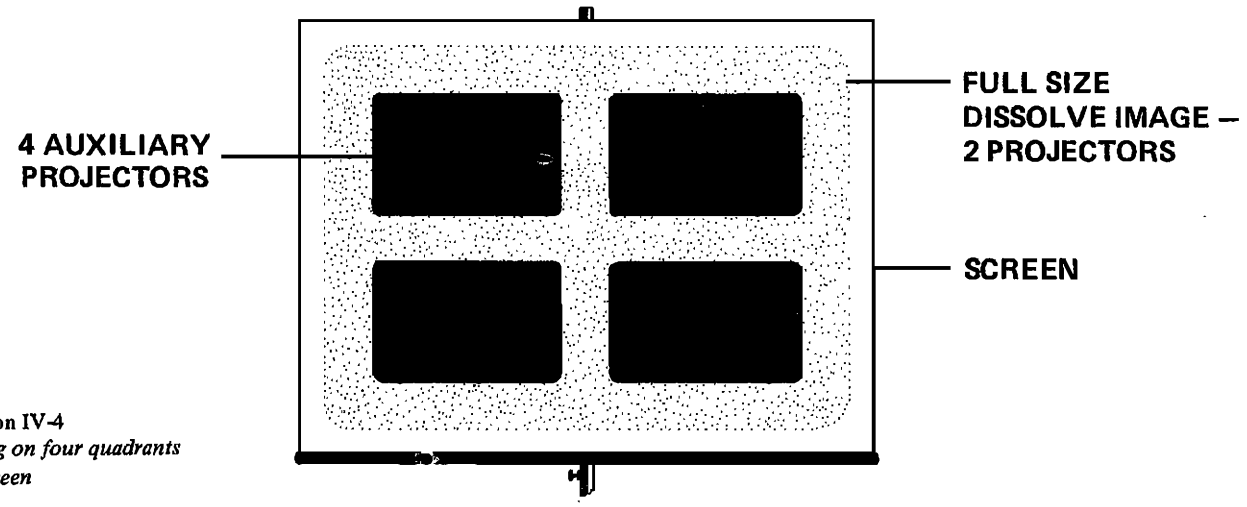


Illustration IV-4
Projecting on four quadrants of the screen

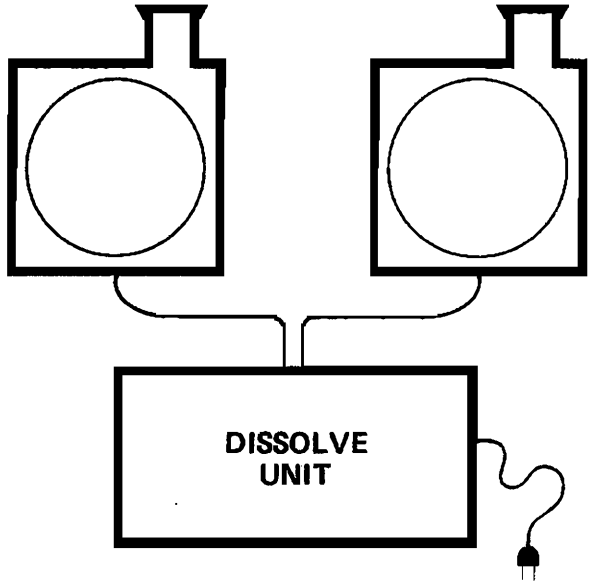
as one shares films, requires at least some general guidelines regarding format. Therefore, to participate in festivals on a regional or national level, producers are requested to use either one or three screen configurations. This restriction seems indeed reasonable when the growth of the art form stands to benefit.

Use of Slides and Motion Picture Film

All audiences are acquainted with motion pictures. Most audiences have been exposed to slide or filmstrip programs although not always in the multi-image format. The technique of multi-image combines still photography with motion photography approaches and sometimes with motion picture film itself.

Dissolving still images is an integral part of the multi-image technique and of multi-image equipment. The concept of the dissolve was "borrowed" from a motion picture technology. It involves "blending" from one image to another without the single projector's "click-click/black space" between slides. This is accomplished by connecting two slide projectors to a dissolve unit.

Illustration IV-5
Connecting two slide projectors to a dissolve unit.



The principle that makes the dissolve unit work is quite simple although the electronics in the unit itself can be very complex. Think of the dissolve unit as a box containing two oppositely gauged dimmer switches (much like a wall switch which allows a room light to be raised or lowered gradually). As the dissolve unit changes the dimmer's setting, it turns the lamp on one projector "up" while turning the lamp on the second projector "down." The result is a gradual, or "soft" transition between visuals. The capabilities of various models of dissolve units and their prices range considerably. It is even possible to build one's own although some commercially available models are priced competitively with the cost of the components necessary for a "do it yourself" job. Many reliable and inexpensive units are "programmable" – enabling the final product to be automated so that the show runs the same every time regardless of a change in operators. (See also the chapter on programming the multi-image presentation in this text.)

By careful photography, one can even simulate a "zoom" effect with the use of a dissolve. Carefully constructed graphics can add the effect of color transition to a visual (e.g., a yellow area on a slide in projector #1 aligned carefully with a blue area in slide projector #2 would pass through green during the dissolve process). Fades to black or up from black can be achieved by using a "blank" slide in one of the projectors. A "blank" is an opaque slide – commercially available and made from plastic or one can carefully cut a 2 inch square from illustration board with a mat knife.

While it is perfectly acceptable to do a slide show without dissolve, once used, a producer will find it distracting to go back to "click-click" presentations.

Superimposition is another multi-image technique borrowed from motion film. This involves placing two images on a single screen area simultaneously. It is often useful in titling although it can be used very creatively in achieving special visual effects. There are two basic ways of superimposing images on the screen. The first is mechanical – by having the lamps in two projectors "on" simultaneously. The capabilities of one's equipment is the key factor here. Check instruction manuals for dissolve and programming units to ascertain if superimposition is possible with the given equipment. A second way of achieving superimposition is within a single slide itself. This effect goes by a variety of names. If done with the camera, it is a double exposure. This can work very nicely if you can plan your photographs in sequence and accomplish correct exposure. If the superimposition is done within the slide mount, i.e., outside the camera, the technique is sometimes called making a "sandwich." The sandwich is made by selecting two complementary images. These images are removed from their original mounts and mounted together in a single slide frame. Two arrangements work particularly well: 1) having both slides slightly overexposed; 2) using one slide that has a strongly silhouetted subject that can be combined with a sky or light effect as a background. A particularly striking effect involves sandwiching a close-up of a face

with a long shot of that same individual. It is often possible to make use of otherwise unusable over-exposures this way for very interesting special effects.

Using the multi screen format effectively: It would be especially useful for the novice to remember that when using a multiple screen format, it is not necessary – perhaps not even desirable – to constantly fill all screen areas with images. One of the "motion" tricks of using stills in multi-image is to keep the eye of the audience moving. Use placement of images to establish rhythms, to establish relationships between visuals, to establish divergent points of view, to establish placement of different speakers. A multi-image production need not have motion film footage in order to create a feeling of motion.

Using motion footage in the multi-image presentation: Another caution to the newcomer in multi-image is to avoid using motion picture film unless visual movement is really necessary and cannot be achieved with still photography. An excellent major entertainment production *Where's Boston** uses no motion footage at all, so rest assured that including film which moves is not the sign of a true "professional." If the proposed production needs motion footage, be aware that good 16mm work is expensive and time consuming to produce. Super 8 is more affordable but sometimes means a compromise in visual quality especially as regards the inferior grain structure of the Super 8 film.

After so many cautions about using film, equal time should be given to the power of blending moving and static images. The screen which has been filled with still photographs and then suddenly "blooms" with motion usually produces a dramatic effect as does using a single screen of motion picture film which slowly becomes a breath-taking three screen panorama.

It is a good idea to shoot still photography at the same time the motion footage is being done. This provides material for some nice effects when it comes time for the presentation. For example, a still picture can jump into action (or vice versa) without the expense of creating a freeze frame at the lab. Still shots of the subject for the motion picture can be projected on the outside screens while the action moves in the center adding increased impact to the treatment of the subject.

Film can more easily provide us with rapid animation than can most multi-image systems currently available. Film is also nice for "rolling" credits and can be superimposed over a projected slide.

**Where's Boston* is currently showing in the Prudential Building in Boston, Mass. (as of 1976).*

Three final notes on film: 1) film scratches easily and looks "old" with continual use. Since the same does not hold true of slides, allow in your budget for a second print if the show will be used frequently. 2) When setting up equipment for actual presentation, be aware of the differences in both the size and aspect ratios of the projected images if the slide projectors and film projector must be placed at the same distance from the screen. Using a Filmovara lens (or equivalent) on the 16mm projector will give some latitute in enlarging the motion image. 3) *Do not* try to sync sound on film with sound from a second source in programmed multi-image situations. It can be done but only with the addition of very sophisticated electronics including a modification to the 16mm projector. Silent motion picture footage in which the audio track for the slide component provides the sound is almost always preferable.

The Physical Arrangement

The physical arrangement of equipment for presentation is usually illustrated in detail in the operations manuals which come with dissolve units and programmers. Beyond this, there are probably almost as many ways to set up for a show as there are rooms where people gather. Thousands of dollars could be spent and volumes written in an attempt to create the perfect multi-image theater. There are some available and their number is growing, but since most producers display their work in less than perfect surroundings, some general set-up suggestions will be noted here. Most of the following assumes a front projection physical arrangement. (See also the chapter "Presenting the Multi-Image Program" in this text.)

1) Check out the physical facility *before* the set-up. It helps immensely to be able to anticipate problem arrangements. 2) Learn about the capability of various projection lens: lens size x distance from projector to screen = image size. Every Kodak projector comes with an operations manual which contains a projection distance chart. A choice of lens sizes gives flexibility of physical arrangement in various sizes of rooms. 3) Align dissolve images and superimposed images carefully so that they will appear on the screen as intended. Some producers use alignment slides which are commercially available; others use the panoramas for "lining up." 4) Project over the heads of the audience if at all possible. The stacking of two standard height tables – one atop the other – works well. It could also be noted that it is desirable to cover the card mazes in and about the tables with table clothes or sheets for a more

pleasing appearance of the hardware. 5) Be aware of potential heads in the projection paths *before* the audience arrives. It may even be necessary to rearrange movable seating or to rope-off certain fixed areas. 6) Make sure power cords and speaker cables are not safety hazards by avoiding placing them across traffic paths. If this is unavoidable, tape them down securely. This not only prevents potential personal injury but also insures that all important connections do not get violently disconnected during mid-show. 7) Make a detailed list of all equipment and software needed for the presentation. Use it for getting there with everything needed and for coming home with everything that left the office. Then *file it* for future reference. 8) Determine beforehand the power-handling capabilities of the house wall circuits. If you are using a large number of projectors you may easily overload the circuit and start blowing fuses. If several circuits are available, find out about them and divide your power requirements appropriately, then locate ALL the unused wall connectors and tape them over with a clearly written note of what will happen if someone plugs added equipment in during your shows. Be courteous and remove all your covers before leaving. 9) Be prepared for emergencies -- extra lamps, a duplicate copy of the audio tape, a copy of the script, extra audio cables and connectors (these are often the place where mechanical problems appear first), take back-up equipment along or know where it can be obtained quickly, flashlight, aspirin and/or "tums" if this is a first show. If your show is important enough, consider the value of paying for a complete set of duplicate slides so you can replace an entire tray of slides in case of a mishap. 10) Allow plenty of time for the set-up -- better too much than not enough. 11) Be confident. If your preliminary planning has been thorough, the show should run without a hitch.

HOW TO ORGANIZE
Part II
Ron Slawson

The following is a diagram of how to prepare a multi-image presentation using one set of equipment from Santa Fe Community College.

FIGURE IV-1

HOW TO PREPARE A MULTI-IMAGE PRESENTATION

STEP I
1. Idea (theme)
2. Storyboard (idea development)
3. Sound track (in conjunction with overall theme)

STEP II
1. Look for pertinent slides in slide file or photograph your own
2. Take slides needed with the Instamatic Visual Maker or 35mm copystand

STEP III
1. Arrange slides on light table in order of appearance using the script of the sound track as a guide

STEP IV
1. Contact multi-media personnel to check timing
2. Insert slides in trays

STEP V
1. Schedule equipment for rehearsal with multi-media personnel

STEP VI
1. Schedule equipment for final presentation with multi-media personnel

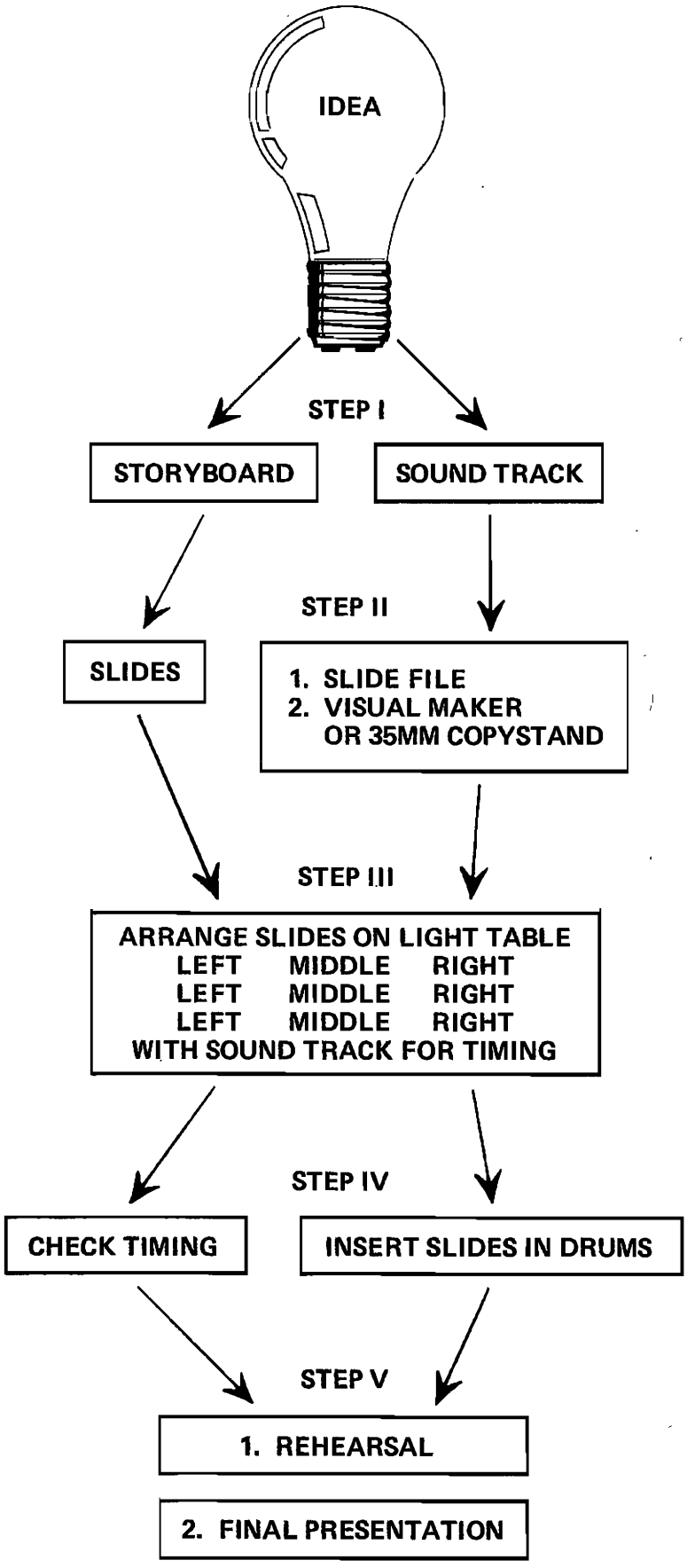


Illustration IV-6
Flow Chart of a multi-image presentation

FIGURE IV-2

PLACING SLIDES ON LIGHT TABLE

A. For three image presentation
   1. Place three blank slides
   2. Place your two outside images remembering that your middle image is dissolving.

IMPORTANT IT TAKES THREE SECONDS, WHEN USING THE DISSOLVE UNIT, TO GET COMPLETELY FROM ONE IMAGE TO THE NEXT IMAGE.
   * KEEP THIS IN MIND FOR TIMING PURPOSES. WHEN USING THE DISSOLVE UNIT. YOU HAVE AN OPTION OF USING A THREE SECOND, NINE SECOND, OR QUICK CUT DISSOLVE PROCESS.

   3. Use blank slides for outside images when you want only the dissolving image to appear.
   4. End with three blank slides.

B. For one image presentations
   1. Place two blank slides
   2. Place one row of slides
   3. End with blank slides

FIGURE IV-3

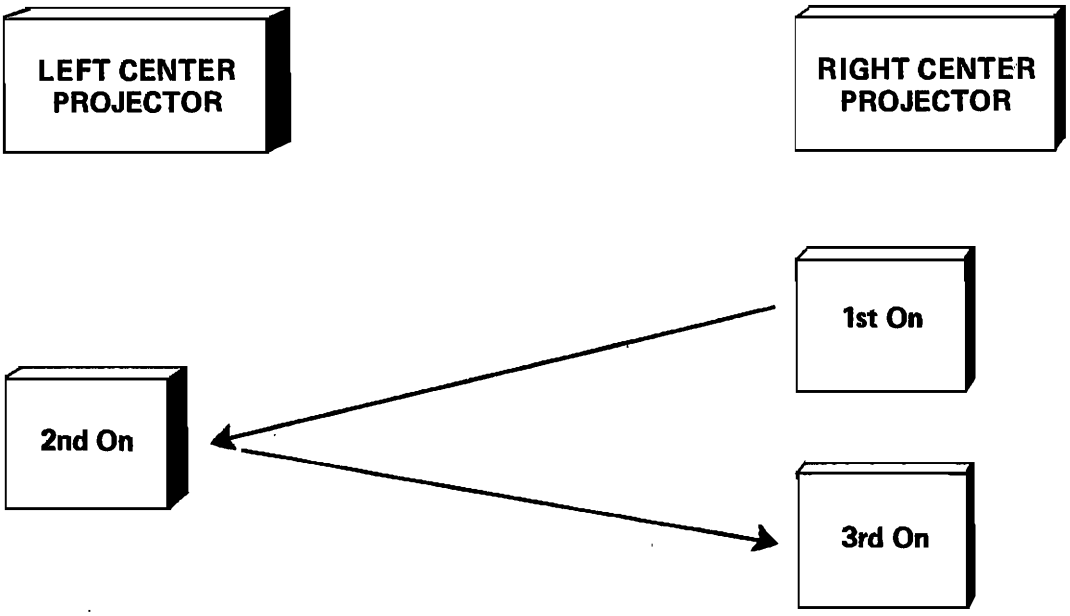
INSERTING SLIDES IN TRAYS

A. For three image presentations be sure to lay the slides out on the light table exactly as you see them on the screen (Left/Middle/Right). Alternate the center row in the two middle drums starting with the first slide in the right middle tray.

LEFT	LEFT CENTER	RIGHT CENTER	RIGHT
BLANK SLIDE	BLANK SLIDE	BLANK SLIDE	BLANK SLIDE
SLIDES		1st On	SLIDES
	2nd On		
		3rd On	

   1. Place four blank slides in.
   2. Your left and right slides go into their respective trays.
   3. Place your middle slide first into right center. From there alternate from tray to tray placing a marker into the middle of the tray of the last inserted slide to remember your place.

Illustration IV-7
One image presentations



1. Place two blanks in.
2. Same as #3 for three image presentations.

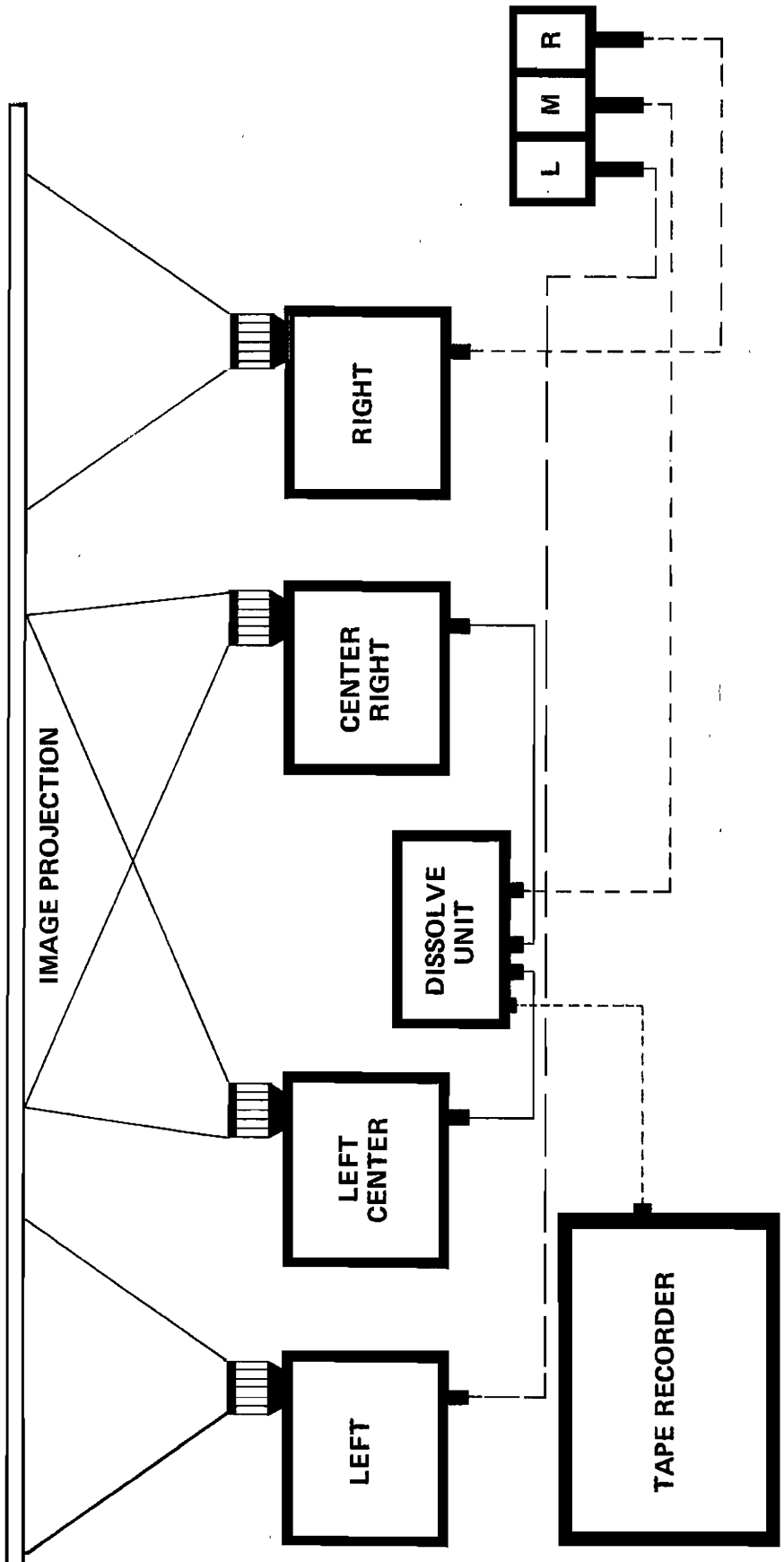


Illustration IV-8
A Multi-Image Set-up

CHAPTER V
PLANNING AND WRITING THE PROGRAM

Palmer E. Dyer

Good multi-image programs can offer much, both in terms of audience involvement and in creating a high interest level. Poorly conceived programs with a hit-or-miss approach and no clearly identified objectives will most often fail to provide any meaningful impact on its viewers. For example, one prevalent multi-image programming error is that of continuously filling each screen merely for the sake of "completeness." When one has decided in advance why each image needs to be where it is, such errors are less likely to occur, for the producer attempts to be constantly aware of the direction to be taken. When we are dealing with instructional multi-image programming, we are aiming for a very precise goal, and that is to teach someone something rather than simply providing a dazzling display or a mind-boggling experience devoid of content and purpose.

There are a number of studies that support the hypothesis that picture and spoken word combinations are effective in the communications process – but, communication of what? In some instances, the lack of specific objectives may well communicate that which McLuhan has suggested . . . that the medium is the message. This has a high probability with most multi-image programming for all too often the viewer has said it was a great program, I thoroughly enjoyed it, but I learned nothing. Again, if you have developed a program simply to arouse, or alert the audience, you can consider such comments as evidence of a successful motivational presentation. If, on the other hand, you had intended to develop an instructional unit, you have failed. Thus, there is little need to spend a great deal of time identifying instructional objectives for the motivational type program. (However, outlining psychological, compositional, and artistic objectives may serve the producer extremely well.) The success of the motivational program can be measured in terms of audience appreciation.

What about the instructional multi-image program? Here the producer is aiming toward a precise goal and it becomes essential that the parameters of the program be clearly delineated.

Setting Objectives

Preplanning is best accomplished by clearly determining the desired outcome and then writing narrowly defined objectives to meet that goal. If *you* are a true "gestaltist" and follow the dictates of Kohler, Koffka or Wertheimer, *you* may be ready to stop at this point and select another mode of instruction. If, however, you find the research outcomes of Thorndike, Watson, and Skinner more convincing, then the necessity for writing specific behavioral objectives for your multi-image instructional program should be quite evident.

The first step is to identify the broad scope or theme of the particular program unit *you* are developing. Once established, the thematic approach should readily lend itself to the drafting of the more narrowly defined, specific, objectives for each segment of the presentation. For example, a multi-image instructional unit could be developed on the broad theme "Modes of Transportation." From this broad category of all transportation, we could move to subdivisions of ground, water and air transportation. A further narrowing of focus would move from all ground transportation to specific modes such as automobiles, trains, busses, and so forth. At each step along the way, from the broad theme to the subdivisions, specific program objectives can be written.

In using this thematic approach, the multi-image producer has a blueprint for instruction, a guide that should aid him in designing a program that will be effective in meeting his stated goal. Now the question becomes: how specifically must my objectives be written? There are no hard and fast rules regarding the writing of specific objectives for multi-image programs. However, the developer of objectives must not only identify the topics to be discussed but carefully determine what aspects of each topic must be understood, what kind of

understanding should take place, and in what observable manner successful understanding should manifest itself, i.e., the producer should know just "what" and "how" the audience is expected to learn the content. Generally, it is accepted that the more narrowly the program objectives are defined, the more likely the program will effectively transmit the desired message. With precise objectives, the producer is less likely to digress from the topic or to become engrossed with the technology and lose sight of the original program goal.

The multi-image form of message transmission is definitely suffering growing pains. Some individuals start to develop multi-image programs on the basis of the hardware or technology available to them, while some programs have been generated solely on the basis of utilizing a selection of slides found in some file cabinet. One may, with luck, develop a successful instructional multi-image program on these bases, but the odds are against it. If the program is strictly of a motivational or aesthetic nature, then starting with the hardware or even with an available body of slides may result in an acceptable program. But, if the program is to meet an instructional goal, the best basis from which to generate an effective unit is from clearly defined objectives.

Now the multi-image producer has a direction. He or she should know quite well where to proceed next and the specific objectives should have been developed to insure that the instructional aims are met. Now comes writing a script, developing a storyboard, shooting the slides, and making the audio tape. Or, is the sequence: develop a storyboard, write a script, shoot the visuals and then make the tape? Even though most instructional multi-image producers would agree that the first step is to write good, clear objectives, there is not the same clear-cut agreement as to sequence of the steps that follow in developing the final program.

Scripting the Program

Many people feel that the key to any successful multi-image program is that of writing an appropriate script, one in concert with the stated objectives. When this step is completed, one develops a storyboard. Others argue that the second step in the sequence is that of developing the storyboard from which one then determines the script and visuals needed to make an effective program. It becomes a moot argument when one considers that the storyboard is a production tool while the script is actually a part of the finished program. For our purposes, we will attend to the area of scripting first and then discuss multi-image storyboarding.

A major problem facing the multi-image producer is that of determining just how much narrative will be necessary to insure that the desired message is communicated and the program meets the stated objectives. One of the inherent dangers in developing any slide/tape program is that of being too wordy. Excessive narrative leaves a visual on the screen for too great a length of time while the dulcet voice of the narrator describes what one is viewing or imparts information relevant to the visual. Whether it be a one-screen or multi-image presentation the effects of over-verbalization can be devastating. Obviously, the converse is equally true when one attempts to overwhelm the viewer with a sequence of too complex or too detailed visuals without either providing adequate explanation or allowing sufficient time to digest the information presented.

Many producers fail to fully accept the fact that multi-image is essentially a visual medium, and fail to take full advantage of the uniqueness of this form of communication. When scripting a program, the novice producer tends to draw on past experience of writing scripts for audio programs or single-screen presentations. There is, or at least there should be, a considerably different approach used in working with multi-image.

The first step in developing a good script for multi-image presentations is to think in visual terms. This may seem self-evident, but it is far more difficult than it appears, for characteristically one tends not to visualize verbal or written statements. The attempt is to articulate a specific point and permit the listener or reader the latitude of supplying the visual interpretation of the statement. In multi-image programming the visuals are supplied and the primary emphasis must be on what appears before the viewer – not on what may be heard from the narrative accompaniment. The key word is *primary* emphasis, for obviously, no one would intentionally write a script that was not in concert with the visuals on the screen.

An experienced producer capitalizes on the visual aspects of multi-image. If too much narrative becomes essential to communicate the desired message then it may be wise to re-evaluate the motives which led to the choice of developing a multi-image program. It would be considerably easier, and perhaps far more effective, to develop a single-screen program where the visual impact is not nearly so dramatic and would not detract from the narrative explanation. It is an accepted practice in single screen programming to use a visual to support the narrative. The desired message, the content, is presented by the narrative and the

visual is used to amplify or clarify the spoken word. This is not the case with multi-image programming. Here, the visual must remain the primary source of message transmission.

Is music an element to be considered when scripting for multi-image? Many multi-image producers question the need for or even the desirability of using any music. Their contention is that the visuals, with limited narrative, should be adequate to carry the message of an instructionally oriented, conceptually sound program. Others, however, consider any program to be incomplete without music in the background, rising at the appropriate moment to provide dramatic emphasis to the visuals. This can become a pointless argument, since valid rationales can be presented for either position.

The crucial requirement is that when a producer does elect to use music, it emerge as integral to the program as are the visuals or the narration. All too frequently, a music selection which is so selected as to amount to an "additive," not only fails to contribute to the effectiveness of the program, but may very well prove to be a detracter. A clever lyric of a current song, a fascinating beat of rhythm, or a haunting melody may instead serve as a formidable obstacle to meeting the program objectives. The lyrics may distract from what is seen, the rhythm may not match the image changes and provide a severe discord. Programs that are conceptually sound may be doomed to failure through the careless or casual selection of music.

If music is to be a part of the multi-image program, it must be considered as an integral part of scripting. An analysis of both the specific objectives, as well as of the mood that is to be created, will aid the programmer in determining what type of music, if any, will effectively contribute to the program.

Another problem many multi-image producers face when scripting a program is that of being too clever with the narrative. They forget they are dealing with *multi-image* – a visual medium and their avant garde approach results in conflict between sight and sound. If the purpose of the program is to create a "happening," an experience, then such conflict may be acceptable. If the goal is to develop a strong instructional unit, such conflict reduces the probability of successfully meeting program objectives. The key is to keep the script simple and direct.

Remember for whom and why the program is being written. Again, a constant review of the program's interests and purposes is necessary to avoid poor, ineffective scripting that detracts rather than supports its goals.

Now that the specific objectives have been identified and the scope or perimeter of the program defined, the basic script should be written and verified to be in concert with the stated objectives. The next step is to develop the storyboard.

Storyboarding

The storyboard is the producer's blueprint for action; a set of guidelines that will aid in the visualization of the program objectives and narrative. A well constructed storyboard will assist the producer in determining the precise sequence and pace of the program so as to insure that each objective and sub-objective has been given adequate treatment. Some objectives can be met with limited visualization and narration while others require extensive treatment.

In instructional multi-image programming, the storyboard is an essential production tool. It is a series of individual cards by which the producer indicates the exact visual wanted for each screen and the narrative which will accompany the visuals. It is at this stage that the producer has to determine what visual effect will best communicate the information needed to cover each specific objective. By making rational and sound decisions at this stage of production, the producer can save much time and expense prior to doing the photography for the program. By following the storyboard, the producer knows precisely which slides must be taken and is less likely to fall victim to the most common error found in instructional multi-image programs – the use of extraneous or irrelevant slides that do not contribute to content. For example, if it is determined that a close-up, medium, and long shot of the Statue of Liberty are needed to meet a specific program objective, nothing else will do. Three well photographed wide angle views would not suffice – the objective requires three different views from varying ranges.

Storyboarding for a non-instructional multi-image program, an emotional appeal or a mood program, may not always be essential. In fact, the constraints of a too rigidly conceived storyboard may prove to be an inhibiting factor rather than a help. In such programming, the inclusion or exclusion of any given visual is usually based on the emotional appeal that the visuals can elicit or the degree to which they can contribute to the desired mood. Since no specific objectives may have been written, the producer should be given wide latitude in selecting which visuals are to be included in a program.

Developing a storyboard for an instructional multi-image program need not be a formidable task. The key is to keep it simple and to constantly

think in terms of multi-image visualization. Avoid drawing into the storyboard all non-essential and needlessly time-consuming graphic details by including only the elements crucial to meeting a specific objective. The use of stick figures and simple, although rough outline, figures can be adequate to meet most needs but, as with any road map or blueprint, sufficient detail to provide the photographer with a clear understanding of what is intended is a must.

The following is an illustration of a storyboard card for a single screen program:

This card contains all the information needed by the producer to insure proper direction and to avoid costly production errors. "A" refers to a simple sketch or rough outline of the desired visual; the letter "B" identifies a brief notation or description of the visual; letter "C" is the exact location for the narration which will accompany the visual; and letter "D" gives us the sequence number.

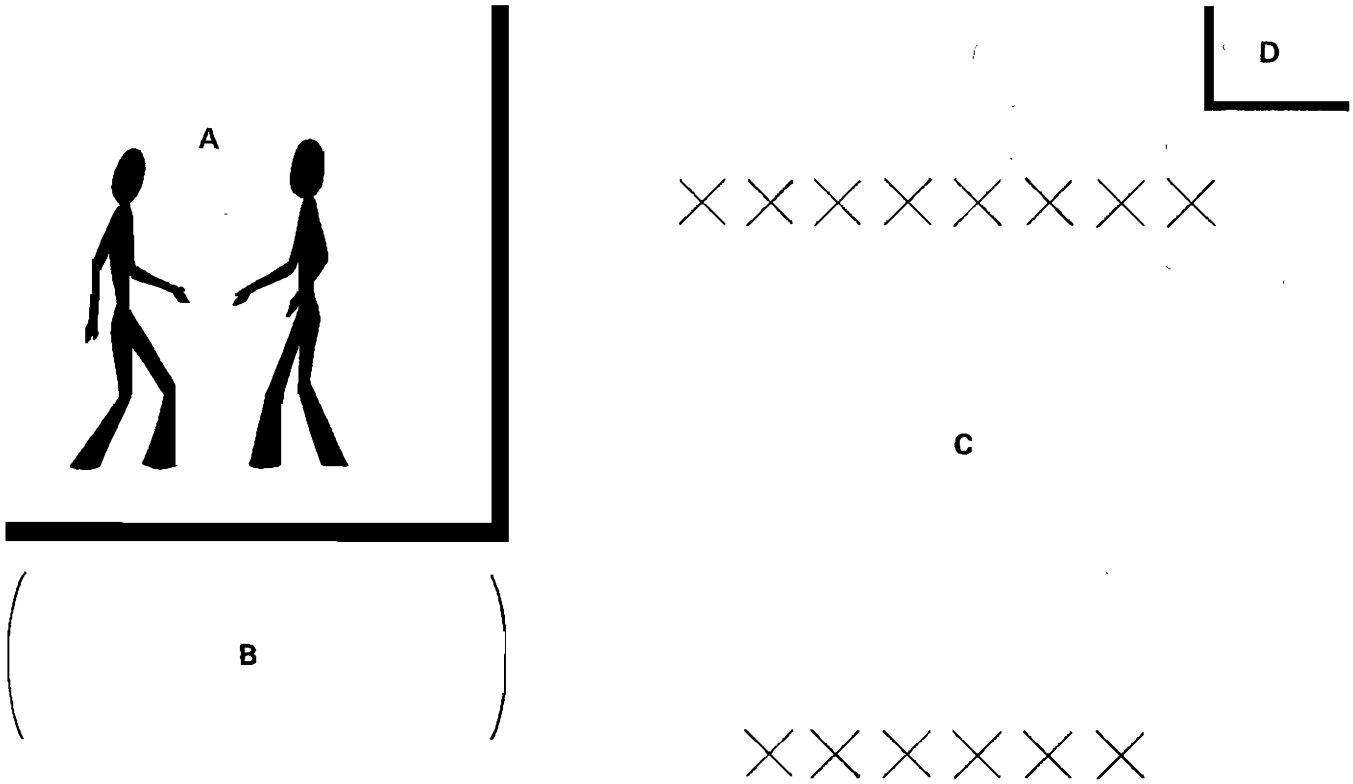


Illustration V-1
A storyboard card for a single screen program.

A storyboard card for a multi-image program contains the same information found in the single screen illustration with one major difference. That difference, of course, is the need to account for the multiple screens at all times. If a screen is to remain black or if a super-imposed image or dissolve is to be used, it must be noted on the card.

Illustration V-2 shows a storyboard card for a multi-image production.

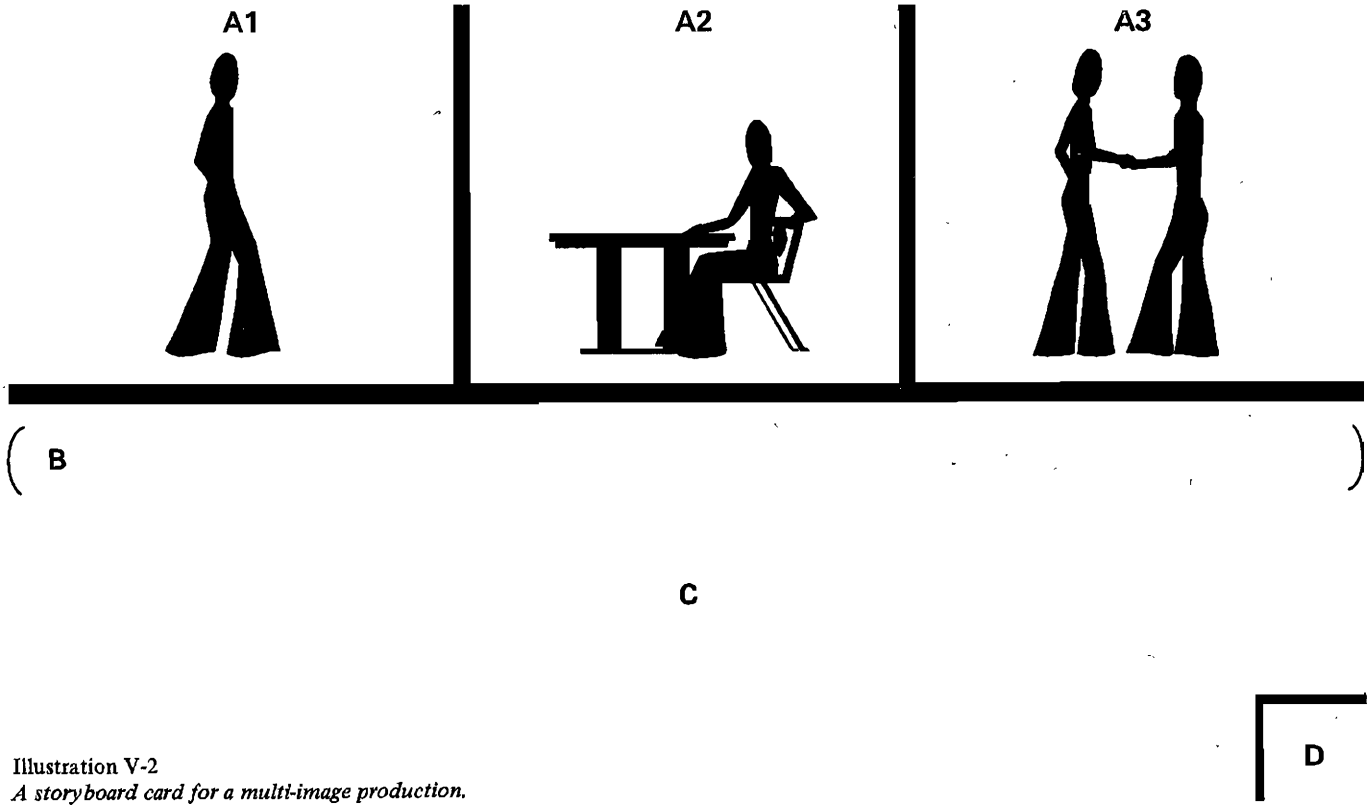


Illustration V-2
A storyboard card for a multi-image production.

A properly executed storyboard gives the producer the direction needed to begin the photographic aspect of the program. In fact, it would be possible to produce the audio portion of a program even before the visuals have been prepared. While this is not usually done, it does emphasize the value of committing time and effort to developing a good storyboard, one that insures that all the instructional objectives have been given adequate attention.

Some individuals have criticized the multi-image form of message transmission on the basis that the technology available exceeds the producer's capacity to effectively utilize the medium. Perhaps what is really being said is that all too frequently, a lack of attention to the pre-production writing of the objectives, the script and the storyboard results in programs that fail to make a positive contribution to instruction.

As examples of readily available pre-printed forms to help in scripting and in storyboard development, the following two pages show two that can be obtained from the 3M Company. The storyboard form is specifically designed to be compatible with programming equipment sold by the 3M Company.

Title: _____

Page: _____ Date: _____ 19____

Multi Image Storyboard

Visuals	Keyboard Keys	Cue No.	Audio
A B A B A B	1 2 3 4 5 6 7 8 9		
A B A B A B	1 2 3 4 5 6 7 8 9		
A B A B A B	1 2 3 4 5 6 7 8 9		
A B A B A B	1 2 3 4 5 6 7 8 9		
A B A B A B	1 2 3 4 5 6 7 8 9		
A B A B A B	1 2 3 4 5 6 7 8 9		
A B A B A B	1 2 3 4 5 6 7 8 9		
A B A B A B	1 2 3 4 5 6 7 8 9		
A B A B A B	1 2 3 4 5 6 7 8 9		

© THE 3M COMPANY 1976

RM-MIPSBS

Courtesy 3M Company

Figure V-1
A multi-image storyboard

Page_____of_____Pages **Script Sheet** Date:_____19____

Title:_____ Draft Number: 1 ● 2 ● Final

Visual Concepts	Script

Figure V-2
A multi-image script sheet

Courtesy 3M Company

CHAPTER VI
PRODUCING THE VISUALS

A. Arvo Leps and Hans-Erik Wennberg

There IS no multi-image show without the images. The quality of the images will make or break all shows – even with brilliant narration, superb musical accompaniment, and splashy sequencing of visuals, if the visuals themselves are dull, poorly produced, or confusing, the result will be unacceptable. Thus every producer must invest a substantial portion of his or her overall effort to the production of the visual content.

What Are The Choices ?

These visuals are almost invariably projected full-frame 35mm slides. They need not be, but the exceptions are rare – perhaps such exceptions should be explored more extensively and creatively. Let us mention some of these possible exceptions briefly and then dismiss them as far as this book is concerned.

There are Exceptions to the 35mm Slide as a Visual.

First, we must mention that multiple images need not result from multiple single projectable items. Some of the most spectacular multi-image presentations have derived from only *one* motion picture film – i.e., the multiple images were incorporated into one piece of film stock. This exception will be discussed briefly in a later chapter.

However, using multiple "sources," multi-image presentations can result from multiple simultaneously projected films (35mm, 16mm, 8mm, or Super 8mm) or even from recorded or computer synthesized television programs being played back simultaneously over several monitor/receivers that are grouped in some arrangement before the viewers. A presentation could consist of multiple holograms, multiple live actors exhibiting either still and moving visuals, multiple projections of dye-flow images placed on overhead projection stages, multiple kaleidoscopic or spinning polarizing disc projections, multiple laser diffraction pattern projections, planetarium projections, or all of these combined in infinite possible permutations. At some point or other all these and more have been presented with varying success.

All of these required the preparation of some kinds of materials for their visuals – and all of these techniques deserve chapters of their own. But not in this book.

Not even slides alone are a sufficiently limiting consideration. Slides can be produced in a number of formats: these can range from the tiny Kodak 110 format through "superslides" (all in 2 inch by 2 inch mounts) and on to the various so-called "lantern slides" in sizes up to 4 by 5 inches and beyond. Finding automatic projection equipment for slides larger than what would fit into the 2 inch by 2 inch format presents a horrendous problem – but one that is challenging enough to invite solutions.

What will be projectable in the 2x2 slide projector? Obviously, the standard 35mm slide qualifies but one can also show a 40mm by 40mm "superslide" (frequently sold in curio stands), a typical "half-frame" slide (usually seen in filmstrips – which themselves could indeed be incorporated into a multi-image presentation), as well as nearly anything smaller (down to the Super 8 "chip" and color microfiche). A recent innovation is the Kodak "Pocket Carousel" designed to permit fully automatic projection of the compact-format 110 slides – a format already being used by multi-image producers anxious to reduce the bulkiness of their equipment. So much for the more prominent exceptions.

The "Standard" 35mm Slide

The great majority of multi-image producers will do their work using standard-format 35mm slides. Just what are the dimensions of a 35mm slide? We must remember that in actuality there are two sets of dimensions to take into consideration. One is the actual image that the camera forms on the strip

of a 35mm film, the other is the area visible within the conventional commercial slide mount.

The multi-image producer is *not* constrained to the use of the standardized commercial mount, and thus an entire wealth of alternatives is available to those interested in using them. These will be discussed under the headings of "mounts and masks" later in this chapter.

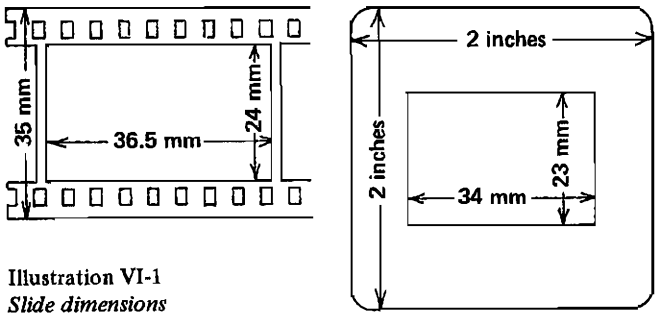


Illustration VI-1
Slide dimensions

The Various "Conventional" Approaches to 35mm Slides.

"The color slide"

The most obvious, although by no means the best, way to obtain 35mm slides is to photograph color transparencies with a camera, using the "real" subjects within the environment, i.e., "go out and take slides." This has the advantage of providing the best possible grain and visual fidelity (depending upon the skill of the photographer) and allowing the photographer the choice of seeking out what is desired and then attempting to photograph it. (Note, not nearly all such "attempts" will however result in usable slides.)

The disadvantages are that the material desired may not be accessible at all – it may have vanished like a canyon flooded by a lake – or it may be extremely hard to get to – say, photographing a wildebeest, or DaVinci's "The Last Supper" (who will permit you into Milan's monastery refectory with a dozen powerful lights?) or snapping a smiling closeup of Ms. Jacqueline Onassis, or getting the view from the top of Mt. Everest, as possible examples. Yet there are plentiful excellent photographs of all these available with only a few hours research in most libraries. Whether or not to make use of these resources is a terribly complex legal decision involving a constantly changing (and constantly reinterpreted) copyright law. Again, not a concern for this chapter.

"The color duplicate"

This leads us to the obvious next step, the duplicate color slide. Not only does the duplicate offer us access to hard-to-obtain material but it also provides the producer with a great deal of after-the-fact control. Even with slides photographed earlier by the producer himself, there may be reasons for altering the way they are presented. Perhaps one needs a segment of a slide, perhaps the tonal balance must be changed, or a dark slide lightened or vice versa, or one may need a "blow up" of a small area of a photo, or the single photo should be converted into three side-by-side slides for a panoramic effect – all of these require rephotography. Similarly, of course, one can rephotograph printed photos, halftone color or black-and-white prints, large transparencies, ... you name it. The advantages are the increase in control and availability of resources. The disadvantages, however, are also many.

Every time a picture or slide is rephotographed there is more-or-less noticeable degradation of image quality. A second, third, or fourth "generation" image is never quite as good as the original. Then there are the aforementioned legal and ethical ramifications, i.e., are you stealing something? Lastly, there are the problems of added equipment and skill. To do acceptable rephotography requires fairly good quality optics, special close-up devices, a copy-stand or equivalent, possibly a slide duplicating device, properly positioned lights of the appropriate color temperature to match the film being used, and for truly outstanding work with repetitive images, the devices needed for precise positioning (i.e., registering) both the work being photographed as well as the film in the camera. To use these devices requires the acquisition of additional skill – something that the average photographer may not have and that take time to acquire and need plentiful opportunities to succeed and to learn from failures.

"The black-and-white transparency"

The least complicated way to photograph existing black and white material is with color film – taking pains to assure that the illumination tonality (i.e., color temperature) matches the film type being used. This saves the photographer the task of processing the film oneself and yields an immediate positive image.

However, black and white (as well as color material) *can* be photographed with black-and-white film. The problem is that this results in a negative which either must be transformed photochemically into a positive image on film (i.e., reversal processed) or else rephotographed (either in a camera or a "printer") to yield a second positive image. Both of these require considerable darkroom skills and more equipment as well as time. However, in the long run, these may save the producer money – color film is far more expensive than black and white.

There is *one* extremely attractive use of black-and-white film that does not necessitate a positive image. Indeed the resultant negative

quality will be exploited to its fullest. And this is the use of high-contrast copy film, such as Kodak's Kodalith Ortho film, Type 3 (in 100 foot rolls it's labelled as type 6556). Such film is usually sold in bulk rolls and must be spooled into cartridges by the user or by some intermediate film handling service.

If properly exposed and processed this film yields only totally opaque black and absolutely clear "white" images. The projected results are luminous images on a black background – an image that holds the eye and is easy to read, if used to present text. To add character, the clear areas are easily colored using several techniques and in almost any colors which consequently blend in and superimpose pleasantly with other color visuals. Unlike producing positive continuous tone, black and white transparencies, this process is comparatively simple and speedy.

These are the major categories of slide types. There are, as with everything else, exceptions that are used by the sophisticated producer, but they lie beyond the scope of this discussion. To mention some, for recognition value, one could use solarizations, the so-called "bas relief" effect, infrared emulsions, and others.

Projection Format Considerations

The use of multiple images immediately raises the possibility of using expansive formats and larger than usual visual areas. This opportunity can be utilized fairly straightforwardly or one can be innovative and try any of many possible arrangements.

The "Aspect Ratio" and What to Do With It.

The term "aspect ratio" refers to a ratio made up of the two dimensions of any visual area, its width versus its height. We'd indicated that the actual 35mm image area was 36.5mm wide and 24mm high, whereas the opening in the standard mount measures 34mm wide and 23mm high (to allow for inaccuracies when binding the slide). Both of these approximate a ratio of 3 to 2 or 3:2. This results from dividing both dimensions by the common denominator of 12 and rounding off.

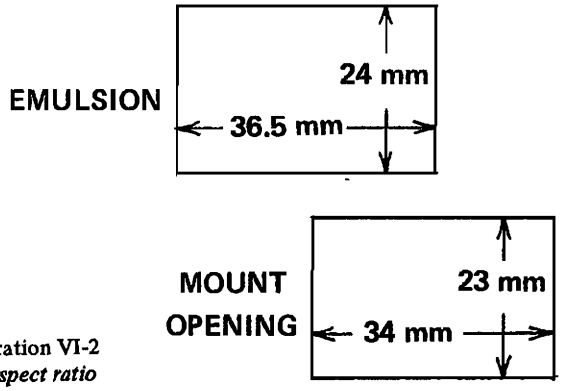
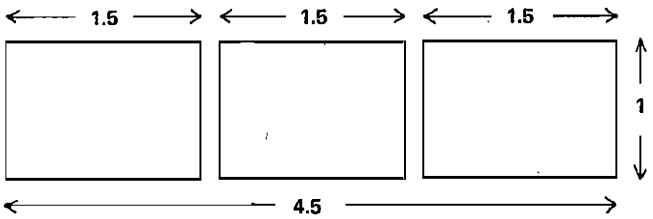


Illustration VI-2
The aspect ratio

A way of standardizing so as to make comparison of aspect ratios easier is to make the smaller dimension always equal to unity, thus the standard slide format could be expressed as 1.5:1 instead of 3:2. In terms of this convention, the most popular version of multi-image presentation – one in which three horizontally oriented slides are projected side by side with no significant gaps between the images would result in a combined aspect ratio of 4.5:1 as seen in Illustration VI-3. Wider aspect ratios are attainable by simply adding images but since man's peripheral vision barely extends further, those seated close to the screen would need to physically sweep their eyes back and forth to capture what is shown.

Illustration VI-3 *Combining the aspect ratio*



Screens, and How to Select and Use Them.

Although the choice of a screen is a matter of presentation, it will dictate how the visuals are to be produced and should be determined beforehand. If a program is conceived for presentation at a fixed site, such as a corporate board room, an advertising demonstration room, or a training facility, then the physical space will partially dictate the dimensions and the resulting aspect ratio. The result may be a 180 degree wrap-around screen, a totally encircling screen, or a standard square format screen. If the program is conceived as being portable, to be set up at various sites on short notice, other factors need consideration.

Thus, one may use solid white-painted wall surfaces, one very wide portable screen, or three or more smaller roll-up tripod screens placed next to one another, or the new "fast-fold" screens on which a fabric is stretched onto a portable, on-site assembled frame. The latter allows for rear projection. The screen may be absolutely straight, curved slightly, or curved into a semicircle. The latter would be very difficult to accomplish in a portable arrangement.

All of these would easily accommodate aspect ratios up to 4.5:1.

How will the screen configurations affect the production decisions? If an extreme aspect ratio of more than 4.5:1 is used on an in-line screen configuration one can assume that much of what will be offered on the side areas will be observed only peripherally. Unless emphatic visual cues are used, the side areas are best left to convey incidental information or embellishment. If the screen is curved, bringing it closer to the visual

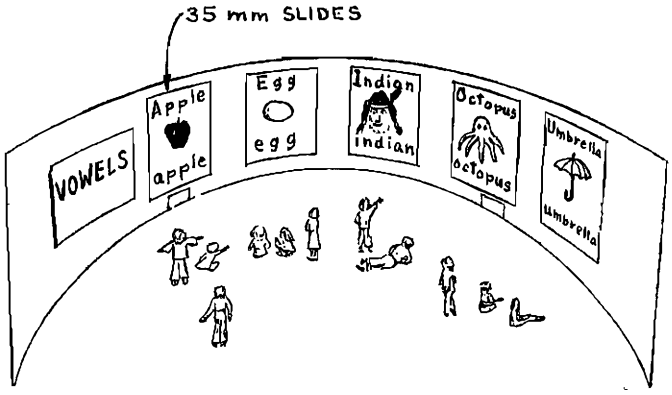
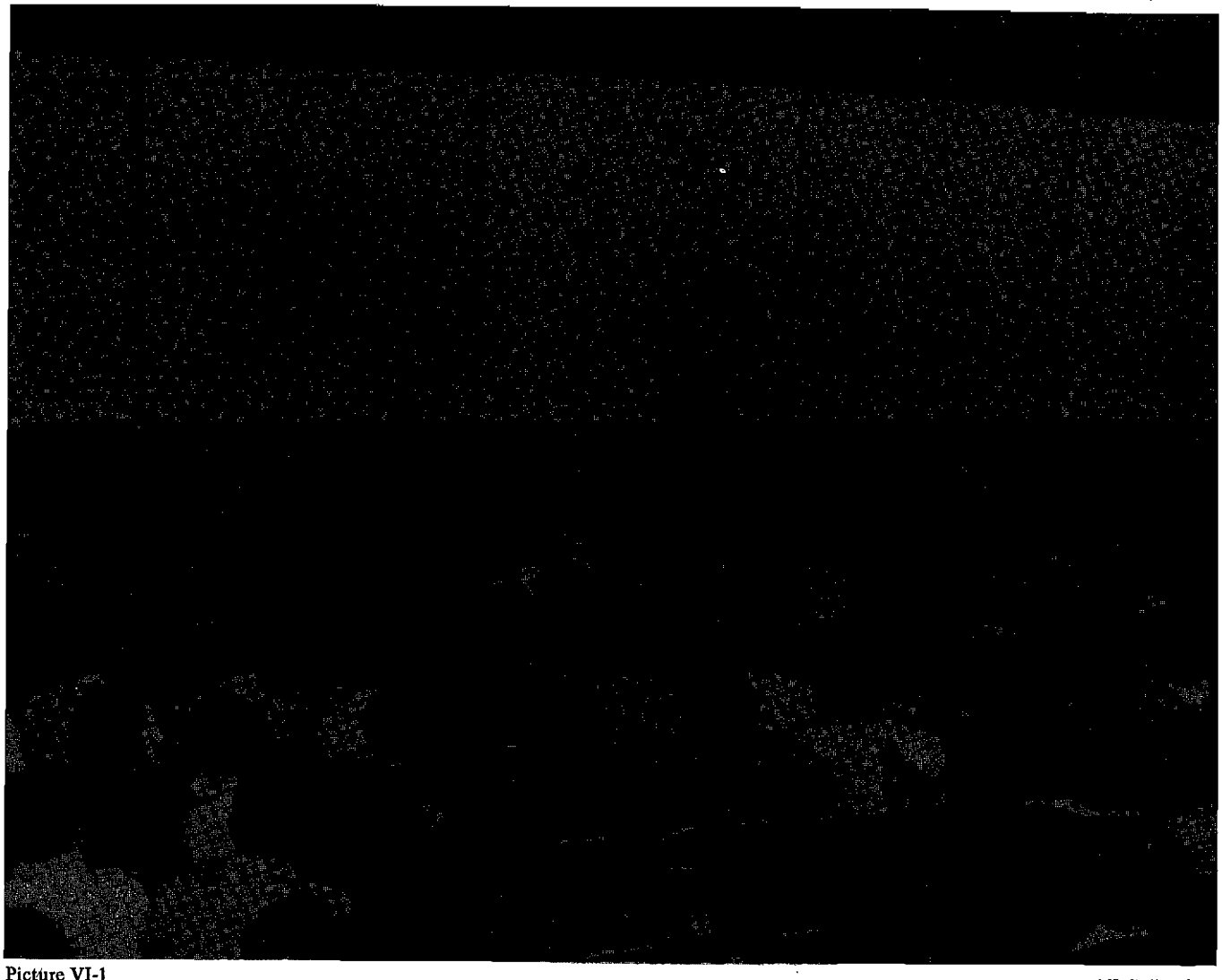


Figure VI-1
A curved semicircle screen in a fixed installation.

Courtesy of Ralph Pandolfi



Picture VI-1
A number of roll-up tripod screens placed next to one another.

AMI Collection

scope of the viewers, more will be noticed. If the aspect ratio is kept to 4.5:1 or less and the screen is far enough from the viewers to stay within their critical visual span – which for most is supposedly around 75 degrees – then essential informative material may be presented on any part of the screen.

Motion picture producers, who pay very careful attention to the physiology and psychology of visual perception, prefer to restrict themselves to aspect ratios of 2.5:1 or less – there may be a lesson in that for multi-image producers to consider. This aspect ratio is already exceeded by a format of two horizontal slides side-by-side, whereas a configuration of three vertical slides projected side-by-side provides an aspect ratio of 3:1.5 or 2:1. Both of these fall easily within the visual field of a viewer.

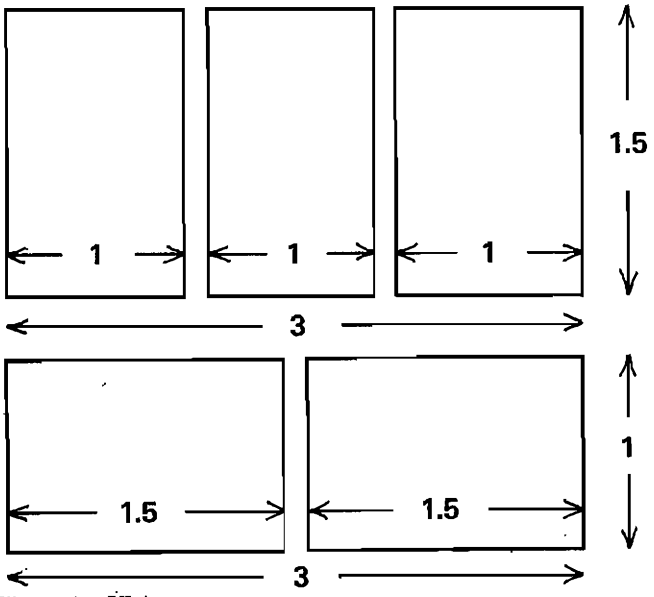


Illustration VI-4
Aspect ratios of two horizontal and three vertical slides.

The Number of Possible Simultaneous Images.
"Orienting three images"

Since most multi-image producers are enamored of the three side-by-side image format let us consider it first. However, it is not the only usable configuration and neither are two images, side-by-side, the only alternative. To allow for flexibility, most producers do not like to constrain themselves to only one or the other image orientation, although very effective programs have been designed with the all-vertical (4.5:1 aspect ratio) or the all-horizontal (2:1 aspect ratio) restriction self-imposed by the producer as shown in examples A and B.

Mixing image orientation calls for screens with a 3:1 aspect ratio and poses an additional problem for the producer. And that is, how to deal with the voids around the images. Most producers simply ignore the challenge, resulting in the uneven spacing seen in Illustration VI-6, others have dealt with it in interesting ways. Notice that with the closely positioned configurations A and B preceding, the aspect ratios of the two screens differed and they were *not* suitable for mixing image orientation, whereas the 3:1 aspect ratio accommodates a mixture of orientations. What this shows us in effect is that each screen has on it three *square* potential image areas of 1:1 aspect ratio into which the images may be projected. By using specially designed offset mounts, the lateral spaces may be reduced as shown in example G, or eliminated as shown in H, and by introducing a trimmed-down "super slide" (mounted in a 34mm square slide mount aperture) the spaces between images could be made to seem to disappear totally as seen in examples I and J. This makes it possible

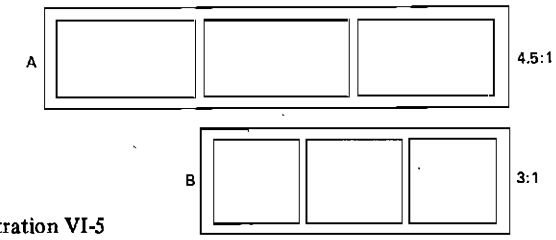


Illustration VI-5
All vertical or all horizontal visual restrictions

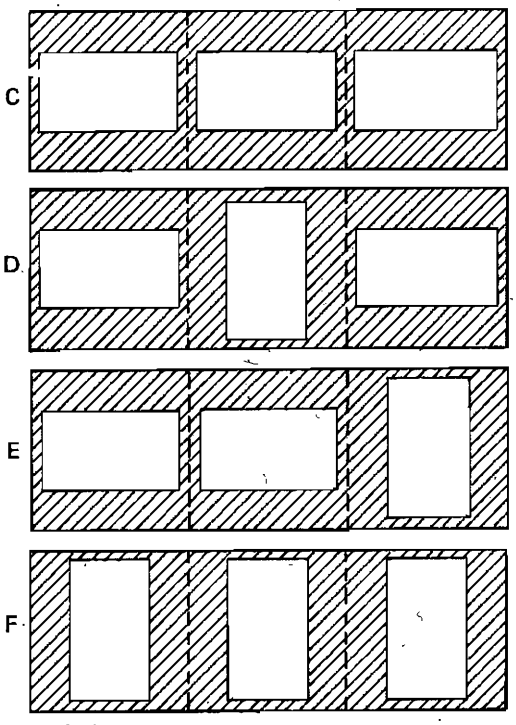


Illustration VI-6
Mixing image orientation

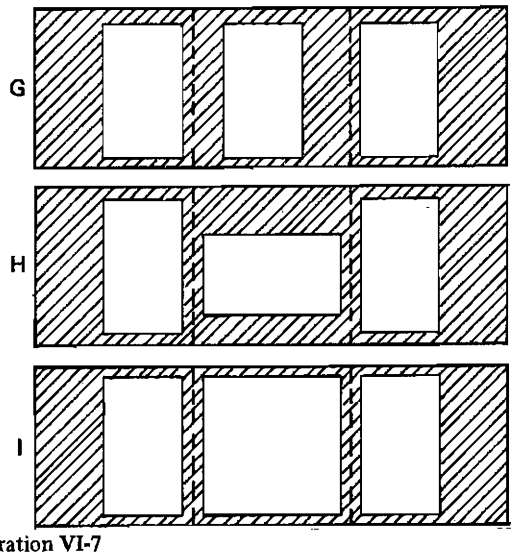


Illustration VI-7
Using specially designed offset mounts

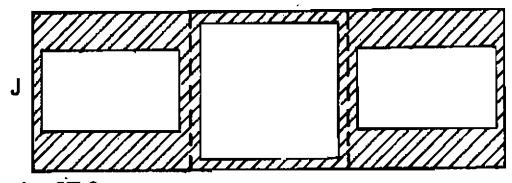


Illustration VI-8
Using specially designed offset mounts

to obtain three-image panoramic presentations on a 3:1 screen without being constrained to the horizontal orientation.

"Composing"

Within the constraints of the 3:1 screen and the three side-by-side potential image areas one can use the orientation with spaces to deliberately organize the visual content. Thus, in example E preceding, one would take advantage of the formal similarity of the two horizontal images on the left to use them for similar content and use the vertical image to carry a contrasting concept. Arrangement D would be suitable for focusing attention on the central vertical using the sides to buttress the central concept. The three widely spaced verticals shown in F serve well to offer three independent or conflicting concepts whereas the three closely spaced horizontals of arrangement C serve ideally for the segmented three-image panorama or for three very intimately indentifiable visuals. The use of the superslide format is handy for emphasis as it will tend to overpower adjacent smaller visuals or to construct a more "compact" three segment panorama of 2-1/3:1 aspect ratio instead of the sweeping 4½:1 ratio panorama of example C.

In preparing the visuals one must take into consideration both their relationship to each other on the screen as well as their sequencing. Color-code the graphics so they do not become dull or repetitious, so that contrasts result not only from conceptual contrast, but from color contrast. Pictorial slides that blend or are juxtaposed should be photographed in the same tonality and illumination. Sharply discordant slides should be separated spatially and temporally so that the photographic differences do not suggest unwarranted (and unintended) conceptual distinctions. Or conversely, introduce deliberate visual differences to reinforce conceptual distinctions.

Also, it makes sense to utilize the slide orientation to emphasize the subject orientation: upright objects are best projected in vertical slides. When considering composition of the forms and suggested motion in the visuals, always think in terms of all the slides projected simultaneously and what precedes and follows in sequence. The progression of the eye should be smooth across all the slides unless a deliberate disruption serves an intended purpose. The typical western viewer has been conditioned to examine a visual field from left to right, the way we read. Incorporate that movement tendency in your slide-to-slide visual composition. When people are shown consider their orientation: a person looking in a direction is probably looking *at* something, it helps to provide that point of focus. Similarly, movement that is depicted should be allowed a direction in which to progress.

"Overlaps"

Multiple projector slide shows make animation possible. Once six or more projectors are involved, quite complex animation becomes feasible. In such instances one can consider more complex overlaps of images than simply allowing one bank of projectors to do straight sequential dissolves. Thus, extremely interesting effects can be obtained by using masks and overlapping images to allow the superimposition of many more than two or three images on one screen area. A simple potential sequence is shown in Illustration VI-9 in which an aspect ratio of 2.25:1 is obtained by overlapping the left and right halves of two conventional 1.5:1 projected fields. With three projectors allocated to each field, the center can animate with six projectors in sequence. Innumerable effects can be obtained, in addition to the few suggested. However, the chief advantage here is that the central, focal area, can be covered by six projectors which can all be flashed on in very rapid sequence without need to wait for the slower cycling time of the Carousel projector.

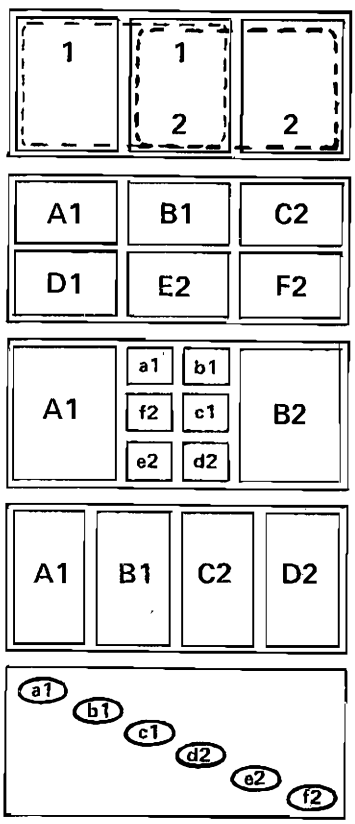


Illustration VI-9
Overlaps

Designing visuals for such a configuration requires a high level of skill and creativity, precisely cut custom masks, and the use of pin registered cameras, copy boards, and mounts to keep everything in continuous alignment.

"Complex matrices"

The preceding example brings up the possibility of placing the visuals in arrangements other than side by side. Slides can be projected in matrices such as a two by two grid, a three by three grid, a two by three, or other configurations as shown in Illustration VI-10.

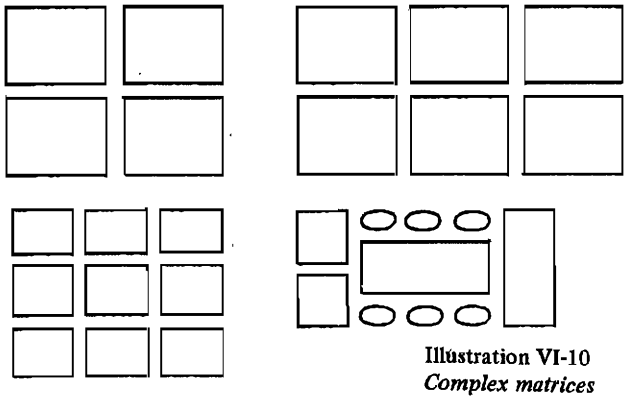


Illustration VI-10
Complex matrices

It is quite likely that the reason that complex matrices have been avoided by multi-image producers is their complexity and not because the simple side-by-side triptych is inherently superior for conveying information or emotional impact. Insofar as stacked matrices tend to use rather small aspect ratios, approximating the 1.5:1 of the single slide, they lack the wide screen's initial impact. However, by allowing for far more "action" and the introduction of two dimensional rather than only one-dimensional relationships between images, far more intricate concepts can be illustrated.

Furthermore, it is not necessary to allocate two projectors for every image area. By judiciously using the overlap principle just mentioned, ten projectors could very nicely cover a three by three matrix. Illustration VI-11 also suggests the use of projectors with differing focal lengths in one show. Thus, two projectors could be allocated to cover the entire screen – both to project large single images, no matter what their aspect ratio, as well as to provide the background ongoing coverage, the visual equivalent of musical "continuo," or the "drone" of a bagpipe or sitar. In the illustration, precise registration has been deliberately avoided to make it possible to show the overlap. Such an arrangement allocates two dissolving projectors to each image area and permits a far more complex matrix than the three by three "basic" grid. Also, the center cell can be animated with the full complement of ten projectors.

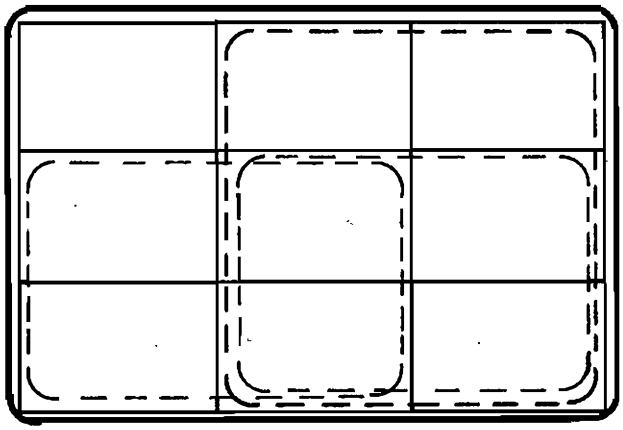


Illustration VI-11
Using projectors with differing focal lengths

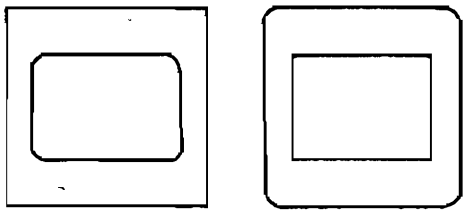
Masks and Mounts

Masks and mounts are of little concern to producers who restrict themselves to full-frame slides projected side by side. If the dissolves used require precise registration, then pin registration mounts would be useful, masks would serve only to help opaque out unwanted areas.

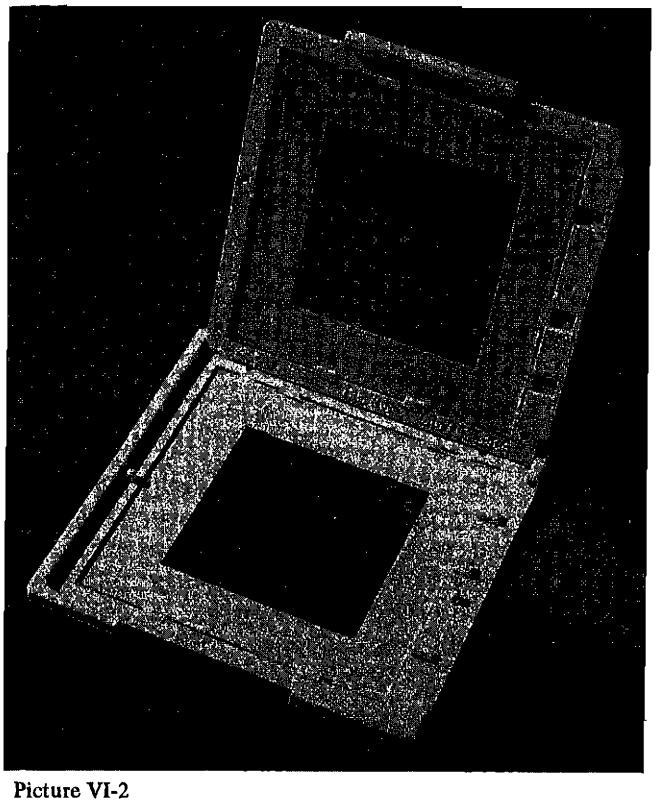
The Choice of Mounts

Broadly speaking, there are three classes of mounts: a) cardboard, b) plastic, and c) glass enclosed. The cardboard mount is the one provided by most color film processors. It is cheap, relatively easy to use – although it requires a heater to seal the slide (ready-made heat sealing presses can be purchased or one can use a clothes iron). The cardboard mount holds the film securely in place and it is both light in weight and thin, making it easy to use in a 140 slide tray. On the other hand, it bends and frays easily, the film can come unsealed in the mount, and the natural roughness of cardboard combined with its light weight makes it more likely to jam than others. There is only a limited choice of formats for cardboard mounts as regards the dimensions of the interior opening or whether the inner or outer corners are sharp or rounded. The typical cardboard mount has opening dimensions of 34mm by 23mm.

Illustration VI-12
Choice of mounts



Plastic mounts come in a wide variety. The least expensive ones cost only slightly more than cardboard mounts. Most do not require heat to enclose the film, and the less expensive ones do not hold the film securely fixed in the mount allowing it to shift slightly. They are easy to use, will not bend, are readily available with rounded or angular corners, assure a smooth movement in and out of the projector, and are available in several weights and thicknesses with the thinner ones working well in 140 slide trays.



Picture VI-2
A commercial plastic slide mount.
Photo courtesy of Wess Plastic

The heavier and more expensive plastic mounts offer internal registration "pins" (actually little square protrusions, onto which the film's sprocket holes may be pushed to precisely locate the piece of film in the mount). Also, mounts of this category do offer a variety of custom apertures that in effect provide masking for each slide.

Glass-enclosed slide mounts offer the widest variety of features. They are available in conjunction with either plastic frames, metal frames, or combined plastic-metal arrangements. They are not cheap. They are substantially heavier than the aforementioned mounts and consequently move with ease in slide advancing mechanisms. As a rule, they cannot be used in 140 slide trays, and many of them are quite heavy, making transportation of large numbers of glass mounted slides cumbersome and expensive.

The glass surfaces of these mounts press the film flat, and thus keep it from "popping" when the film heats up. Thus they also make uniform field focusing much easier. The present-day glass surfaces are so coated as to minimize the appearance of diffraction patterns – known as "Newton's" rings – and are frequently labeled as "anti-Newton" mounts. The glass obviously serves to protect the film surface as well as keeping it flat, but introduces the problem of the vulnerability of the glass itself. The glass mounts provide locating clips to keep the film positioned as inserted. However, deliberate shifting of the film piece in the mount is not easy. The more expensive glass mounts also incorporate registration pins as well as a great variety of precisely fixed masks – usually made of thin metal, making for very accurate apertures. Similarly, there are glass mounts in which the apertures (or openings) are molded in the plastic frame itself.

It is helpful to know beforehand, when taking the photos, how the slides will be mounted and whether they will be pin registered or not, so that one can plan for exact positioning. Informative sheets and pamphlets are available from custom mount manufacturers detailing the mount and aperture dimensions. For major, well funded productions, it is even possible to order custom-made mounts to suit any need.

Masks and What They Offer

The use of masks has been discussed throughout the preceding sections. Masks serve to either simply "mask out" unwanted content, to change the aspect ratio of portions of individual full-frame images, or to impose novel outlines on images – such as circles, ovals, diamonds and others. The more important use for masks is to make it possible to use one single slide to project multiple images and to position image segments in specific subregions of the image field. Thus, masks are essential to producing programs using extensive overlapping and for animation effects in which different areas of a field are projected in a rapid sequence.

One suggested use for masks is to create matrix effects without extensive rephotography. A readily available mask, such as the one in Illustration VI-13, may be used to hold two cut-down film pieces in a mount so as to in effect project two distinct images, A and B, with one slide. When used in conjunction with a three by three "matrix" as suggested before, single slides with various masks can in effect produce the matrix with a few slides. The combination that the producer would select would depend upon the sequence preceding and to follow, it would depend on what is to be left constant and what is to change.

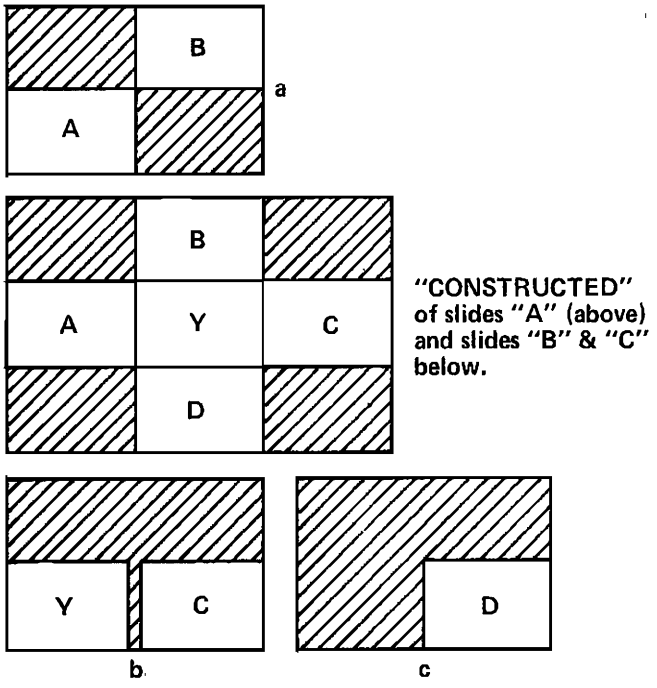


Illustration VI-13
Slide masks

Producing a visual script for something like this can be difficult – but if creatively handled, the results can not only be spectacular but also provide a level of design control otherwise not possible. When photographing slides for such a production, extensive preplanning is needed if one is to avoid rephotography of all slides to reduce them to fit the apertures. This can be avoided by inserting the mask over the camera's focusing screen (possible only with single lens reflex cameras with readily exchangeable focusing screens) and centering the material in the intended locations.

Masks can be avoided altogether by rephotographing each subsidiary slide on a backlighted animation copy board. At some expense, such sophisticated rephotography service is offered by several slide production and duplication companies.

Masks are available in at least five possible forms. The most primitive do-it-yourself approach is using an opaque tape or coating applied to the film to outline the desired areas. Care should be exercised to assure that the material is truly opaque and that it does not "bleed" when heated up in the projector. Aluminized mylar tape offers a sharp, clean edge and when applied to both sides of the film is satisfactorily opaque.

Another do-it-yourself mask results from photographing the desired masking pattern with high contrast black and white film and sandwiching the resulting mask in the mount. The other three alternatives are to use commercially available products. These may be: a) opaque, pre-cut mylar tape masks that one can apply to the film, b) thin metal cut-out masks prefitted into the slide mounts to which the film is then keyed, using either a retaining clip or registration pins, and c) mounts in which the configuration of the opening itself in the plastic frame constitutes the mask. All are probably equally serviceable, although the cost varies. Literature on masks is available from the same manufacturers that produce professional mounts.

"Going beyond 35mm film"

It is not essential to restrict oneself to 35mm film to make 35mm slides. When designing complex, large-scale matrices it may be desirable to cut up a large transparency, say a 4 by 5 view camera transparency, into several 35mm slides that abut precisely, either for panoramic effects or to create a jig-saw puzzle assembly effect. This is possible if one purchases a special cutting jig that accurately cuts sheet film into the 35mm format while punching in the sprocket holes to enable accurate registration in the mount's registration pins.

Rephotography

Making slides by photographing existing visuals on a copy stand involves more than just making the exposures. One needs to locate, or more frequently make up, the materials to be rephotographed; one needs to prepare the material for the exposure, and one has to decide on the types of films and effects desired. Let us start by looking at making up the subject material.

Making Graphics

Graphics, as used in multi-image presentations, range as widely as they would in illustrating text. However, since the pace of multi-image shows tends to be fast, they should be simple, easy to grasp, using minimal text, and amenable to color coding. Under graphics one could identify three broad categories: a) linear pictorial illustrations, be these detailed black and white line drawings, simple stick figures, cartoons, or diversionary patterns used to terminate or break up a sequence; b) tabular material such as charts, tables, maps, or flow-charts; and c) text, be it one emphatic word or a few paragraphs.

"Illustrations"

Unless the work of a competent graphic artist, pictures rendered by the producer should be as simple as possible. A certain degree of simplistic crudeness in drawings is frequently acceptable if they are not elaborate. It helps to work big, to use extremely opaque inks, and paper on which the lines will not run or "bleed." Also, the use of

various transfer-type artists aids simplifies the task. Humorous cartooning should be left up to those who are skilled at the art. All work to be reproduced with high contrast copy film should be so executed as to avoid any continuous tone gradations.

"Tabular material"

Any charts and tables that are used from existing sources should be so masked as to exclude any extraneous material. Charts drawn specifically for the presentation are best done using various graphic art materials such as line and pattern tapes. Drawing or inking good looking, densely black lines requires great skill, special smooth paper, and appropriate pens and inks. Lines drawn with a pencil or nylon point pen seldom appear acceptably uniform when blown up on the large screen. On the other hand, straight lines of variable widths can be easily made using "chartists" tapes which are available both in solid colors (black) as well as in varying patterns. Text and numerals should be done as discussed in the following section.

"Text"

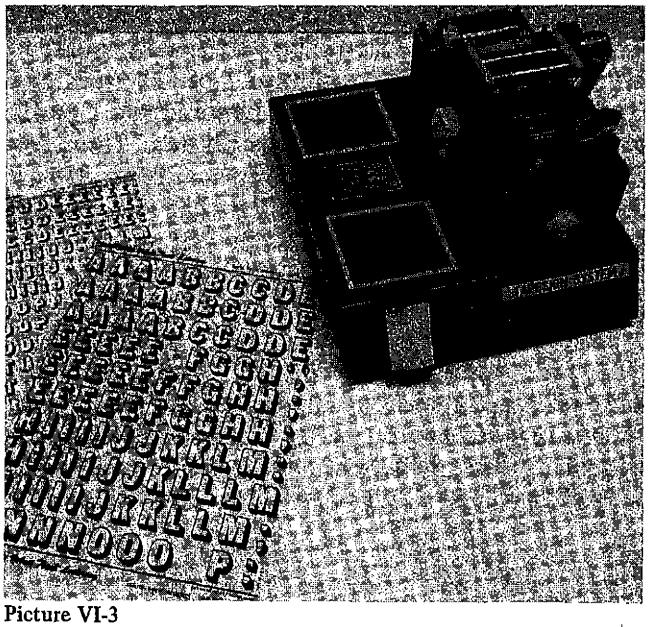
Standard typewritten letters and numerals, when enlarged extensively, look extremely "frayed" and uneven. Consequently, it is well worth the expense to have text typeset. There are presently available numerous relatively inexpensive, so-called "cold type" devices, many of which are available in walk-in, printing service facilities. Insofar as one seldom needs right and left justified text, all that is required is that a series of words and sentences be typeset on a sheet of smooth, chalk paper.

Since such service costs by the hour, one should first handletter the text, with appropriate spaces between and above and below each word group, using capitals and lower case where desired, and then give the operator specific instructions. It helps to use the largest type style available – to keep from having to do extreme microphotography – and to pick one style for its legibility and attractiveness. A sheet of typeset words is likely to cost little more than a few sheets of rub-on artist's aid letters and save one a great deal of time.

Firms that specialize in typesetting usually work for various publishing enterprises. Consequently most of them should be able to coat the back side of the typeset sheet of paper with adhesive wax. Waxed paper is far easier to position and fix to a layout than doing the same with rubber cement or other adhesives. However, care must be exercised to keep the surfaces clean.

Once armed with the sheet of waxed, typeset text one simply cuts out the words and phrases, positions them in the proper art work – or constructs the artwork around the text – and they are ready for rephotography.

The only meaningful alternative is the use of rub-on artist's aid letters. These are available in a great variety of type styles and are easy enough to transfer if not too many words need to be made up. One must pay attention to spacing, to maintaining alignment, and to assuring that all parts of each character have transferred before lifting the sheet. Mistakes can be corrected by scraping but corrections are seldom satisfactory – doing the art over again can be time consuming. One also does well to assure oneself of the freshness of each sheet before starting; old, dried-out letters tend to transfer only partially, causing problems with constant need for corrections.



Picture VI-3
Sheets of commercial transfer letters and a lettering device.
Photo courtesy: Duane Troxel

Layout

Just as when working with animation techniques, it helps to do the work in premeasured and pre-ruled "cells." For full-frame rephotography, cells can simply be rectangles with a 1.5:1 aspect ratio ruled in "drop out" or light blue on good quality blank index cards. Ready made cell cards may be purchased from slide mount and mask distributors.

It is suggested that one standardize on a limited number of cell sizes – three or four may be appropriate. A reason for varying the cell sizes is that a visual with one short word logically requires a larger type size than one encompassing a phrase. Instead of using larger type, one can simply photographically enlarge a smaller cell. To minimize changes in copy stand settings it helps to standardize on a limited set of "scales," rather than vary the size continuously.

The layout of each cell itself should be so composed as to consider the layout of adjacent cells – indeed, it helps to keep the "artwork" for several simultaneous visuals together. If some of these are already taken pictorial slides, a rough outline sketch of each slide should be kept on hand for reference.

During the layout phase one also does the preparations for animation. This is usually best handled through the use of multiple overlay sheets, which can be of transparent acetate stock or paper, thin enough to be translucent over a light table, thereby allowing keying the consecutive visuals to a master visual.

"Creating panoramas"

Multi-screen panoramic photos can be taken directly in nature (a procedure discussed in the final section) or they may be "artificially created" from existing prints, photos, or even slides. Producing second-generation panoramas is easily accomplished using prints or photos. However, since the degree of enlargement has to be at least three-fold, one should verify first that the orginal's grain structure is fine enough not to become offensive under extreme enlargement. A full three-field panorama calls for isolating the section to be used and then measuring out a rectangle with a 4.5:1 aspect ratio on a firmly attached more-or-less transparent overlay sheet. The actual dimensions are computed by basing a ratio on the critical dimension which may be either the height or width. Thus a 7.5 inch wide area requires a height of 7.5/4.5 inches, i.e., one needs a 1-2/3 inch high rectangle 7.5 inches wide. This long rectangle is itself divided laterally into three equal 1-2/3 inch by 2½ inch adjacent rectangles on the overlay.

To rephotograph the panorama, sequentially align each rectangle in the camera's viewfinder, lift back the overlay and make the exposure, then align the camera with the next area on the overlay and repeat the procedure.

Using the Copystand

A copystand may vary in sophistication from an inexpensive single-lens-reflex camera mounted with a home-made plate to the focusing rack of the head lifting mechanism of an enlarger from which the enlarging head itself has been unbolted (not possible with all enlargers) to a full fledged animation stand equipped with a rotating, indexable copy carrier and a top quality camera modified so as to assure repetitive pin registration for each frame. Although equipment dealers also advertise rigid copy stands equipped with instamatic cameras, this is definitely not suitable for the multi-image producer. Between these extremes exist a wide variety of quality and cost combinations.

A through-the-lens reflex camera is essential. It helps to select a camera in which the viewfinder exactly covers the entire field. Frequently the film will capture more than the viewfinder shows and then the producer may have to mask out extraneous material. Also, a close-up, or so-called

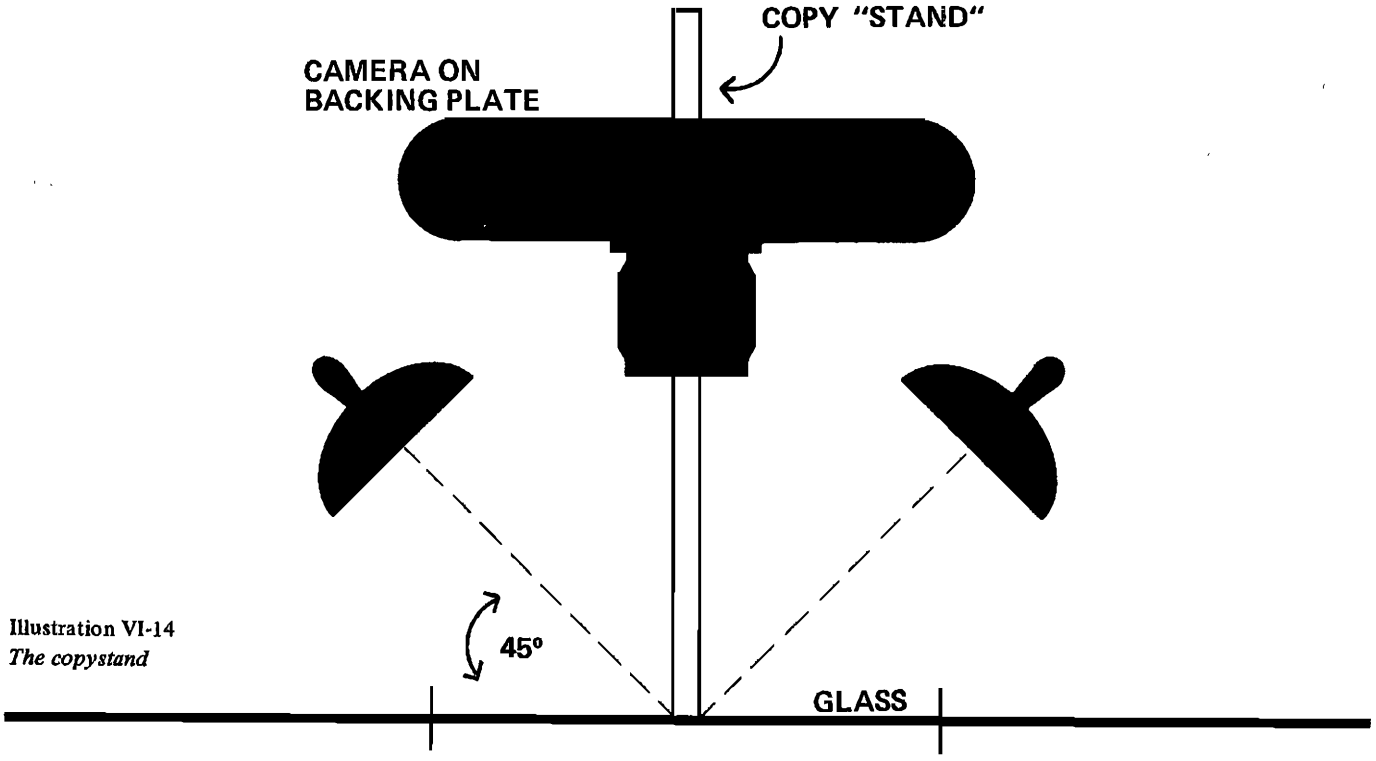
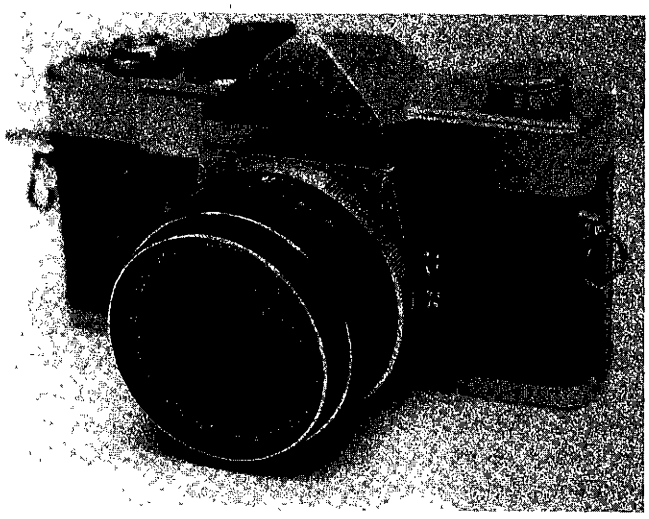


Illustration VI-14
The copystand

"macro lens" is to be preferred, the longer focal length lenses interfere less with illumination in extreme close-ups, but require a longer travel on the raising mechanism for large artwork. For extreme enlargements a set of "extension tubes" is needed – fully coupled tubes make work easier.



Picture VI-4
A single lens reflex camera.
Photo courtesy: Duane Troxel

Illumination should be bright enough to permit making short exposures. The lights are best aligned at 45 degree angles to the artwork and should be equipped with lamps that are rated at a color temperature compatible with the color film being used. If the film and illumination do not match, a color correction filter must be used – this, however, reduces the incoming light and calls for longer exposures. Photoflood lamps generate a great deal of heat, consequently working at the stand may become quite uncomfortable and the artwork may overheat and curl up unless one constantly turns the lamps on and off and flattens down the artwork with a sheet of heavy and optically more-or-less flat, plate glass. To eliminate picking up reflections, the light from the two lamps may be passed through sheets of polarizing material and the lens equipped with a polarizing filter. This again decreases the light entering the camera and lengthens exposure time.

Films for Rephotography

Since rephotography is usually done using incandescent, or tungsten filament lamps, it is sensible to use "indoor" rather than "daylight" films. Rephotography could be done outdoors in sunlight, or indoors using daylight film with color correction filters, but these approaches are worth considering only in "emergencies." Rephotography always introduces image quality deterioration; hence, it is sensible to use the finest-grain/highest-resolution films to minimize degradation. However, fine grain films are usually slow in "speed" and consequently the producer wishing to rely on fast exposures (possibly to minimize the effects of copy stand vibration on long exposures) may have to compromise.

The other film suitable for extensive copystand use is the high contrast copy film – such as Kodalith Ortho Film, Type 3. That film has an extremely slow film speed – indeed the ASA rating is not published by Kodak. If one also uses extension tubes, which affect exposure differently depending on their length, it is best to start by exposing a test roll at various magnifications and for varying artwork. Carefully maintained records will soon make accurate exposure estimation easy.

The resulting high contrast white-on-black slides can be toned with sandwiched color transparency overlays, with chartist's colored transparent tape (available in many widths), and by applying dyes on the film – these could be food dyes or inks from various acetate coloring felt or nylon-tipped pens.

The choice as to whether to process the films oneself, depends not only on skill and equipment available but on scheduling pressures, prevailing wages of the personnel involved and previous experience regarding quality and reliability in meeting schedules.

Photographic Basics

It would be pointless to include instruction on the "how to" of photography in this book. There are too many excellent ones available already and those who are novices would do well to study them. However, there are some unique aspects to doing photography for multi-image presentations and these require some explanation.

Maintaining Tonality

To a great extent the multi-image producer's task is far more similar to a cinematographer's than to the ordinary still photographer's. Since the temporal sequencing is as important in multi-image as in cinema one needs to preserve continuity where it is intended. Sequential photographs under sunny, then overcast, and then morning lit, illumination will tend to clash. Changing films and processors mid-stream can lead to the same problem although it may not be as noticeable as changes in weather and time-of-day.

One way to assure continuity is to do what the filmmakers do: use artificial light to override the natural illumination. The only way to do so economically may be with judicious use of strobe flash fill-in. That, however, is only applicable for near-foreground illumination and useless for landscape or cityscape photography. In those

instances one simply tries to standardize picture taking to specific conditions, allows for these abrupt changes in the narrative scripting, or isolates very different visuals by interspersing content that breaks the continuity.

Using Vertical Orientation

Many producers like to standardize on the horizontally oriented slide and shun mixed presentations as discussed in the section on "orienting three images." Knowing this in advance helps to assure adherence to the chosen format when photographing "situations of opportunity" with the possible intent of using the images later on. If one is photographing "on assignment," as it were, it behooves one to have the storyboarded script along for constant reference. Again, it helps to cultivate the thinking patterns of a cinematographer rather than of a single image photographer who only occasionally thinks in terms of "series." In a pinch, vertical slides can be cropped to the square 23mm format or rephotographed to yield a horizontal, enlarged copy.

Photographing Panoramas

Photographing a three image panorama in nature is more problematic than simply pointing the camera at three consecutive fields of view.

For one, the panorama offers the viewer an intense awareness of the horizon – hence all three exposures must adhere to the true horizontal. Level the flat pan head platform of your tripod first with a bubble level, secure the tripod solidly, and then allow only lateral rotation for the camera, once mounted. This assures following the horizon. Try to avoid extreme wide-angle lenses, even a 28mm lens tends to photograph the world as shown in Illustration VI-15 with the result that any existing or imagined parallel lines above or below the horizon will fail to line up. Furthermore, three wide-angle images projected onto a non-curved screen offer an extremely unrealistic view of the world. (The 28mm lens covers a picture angle of 74 degrees, hence 3 such images in a row represent a 222 degree wrap around – or "fisheye" – view, not really realistic on a flat screen.)

Indexing the camera as one rotates the camera through the panorama sequence is best done with a precision device such as Nikkor's "AP-2 Panorama Head" which provides precision indexing points for lenses of varying focal lengths. Lacking such a device, one should select, and commit to memory, convenient distant markers and orient these at the juncture points. Avoiding close-in, or detailed subject matter at the break points will help minimize any visible discontinuities. When photographing panoramas, one must also keep in mind whether the three images will be projected with small dark spaces between them on the screen and whether the viewfinder shows the entire image area or leaves some out. Both factors will affect the resulting match between slides.

Whenever photographing three screen panoramas with rapidly moving subject matter – such as crowds, a freeway, or a stormy ocean, it is not sufficient to use exposures fast enough to "freeze" the movement in each slide. The movement can make it hard to match the three slides. In such instances one must align three identical cameras over a common crossing point, as shown in Illustration VI-16, and make all three exposures simultaneously using three cable releases triggered at the same time.

It is worth noting that, strictly speaking, the three image panorama is not a multi-image entity but a very large single image. As such it clashes with the rest of the presentation – usually to good effect. However, it should be used with discretion and only where appropriate. A dozen panoramic displays in a ten minute program seems too many, unless showing panoramas is central to the theme.

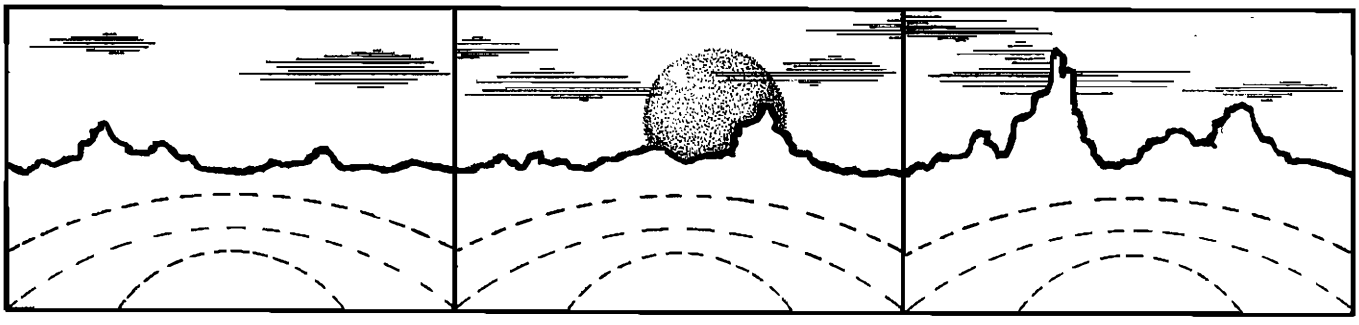


Illustration VI-15
Photographing panoramas

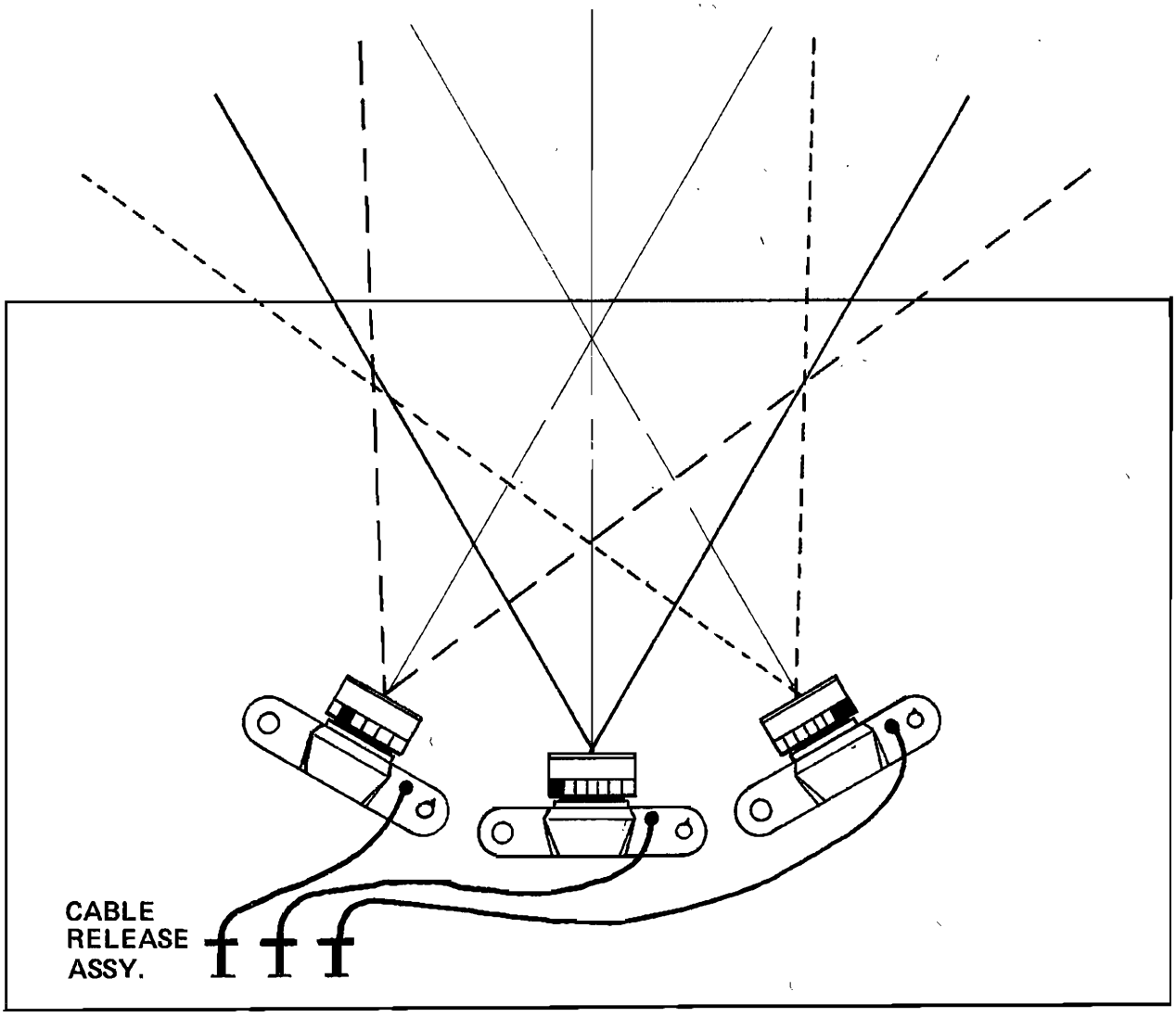


Illustration VI-16
Aligning three identical cameras over a common crossing point.

Model Releases

Unless you are working only for the pleasure of it and do not intend to publicly exhibit or somehow profit from your work, you should obtain model releases from every distinctly figured person in your slides – anyone who could be recognized and is not in the midst of becoming a "newsworthy" personage, i.e., is minding their own business. Photographing such individuals can constitute invasion of privacy and the signed release will help minimize future confrontations. You need *not* obtain the release *before* taking your photograph but you should not display it publicly without such a release.

Doing photography on private property or in privately controlled buildings open to the public may also necessitate approval to use the resulting pictures. One can always take a chance, but becoming the subject of a "test case" can cause extreme grief and expense.

As mentioned at the start, it also behooves a producer to constantly refamiliarize himself with the latest interpretations of the copyright law so as to know how to handle available "stock slides," and various visuals that seemingly unavoidably wind up on the copy stand because, "after all" they fit so well . . .

CHAPTER VII
PRODUCING THE AUDIO

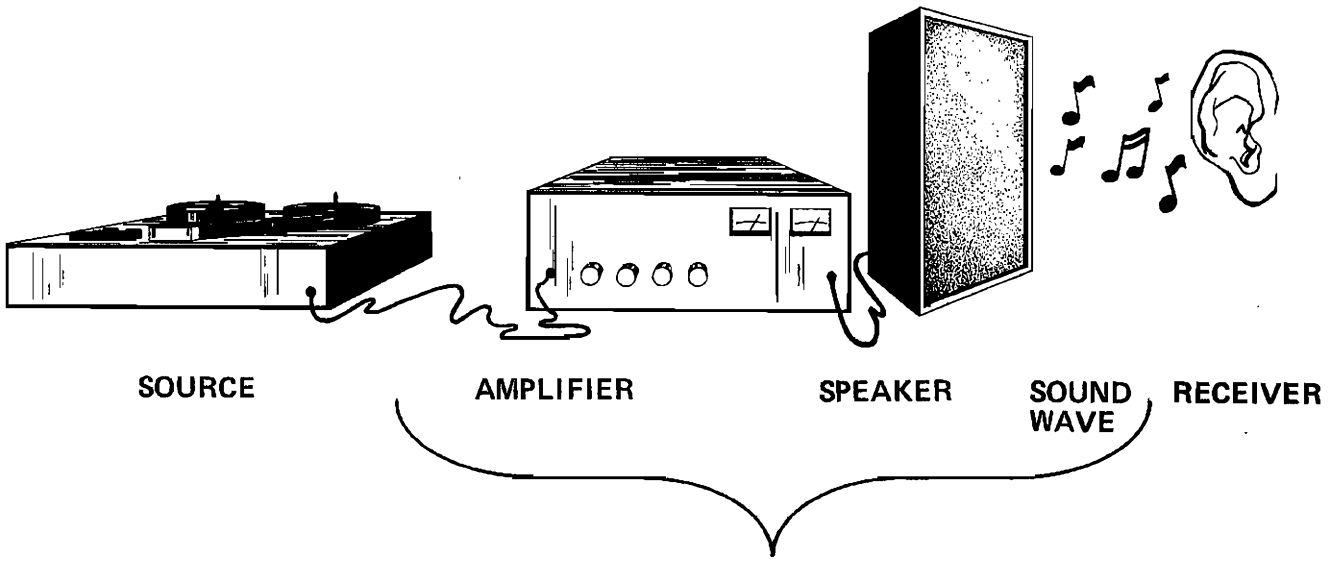
Ken Burke

Introduction

In this chapter we will discuss the audio accompaniment to a multi-image program. No technical expertise is expected of the reader, but those who would prefer more elaboration on various aspects of audio may refer to excellent texts. Technical operations and organization of American radio stations are summarized in Oringel (1972) whereas Nesbitt (1972) offers a more complex look at radio, especially from the viewpoint of BBC radio drama broadcasts. Contemporary music studio recording is treated at length by Runstein (1974), while Alkin (1966) provides a handbook for using audio in television productions. Hopefully these references will provide the type of advanced knowledge sought by readers who have mastered the material in this chapter.

The Nature of Audio

Audio, as we will use the term, refers to the electronically amplified sound recording used with a multi-image program. While it is presumed that such a soundtrack will be recorded on audio or video tape, a phonograph record, or a strip of film, it is conceivable that someone might follow the example of John Cage and expand that possibility by using a live broadcast from a radio or television receiver to accompany the visuals. Another possibility would be using music and/or readings by live performers. Nevertheless, it is most likely that a multi-image program will have its soundtrack on reel-to-reel or cassette audio tape. Thus, the discussions in this chapter will center on recording and editing for the medium of audio tape.



In terms of communication theory, these would all be electronic and acoustic channels carrying the message (signal).

Illustration VII-1
The Audio Process

Physically, audio consists of: a *source* (the recorded signal), an *amplifier* (to increase the volume of the signal, a *speaker* (to transmit the signal into the listener's environment) and a *receiver* (a person with an ear to respond to the signal).

We have defined audio in terms of playback only, since this is what concerns us in using the final soundtrack. This presumes the entire process of recording our audio. We will devote most of this chapter to explaining that recording process.

Sound is measured in terms of its pitch (frequency) and loudness (amplitude). The first is measured in units known as Hertz, or Hz, and the second in decibels or dB. From the standard 0 dB level (which is below the threshold of normal hearing), ordinary conversation is rated at about 60 dB while a jet take-off is rated at 120 dB.

On a tape recorder volume meter, dB are measured as amounts of volume either above or below peak recording efficiency. In Illustration VII-3 the needle shows the amount of volume as being -2 units from the optimum level. As we have seen, a loss of only 2 units from a comfortable level is hardly noticeable. Remember that dB units are simply units of measure and relative ones at that.

The 0 Volume Unit (VU) mark on your tape recorder is another standard against which you measure increases and decreases of volume. More information on using the volume meter is provided in the section on tape recorders.

As regards the other primary measure of the soundwave, its frequency is measured as Hertz (Hz), and it indicates the pitch of the sound. The higher the Hz number, the higher the pitch of the sound. Each instrument has a limited range of frequencies it can produce, going from a low of 50 Hz for the bass drum to a high of 16,000 Hz for the oboe. Human voices range from 100 to 8,000 Hz for males and from 150 to 10,000 Hz for females.

We need to know about frequency ranges in audio recording when choosing equipment that must be able to reproduce the range of sound to be recorded. If a recorder or microphone is sensitive only to sounds in 500-10,000 Hz range, there will be certain kinds of sounds which will not be recorded. On the other hand, there would be little need for the added expense of a machine that could capture a 30-30,000 Hz range since very few untrained ears could hear the difference. Choose equipment that will serve your recording needs.

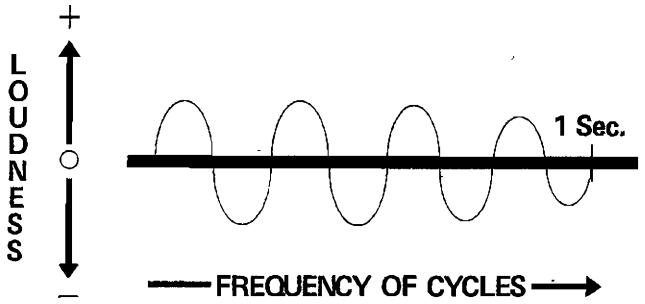
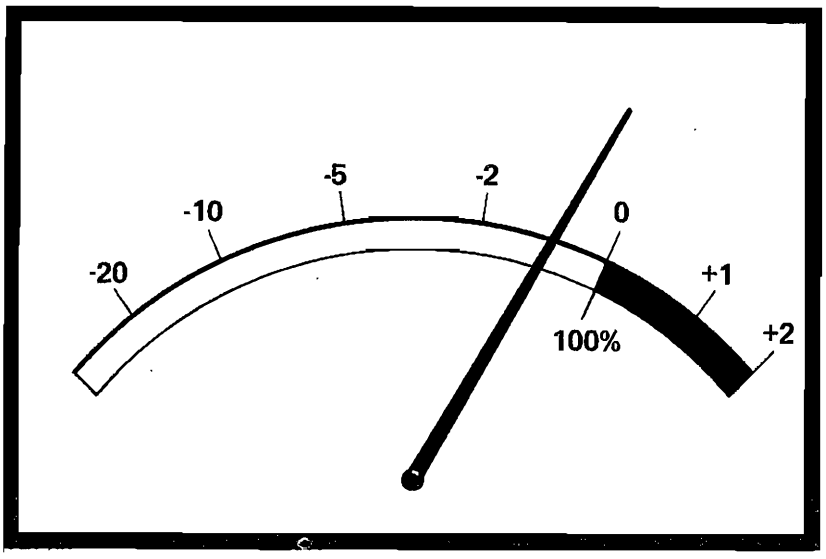


Illustration VII-2
The Soundwave



The Volume Meter, which measures decibles as Volume Units, is more commonly known as "VU Meter".

Illustration VII-3
The Volume Meter

For simple transcribing of speech a range of 200-5,000 Hz is adequate. Studio equipment should be better.

Use of Audio in Multi-Image Programs

We will normally find multi-image program soundtracks on audio tape, but we might on occasion use sound motion picture film as well. Film sound can be either optically or magnetically recorded.

Once we understand these differences the average multi-image producer can do little with film soundtracks except ignore them or play them. If a soundtrack must be taken from a file, make every attempt to run it through a tape amplifier system rather than directly through the detachable projector speaker. Film projector speakers do not compete with tape speakers, because so much is lost when trying to mix the two. By following the pointers later in this chapter, it should be simple to run film or video sound into an audio tape speaker system. You may also ignore the film sound by turning it off and substitute another audio recorded on tape. Often this gives the producer greater control over timing and content clarity.

Our first recommendation in producing the soundtrack for multi-image programs is to use an audiotape recording and playback system. Audiotape is high in quality, yet affordable. The signal may be recorded in various ways on audiotape; these can be grouped as follows: (1) *simple recordings* from one source onto the tape; this includes both direct narration or music recorded through a microphone and copying (*dubbing*) a signal from a prerecorded tape or record; (2) *voice-over* (VO) *narration* where the primary message is embellished with background music or sound effects (SFX); this can be accomplished on a stereo recorder without using a mixer; (3) *edited tape* where changes are made in the original recording by splicing the tape; and (4) *mixed tape* which uses an electronic mixer and additional sound equipment. Mixes can be simple transitions between two sources, sophisticated ways of providing VOs, or complex means of building up layers of voices, music, and SFX.

Physical Characteristics of Audio Components

Audiotape

Audiotape consists of an *emulsion* of powdered metallic oxide (or rust) mixed into a *base* of some sort, analagous to the emulsion of photographic film. This is where the signal will be recorded. Quality of tape recordings depends on the quality of the emulsion. These emulsions vary but iron, or ferric oxide, has been the most popular for years. This rusty-red or rusty-brown tape is still the most readily available recording tape. Improved mixtures have been released in recent years. Of these, chromium dioxide (CrO^2) emulsions seem to offer a marked improvement over standard tapes. There is also "low noise" tape, which is simply a better manufactured version of ferric oxide. Choice of tape depends on the importance of the subject and the budget of the producer; "low noise" is generally more expensive per reel than standard tape and CrO^2 costs even more, but tape costs seldom account for a large part of production costs.

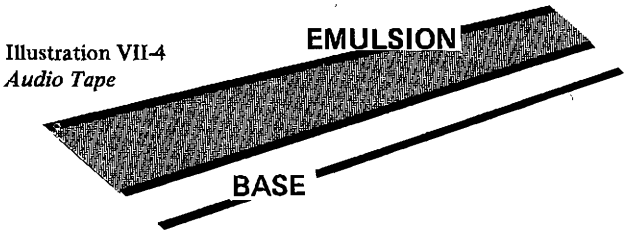


Illustration VII-4
Audio Tape

Tape base is now almost exclusively polyester plastic, but older magnetic tapes were backed with acetate. Acetate is very good for editing because it cuts smoothly and easily. Unfortunately it also breaks easily and is subject to sticking to itself when stored in warm conditions. Polyester stores well and has been greatly improved in its editing capacity; however, it does have the disadvantage of stretching under tension. It is much more durable in ordinary recording use than acetate, but when pulled tightly it will go wire-thin before breaking. Broken tape can be repaired, but stretched tape is good only for odd sound effects.

A related aspect of tape base is thickness, measured in thousandths of an inch (mils). To counteract the polyester's tendency to stretch, it is best to use the thickest tape available – 1.5 mils. Tape thickness also determines how much tape is on a reel. Since reels come in standard sizes (10", 7", 5" and 3"), different lengths of tape can be put on the same size reel, depending on how thick the tape is. The thinner the tape, the more you can get on a reel. Thin tape has a greater possibility of "print through," where the recorded signal "bleeds" to other adjacent layers of the tape as it is wound tightly onto the takeup reel thus causing extraneous sounds on the recording. For multi-image programs nothing thinner than 1 mil tape should be used.

Tape running times are usually printed on box lids in which tape is sold and is directly related to how much tape is on the reel and how fast the recorder is transporting it. Recording quality is best at faster speeds, so some basic rules are 1) always use 1 or 1.5 mil tape, 2) always record at

least at 3¾ ips or preferably 7½ ips, and 3) use only one "side" of the tape so that you can edit later by cutting the tape.

Recording occurs as the metallic particles of the tape are magnetized by the incoming electronic signal. The more the particles are magnetized, the better will be the quality of the recording.

Another factor that affects tape quality are the number and widths of the tape tracks. As shown in Illustration VII-5, standard ¼" audiotape and cassette tape may be divided into several formats. This is accomplished by the configurations of various recording heads. With more tracks there are less particles available per track. Thus, the complexity allowed by multi-tracking sacrifices some recording quality and must be compensated for by using higher speeds.

In summary, tape recording quality is affected by: (1) composition and quality of the emulsion, (2) recording speeds, and (3) width and number of tape tracks. A fourth factor is the size of the gap in the recording head.

As shown by Illustration VII-5, there are several ways in which a signal may be recorded onto a length of ¼" audiotape. The important fact is that you never record on the "backside" of the tape, but rather on tracks that were not magnetized on one pass of the tape across the record head. The symbols next to the tape tracks in Illustration VII-5 refer to tape recording heads. Note that the gap in the white part of each head is all that actually functions during recording, so that in some configurations it is possible for tracks to pass over the head without recording a signal. When the tape is turned over, the recording head is then in position to record on those "empty" tracks.

As noted, the wider the track, the fewer tracks per tape, and the better will be the quality of the recording. This is why audio studios use full and half track decks. (Some recording studios may use 16, 24 or more tracks, but they compensate by using wider tape, often up to 2 inches wide.) For the producer of educational multi-image programs, track stereo should be adequate. Quadraphonic sound would provide even more versatility but

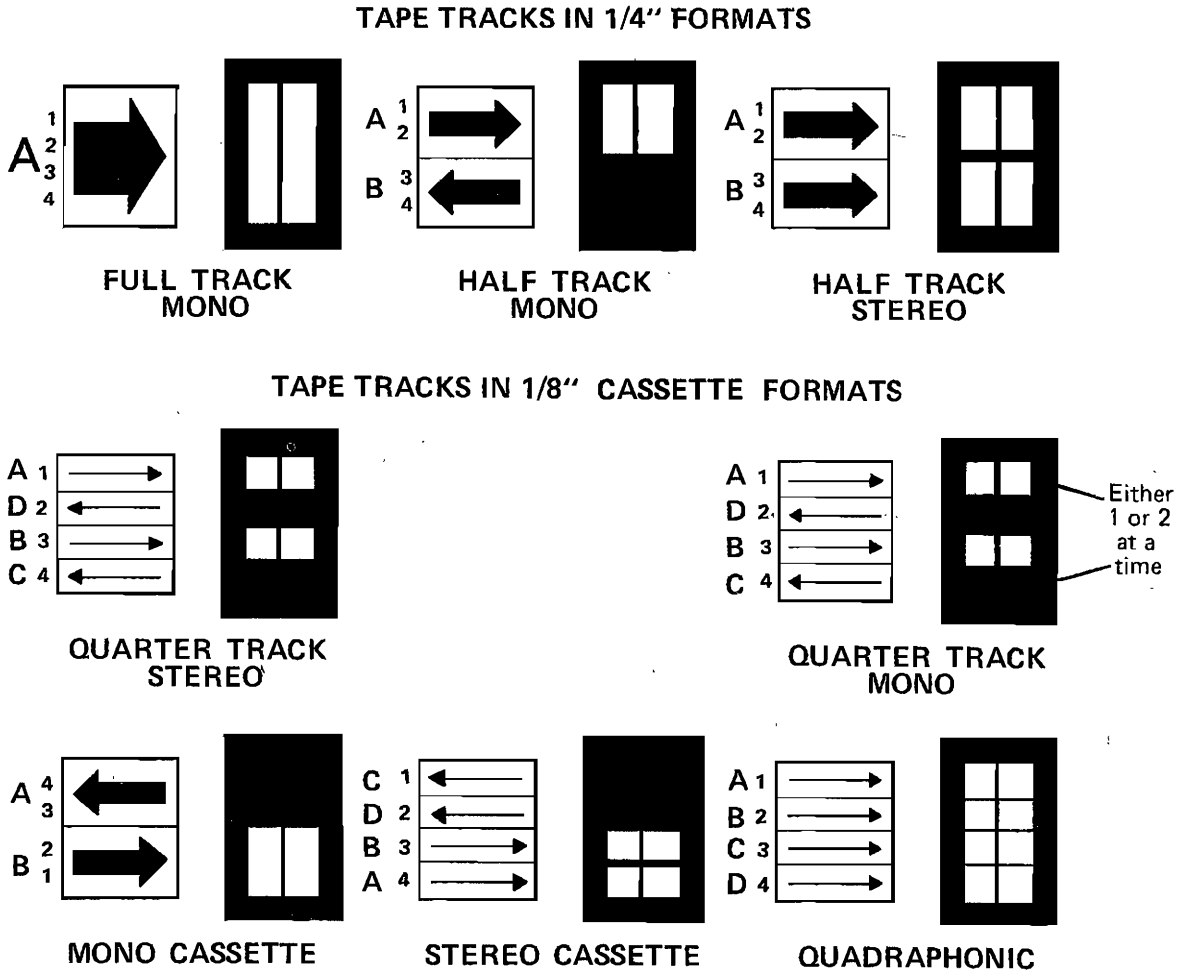


Illustration VII-5
Tape Track Formats

requires more playback gear if all channels are to be used for soundtrack material. A last reminder is that any reel or cassette tape can be used on any reel or cassette recorder; special track configurations do not necessitate special tapes. However, chromium dioxide tapes do require recorders whose electronics have been designed for them if their full advantages are to be utilized.

Tape Recorders

Now that we have covered the nature of tape, we will discuss tape recorders. Illustration VII-6 shows the two basic tape recorder systems: the *transport* system reels and the *electronic* system. All these elements are shared by most stereo tape decks. One main transport difference with 8-track cartridge tapes is that the tape is all on one reel that continuously moves the tape in a circle across the heads.

The key part of all transport systems is the tiny rotating cylinder known as the *capstan*. When tape is pressed against it by the large rubber *pinch roller*, the capstan pulls the tape across the heads at a constant rate. When loading reel tape be sure to thread it between the capstan and the pinch roller. Also noteworthy is the small wire cut-off switch to the left of the heads (on most tape decks). Failure to pass the tape over this switch results in the recording remaining turned off. All these devices are automatically engaged with cassettes and cartridges.

Tape recorder electronic systems are focused on the *heads*. Sophisticated recorders use a separate

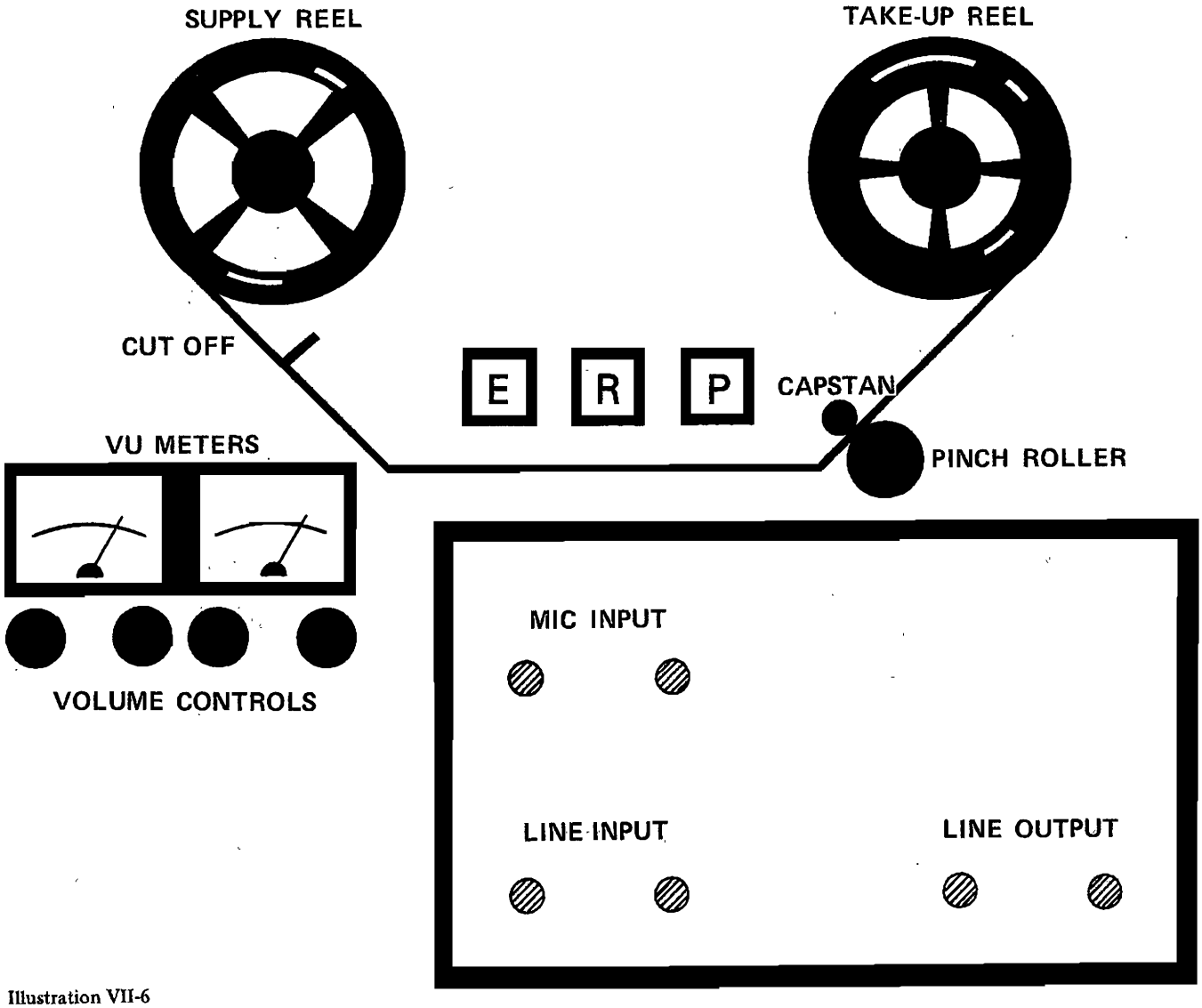


Illustration VII-6
The Tape Recorder

Picture VII-1
A stereo tape deck.

AMI Collection

head for record and playback; less expensive ones combine these functions in one head with a resultant loss in quality. In the record mode, tape is automatically passed over the erase head which is activated in the appropriate track so as to demagnetize existing signals before new ones are put on. In the playback mode the tape also passes across the erase and record heads, but they are not activated. In the fast forward and rewind modes the tape is lifted away from the heads before being rapidly transported.

Recording occurs at the tiny gap in the head where the magnetic fluctuations contact the tape. The smaller the gap the better the varying magnetic field is focused and the better will be the final recording. The playback head reverses the process and translates magnetic fields into electronic signals which are amplified and carried to the speaker where it is transformed back into acoustic energy or soundwaves.

A recorder's heads should be periodically demagnetized and cleaned. Demagnetizing is accomplished with a demagnetizer. Its "business end" is passed close to the heads, but should *never* touch the heads. Cleaning can be done with cotton swabs and either special fluids or various forms of alcohol.

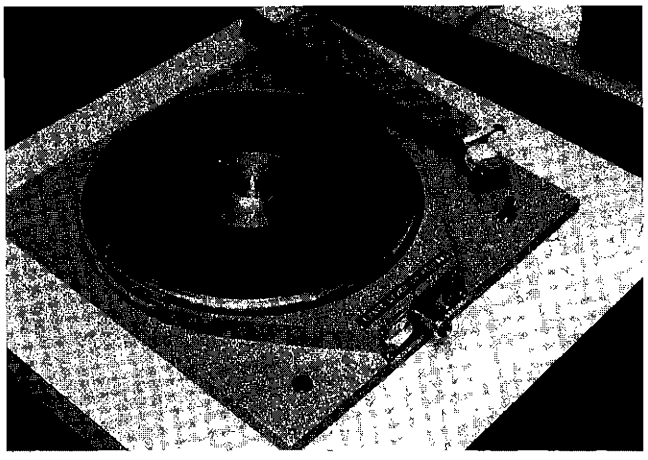
Another important component of the tape recorder are the VU meters that show the amplitude of the recorded material. Recordings should always be monitored with earphones, but reference to the meter settings will help in obtaining the proper level. Record close to 100% VU capacity with only occasional bursts into the red overload area. Recording too loud causes signal distortion, but recording too low will result in emphasizing unwanted machine and tape noise (hiss) during playback. For soundtracks it is best to monitor the entire tape, making periodic adjustments if necessary. Automatic level controls, (ALCs), should not be switched in or used because these adjust all incoming sounds, no matter how loud or soft, to one level. Crescendos are softened and quiet moments (with accompanying tape hiss) are unnaturally boosted. Practice manually adjusting record levels ("riding gain") so that you can do it smoothly during recording if you have to. Simple duplicating (dubbing) does not require riding gain, though; just set your level during the first several minutes so that it will not *peak* (bounce into

distortion) too often and let it go. Commercial materials have a range of volume, as does all natural sound, so do not expect to always operate at the 100% setting. For many kinds of sounds a 60%-80% setting is ideal.

Normally, reel-to-reel recorders are the best format because they offer far greater flexibility in editing. It helps to also have quality cassette decks (preferably the portable kind equipped with a Dolby circuit) on hand, but where budgets restrict, it seems that reel-to-reel recorders offer the greatest flexibility except for portability.

Turntables

Since much of the musical source material that one uses will come from records the producer should have available a quality record turntable that will produce good, clear sound.



Picture VII-2
A quality record turntable. Photo courtesy: Duane Troxel

One problem that the multi-image producer must learn to overcome when using material from records is that disk sound is a pre-arranged product that cannot be altered until after it has been transferred to tape. Only a few turntables provide a precise way of "cueing" the records so that a sound can start at the instant that it is needed, so that this starting/stopping may have to be done with intermediate tape recordings. Records offer a wealth of lyrics, music and SFX; nevertheless, they tend to be too clumsy to use as complete soundtracks and should only be used as sources in dubbing or mixing material onto tape.

Microphones

Essentially, microphones (as mikes) are transducers – devices that transform one form of energy into another. Microphones accomplish this by re-using one of several kinds of vibration; the major types are listed in Figure VII-1.

Another important characteristic of microphones is their *polar recording pattern*, which is the angle of acceptance for incoming sounds. Omnidirectional mikes take in sound almost equally from all sides, *bidirectionals* have two "dead" sides, and *unidirectionals* (*cardioids* – from the heart-shaped polar pattern) have one end which is more "live" or receptive. Not all cardioid mikes are equally "unidirectional," so that if high directionality is desired, be sure to study the polar pattern of several alternative mikes before picking one you want. Practice is necessary to learn proper mike placement for giving a sense of reality to the recorded sound, yet becoming familiar with each

Figure VII-1
Characteristics of Microphones

Type of Mike	Element Vibrated	Durability	Polar Recording Pattern	Normal Impedance
crystal, carbon, ceramic	salt crystals, carbon granules, ceramic plate	fragile	omnidirectional	high
ribbon	aluminum ribbon between poles of magnet	fragile	bidirectional	high
condenser	air pressure generates, a current from a separate usually built-in pre-amp power supply	may be fragile (although newer ones tend to be quite rugged)	cardioid or omni	low, but often adjustable internally
dynamic	diaphragm	rugged	cardioid or omni	high or low

For reasons of cost, reliability and durability, we would recommend either *dynamic* or *condenser* microphones for most recording purposes.

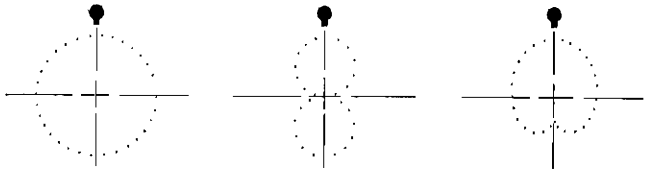
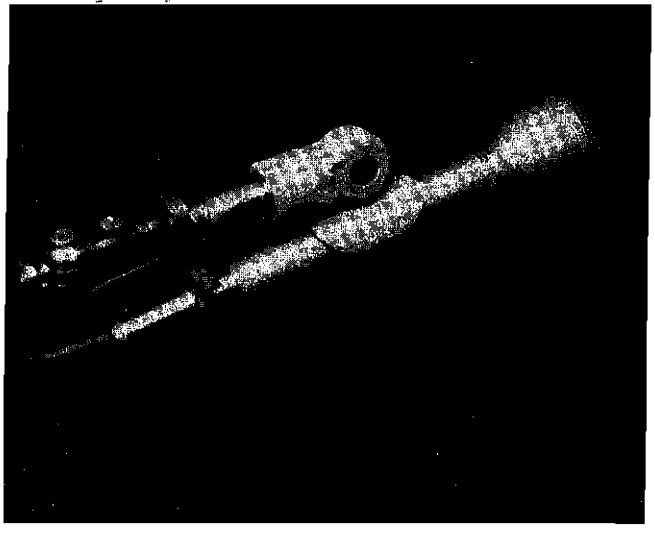


Illustration VII-7
Polar Patterns of Microphones

mike's polar patterns is the first step in properly recording a situation. A cardioid mike would be used for a narrator or singer or to allow a minimum of "location sound" to mix with the dialogue. An omnidirectional would be best for a group engaged in interviews, background vocals or constantly shifting action. When taping outdoors, be sure to use *windscreens* (porous shields which block most of the "roar" caused by the wind) and *shotguns* (super-cardioid mikes that accept only a narrow angle of sound, even over distances and can be pointed at the sound source).

You should also be sure that each microphone's *impedance* will match the published impedance range of the recorder's input. You must also match impedances between components or you will suffer a serious loss of performance. A low impedance mike sends so much current into a high impedance tape recorder input that the signal becomes distorted. Similarly, a high impedance recorder played through a low impedance amplifier provides it with too weak a signal; as volume is boosted, inherent electronic noise is also boosted. When checking for impedance match, you can assume that most consumer-type equipment has high impedance inputs.



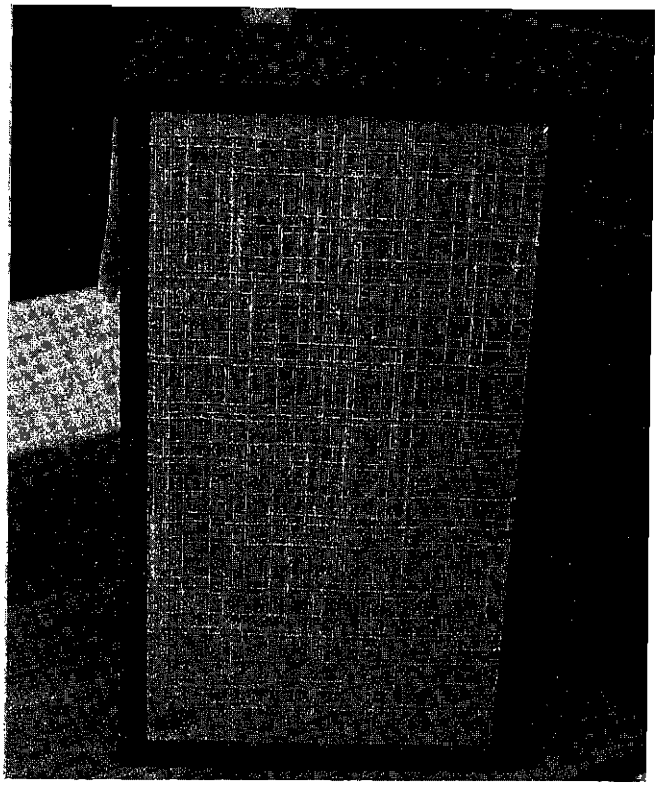
Picture VII-3
An Omnidirectional Microphone.
Photo courtesy: Duane Troxel

Amplifiers and Speakers

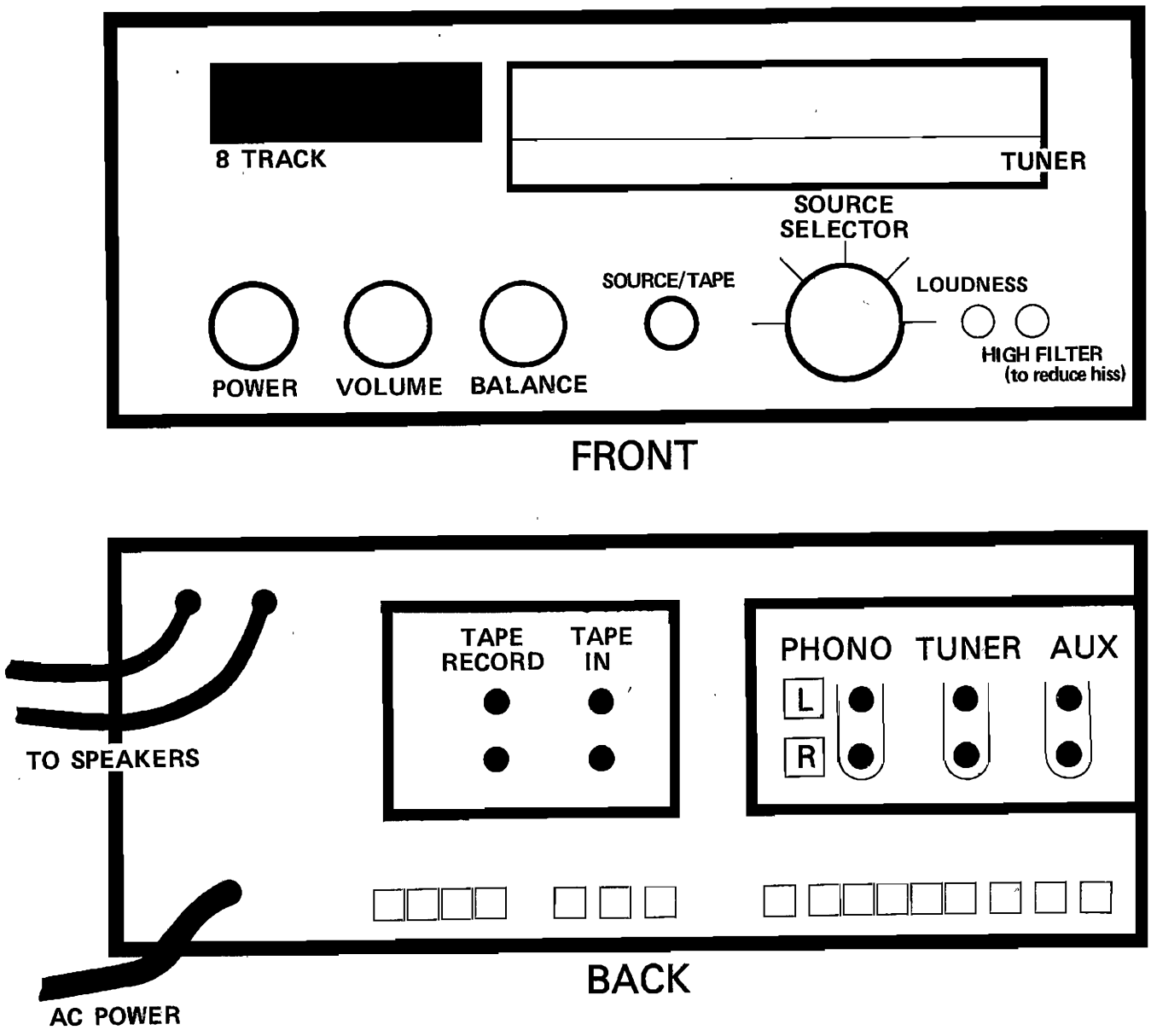
While the electronics and design of amplifiers and speakers can be quite complex, their function is simple: to increase the level of the signal or volume to an acceptable hearing level, then translate that signal back into acoustic soundwaves. In loud speakers the electronic signal vibrates a movable coil attached to a cone which then moves the air, thereby producing an audible sound. Sophisticated speakers may use other vibrating elements to give maximum clarity to the sound.

Modern consumer-type amplifiers offer very sophisticated controls that can allow the audio recording operator extensive opportunities to regulate, alter, and move the signal back and forth without having to connect and disconnect cables. When choosing among available units, ask the sales representative to demonstrate various available equalization and tape dubbing features, as well as look for the greatest variety of built-in input and output terminals.

If you are lucky, your speaker inputs will have plugs at both ends of the cable; if not, you will have cables with wires that must be attached to screws. This will be either one wire or a pair for positive and negative grounding, as in Illustration VII-9. These double wires will be color coded; keep your wiring consistent to avoid playback distortion.



Picture VII-4
A typical loudspeaker.
Photo courtesy: Duane Troxel



These inputs will not be on amplifiers with built-in sources, such as the one shown in the front view.

Illustration VII-8
The Amplifier

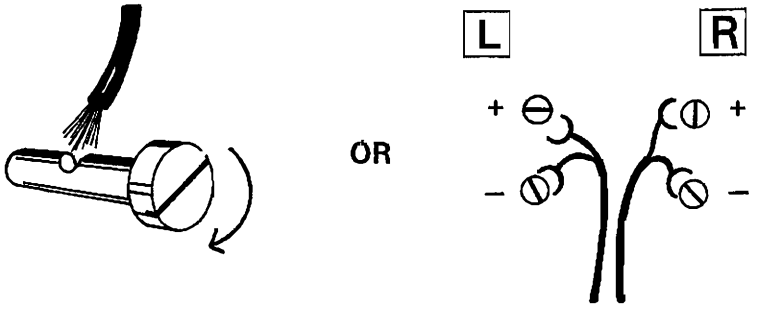


Illustration VII-9
Speaker Cable Connections

At this point we should clarify the process of connecting, or "patching," components together. Illustration VII-10 shows the major types of cable *plugs*. Cannon Connectors are normally used for low impedance use and come with an additional grounding element built into the table. One quarter inch *Phone* plugs are also often used with low impedance gear, while RCA type or *phono* plugs and *mini* plugs tend to be used for high impedance. Adapters are available that will convert one format to any other.

Illustration VII-11 shows how a Cannon mike cable can be adapted into a mini-recording input. Impedance is also adapted at the Cannon-phone stage.

The much used "male" and "female" terminology is analagous to biological structure, and the input terminals for plugs are also known as *jacks*. At the amplifier there will be input and output jacks, with corresponding input and output jacks at the other components. Thus, a standard set of stereo patchcords is a pair of cables terminated in phono or RCA plugs that carry the signal from one machine to the next. Patchcords come in varied lengths and can be extended through proper adapters up to about 20 feet without any serious deterioration in signal quality. Note that the recorders have two sets of input jacks, one for "MIC" and one for "LINE." The line input is for an amplifier source – usually its high impedance "tape" output.

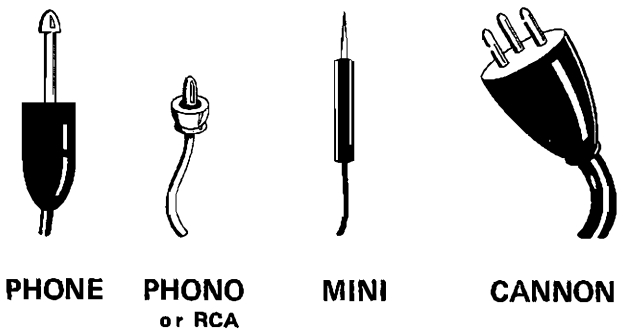


Illustration VII-10
Plugs

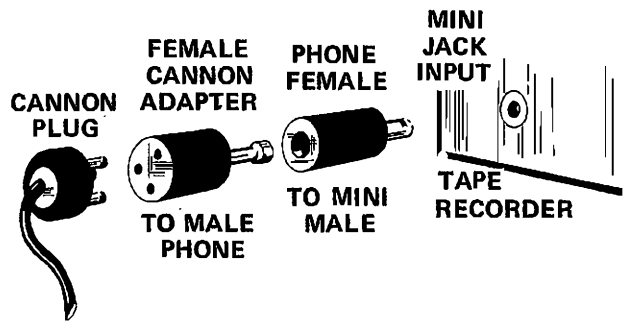


Illustration VII-11
Cable Adapters

Mixers

Patching leads directly into a discussion of mixers, since mixing is essentially the patching of several sources together before sending them to a master recorder.

Mixers come in two varieties, "active" and "passive." Active mixers have built in preamplifiers and cost several times more than the passive kind. Passive mixers do all on one to mix signals but one can only "mix down" – i.e., the signal coming out will be reduced and must be reamplified by the next electronic device in line. Passive mixers are not suitable for mixing signals from sources whose level outputs differ greatly.

Some mixers take only phone inputs; others provide phone inputs for low impedance mikes as well (impedance adapters are built into the mixer). Most mixers allow input volume to be controlled through a *fader* which slides vertically from 0 to maximum sound. If the fader is a round knob it is known as a *pot* (for potentiometer). Stereo mixers give you a separate fader for each channel of each input; you must then set volume levels for balance between all inputs and for the total output. Normally there will be a VU meter and a master volume control on most active mixers to help you accomplish this. To insure a good balance, monitor the process with headphones as well.

Two other common features on mixers are *attenuators* and *panpots*. The first is a switch below each fader; it allows you to cut the volume of loud inputs by some level, say 20%. This should not be used unless it is necessary because you do not want to boost the input volume any more than you have to in achieving a 100% VU meter setting. Any time you boost any type of volume you increase the amount of electronic noise which will then be included on the recording. Panpots allow you to spread a single channel source, such as microphone narration, over both stereo channels. This is often done with a *distribution switch* that sends the left signal to the right channel also, or vice versa. Mixers with such an input position are very helpful in giving more fullness or directionality to microphone recording. A final note is that this input position does not affect the rest of the mixer. Thus, you can keep background music in its original stereo separation while sending mono narration to both channels.

Other Modulating Equipment

More detailed texts should be consulted for explanations of such devices as echo generators, compressor expanders, Dolby noise reduction systems, and equalizers. All of these can be used to enhance sound quality or to add unique effects. Briefly, we can say that *equalizers* and *filters* work

by changing the frequency emphasis within the sound (they are complex tone controls) while *compressor/expanders* – change the volume "envelope" of the entire sequence of sound and act as complex automatic level controls). Compressors also work as *limiters*, cutting off any volume program on beyond the 100% VU level so as to prevent distortion.

Recording Techniques

Since many other handbooks stress the "how to" of recording, we have stressed the nature and operation of audio equipment. However, we will offer the following suggestions to aid you in the recording process.

Miking

1. If possible, choose a polar pattern that best suits the recording situation.
2. Normally, the mouths of narrators or singers should be about 6 inches from the mike for maximum recording efficiency.
3. Speak "across" the mike, with it about 45° to the mouth, to help reduce popping sounds.
4. Isolate the speaker in a studio or sound-insulated room. If none is available, cover a room with carpet and cardboard egg containers or isolate the speaker with some type of portable panels (*baffles*).
5. Do not mount lavalier mikes (small ones designed to be worn around the neck) on a stand away from the speaker. These are designed to cut off bass frequencies – which are emphasized by the chest cavity – and they will produce an unnatural, tinny sound when moved away from the body of the narrator.
6. Always use a very sturdy mike stand, but do not put it on surfaces that will be vibrated by those present. Finger tapping on a table or foot stomping on a stage will be picked up as noises. Use a boom stand or hang the mike from above.
7. Do not expect perfection from your narrator. If a mistake is made, repeat and identify the next attempt ("take two") and the content ("page 4, third paragraph, sixth line") for later ease in editing. This is much easier than constantly starting over or re-recording.
8. Turn off playback speakers while recording through a mike, or a sound loop will occur that causes a screeching *feedback* noise.

Dubbing

1. Patch as directly as possible between components because adapters and extra distances can cut down on quality. Tape recorders have adequate *pre-amps* to allow patching directly from one to another. Mikes can also go directly into recorders. Turntables must first go through an amplifier.

Plan ahead to accommodate any problems.

2. Most tape recorders have a "pause" control that allows you to halt the recording process without disengaging the record mechanism. Thus, you can start in the pause made before you hit "record" and then patch in your input signal. This allows you to set proper recording volume and begin taping at the right time without wasting tape. When doing in-deck edits during a recording session, use the pause control and manually back off the tape each time you restart (a 1/8th of an inch will do) to minimize starting noises.
3. This way you can tape your segments tightly together, thus eliminating "dead air" tape and reducing your past-session editing needs.

Editing

1. Electronic editing is done by combining sources in real recording time through a mixer. If you choose to work this way, trial runs and a stopwatch are mandatory.
2. Physical editing is done by cutting the tape and splicing the ends back together. For best results use a metal splicing block and a razor blade. Locate the place to cut, mark it with a white China marker, cut it on the block, and put the proper ends together with 7/32" splicing tape.
3. Locate your edit points by listening carefully to the audio segment, engaging the pause control, advancing the tape by hand (rotate both reels to prevent stretching), and listening through headphones to hear the proper tape position. This is relatively easy when the task is to cut out dead air and extraneous noise; it becomes more difficult when the cut must be made at the end of a word or a note of music. Only practice will give you the needed skill, but it is possible to splice around individual syllables once you have mastered the technique. Keeping the heads in contact with the tape while moving the reels by hand is only possible with mechanically controlled (not solenoid actuated) and very expensive tape decks.

4. Since some recorders will not allow you to monitor signals while in the pause position, try removing the tape from between the capstan and the pinch roller, engaging the pause control, and pulling the tape by hand slowly over the heads. If this does not work, you must locate a mechanically controlled tape deck for editing.

5. Always splice plastic leader tape onto the front of your soundtrack. This allows you to "cue up" the beginning of your presentation for a quick, smooth, professional start. If there is more than one soundtrack (*cut*) on your final tape, put about 2 feet of leader tape between each cut. This will enable you to find everything and cue it up quickly. Another organizational trick is to label both reel and box with content, playback speed, running time, and mono/stereo designation.

Simple Voice-Over (Narration with Music)

With a stereo recorder you could "mix" a soundtrack of narration and background music. This is done by putting voice on one channel and music on the other. You could do this in real time, but any mistakes would require a complete retaping. A better technique would be the following:

1. Record the narration; edit all mistakes out of it. If there needs to be silent segments for concentration on the visuals, edit in an appropriate length of leader tape (7½ inches or 3¾ inches per second).

2. Dub this directly from one tape recorder to the left channel of a second stereo tape deck.

3. Choose an appropriate length of music, either full version or edited.

4. Dub the music onto the right channel of the second stereo recorder, while playing back the left channel to allow you to monitor timing and volume. Do not overpower the narrator, but do boost the music when it is to be used alone. Use your ear as the guide, not just the VU meter. These two channels will be slightly out of sync because you will hear the left a fraction of a second before the right records, but this is usually negligible.

5. If you are dubbing stereo music onto the right channel, use a "Y" adapter to retain both channels of the original music.

6. Feel free to switch left and right from this suggested pattern since this is only a conventional arrangement.

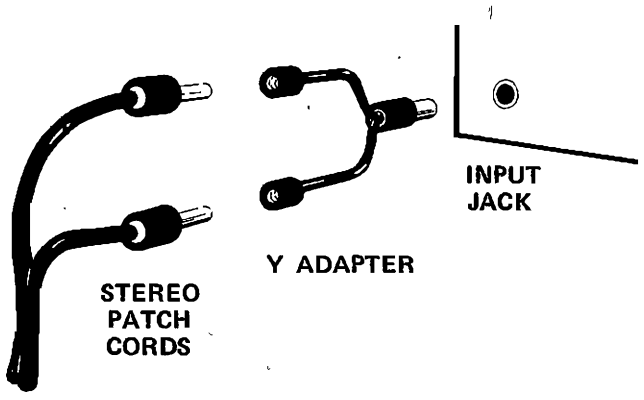


Illustration VII-12
"Y" Adapter Cable

Mixing

1. Patch all necessary sources into the mixer.

2. Decide if you will use *cross-fades* (sound is actually mixed) or *segues* (one source fades out, next one fades up quickly). Practice.

3. Predetermine good recording levels for each single source. Note whether two or more simultaneous inputs cause a total increase in mixer output volume. Ride gain on the master if necessary when adding sources.

4. It is probably best to monitor the mixed signal at the recorder. Also, most recorders will allow you a simultaneous playback through speakers while recording. This is still the input signal, not the playback signal, but you should listen to it through speakers and judge your final recording through a live mike.

5. Cue up all inputs tightly to avoid dead air between audio segments. Splice out dead air or mistakes or noises if they occur.

When Working with Tone Regulated Synchronizers

Many less expensive programmable two-projector dissolve/synchronizers work by first recording and then playing back an audio control signal on the soundtrack tape. This obviously requires the use of a stereo tape deck – a quadradial, or four track, deck would offer further control.

1. Record and mix your sound track with its narration, interviews, sound effects and music first.

2. Transfer that mixed material onto one track of a stereo tape.

3. Now, record your control signal onto the other track while listening to the sound track and simultaneously programming the slide advances/dissolves/superimpositions.

4. It is not advisable to do the visuals first because the audio portion is less likely to be flexible in timing. Recording the visual programming simultaneously with live narration recording is unbelievably hectic and permits the pick up of extraneous sounds like projector-mechanism noise.
5. The initial recording is best done on a reel-to-reel deck, but the working tape could be a cassette re-recording of the original. Cassette stereo decks offer portability unavailable with reel-to-reel machines. However, care must be exercised that the synchronizing control signal is not recorded at such a high level as to "bleed through" into the adjacent audio track.

Final Reminders

1. Try to avoid dubbing "acoustically," that is by recording from a speaker into a microphone. Patch your source directly into your tape recorder to retain the full quality and range of your original.
2. Play back your entire finished product. Tape surface can be defective and leave you with problems that you could not hear in recording.
3. Commercial records and tapes are covered by copyright, recording rights, publishing company contracts, and musicians' unions rules. At present, the only way to avoid conflict is to consult a music store for the names of companies that will sell you usable music and SFX. You can buy these original compositions with rights guaranteed for your use. If you wish to copyright music that you have composed or commissioned for your soundtrack, contact your local Internal Revenue Service office for further information.

CHAPTER VIII
PROGRAMMING THE PRESENTATION

James Hulfish

In the still emerging jargon of the multi-image specialist, the term "programming" pretty well equates with the term "automating." When we program a presentation, we are – in fact – automating it, equipping it to run automatically (or at least semi-automatically). So the origins of programming are essentially the same as those of audio-visual automation overall.

History of Automation

The history of A-V automation did not begin until the year 1939. It was in this year that the world's first automatic slide projector was introduced. Prior to then, slide projection had endured an extended push-pull-click-click period. Everything was manual because the projectors themselves were manual devices. Very manual.

With the appearance of the automatic slide projector, however, A-V innovators immediately sprung to the task of devising ingenious ways to somehow lock slide changes to the cue points within a prerecorded soundtrack. The search for the fully automatic, sound-slide presentation was underway. It led initially to the development of the device we today call a synchronizer.

The early scramble to find an ideal way to automate the single-medium, single-screen slide show produced an incredible variety of synchronizing systems. Among the earliest was a device which responded to moments of complete silence within the soundtrack. A two-second pause, for instance, could be used to trigger a slide advance. This ruled out such audio niceties as background music under your narration, of course, but it was applicable to both disc and wire recorded soundtracks, the only two audio media available in those early Forties.

The introduction of the tape recorder following the end of World War II opened up a whole grab bag of new techniques for synchronizing sound slide presentations. One system involved using a special rectangular notebook punch to put a hole through the soundtrack tape itself wherever a slide change was wanted. An electrical contact was made through the holes as the soundtrack was played back causing the slides to advance at the appropriate points. The greatest single drawback to this system was the recording tape of the early 1950s. It was pretty flimsy stuff compared to today's plastic tape stock, and the ever-present danger of tape breakage was hardly helped by punching it full of holes!

Other systems that were tried with varying degrees of success involved such things as making special pencil marks on the soundtrack tape at cue points, or applying metallic foil patches directly to the tape. In all of these early systems, the job of synchronizing was a rather tedious, time consuming undertaking.

It was not until the second half of the decade of the Fifties that the forerunners of our contemporary synchronizer first appeared. These devices recorded a musical note, or "pulse" onto the soundtrack, and, subsequently, during playback could translate this pulse into a momentary contact closure for advancing a slide projector. In some systems very low frequency "subaudible" pulses were integrated into the soundtrack itself, but the introduction of stereophonic tape recording made it possible to place audible-range pulses onto a second track fully separated from the soundtrack. This made it possible to revise a synctrack without disturbing the recording. (In subaudible systems it was impossible to erase and move a syncpulse without erasing the overlying soundtrack.)

In subsequent years the technology of the synchronizer has been refined and polished until there remains today little more to be asked from such a device. Corresponding improvements in the fidelity and stability of the tape recorder have also contributed to the high level of reliability achieved

with today's synchronizer. These devices are now available as ultra-compact accessories for use with reel-to-reel and cartridge stereo recorders, and there is a wide selection of cassette recorders available with built-in synchronizers. The search for the effective synchronizer appears to have ended.

With the "shakedown period" behind them, manufacturers of synchronizers have joined together under the auspices of the National Audio-Visual Association (NAVA) to establish universal standards for these devices. The voluntary agreement consists of establishing the standardized syncpulse at 1,000 Hz, the length of this pulse (in fixed-pulse-length systems) to be standardized at 0.45 seconds.

Defining a Synchronizer

By definition, a synchronizer is a device to automate only one thing or event. That "one thing" may be a single projector, or, more recently, it may be a pulse sent to a single dissolve control to initiate a dissolve transition from one projector to the other, thus, the dissolve control is controlling, in effect, two slide projectors, but the "one thing" actually being automated is the dissolve control. As the search for the synchronizer was drawing to a successful conclusion, a new and far more difficult problem in A-V automation emerged.

Along came multi-image!

Automation and Multi-Image

Prior to the 1960s, the concept of multi-image presentation had appeared on the doorstep of the audio-visual community as the possible offspring of rather diverse and sometimes disreputable parentage. It's birth may have been attributable to this or that World's Fair, or this or that super-extravagant amusement park, or even possibly (it had to be reluctantly admitted) the utterly undisciplined but always flamboyant "light shows" of the day. It did not really matter. The fact is that with the decade of the Sixties, multi-image presentation began to descend from the exotic heights of it's origins and come down to the somewhat more pedestrian levels of trade conventions, sales meetings, and occasionally, even classroom instruction. And this descent carried with it a nightmare of new complexity for the boys in the back of the room – our ever-faithful projectionists.

Consider, for instance, what happened to the problem of the projectionist when we simply step up from a single-screen slide show to one involving three screens. At first glance the projectionist's problem would appear to be three times more complicated. But keeping in mind that the projectionist deals with cues, not screens, look at what actually happens:

Our projectionist has cues to advance (1) the left-screen projector, (2) the middle-screen projector, (3) the right-screen projector, (4) the left and middle-screen projectors simultaneously, (5) the middle and right-screen projectors, (6) the left and right-screen projectors, and (7) all three projectors simultaneously. So we have actually multiplied the complexity of the projectionist's job by a factor of seven. At any given cue point in the script, there is one correct choice . . . and six wrong ones!

Multi-image presentations frequently involve more than just multi-screen slide presentation, however. They often involve other media, motion pictures, video, special lighting effects and the like, all in addition to slides. To further aggravate these complications, something profound happened to slide presentation with the introduction, in the late Sixties, of multi-speed dissolve controls. Instead of having only one button to press to control slide advances on each screen, the projectionist suddenly found that he had four or five to press to control slide advances ... on EACH screen! There was more than just one way to move to the next slide.

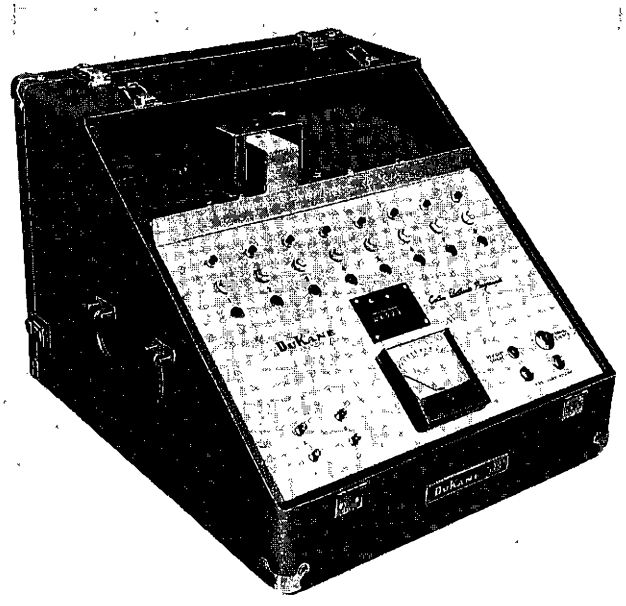
Clearly an altogether new need had surfaced, one that went well beyond the capabilities of a simple synchronizer. The projectionist found himself in desperate need of something to automate – or at least to semi-automate – these multi-image presentations.

Multi-image producers shared the same concern. Performed manually with a team of projectionists, early multi-image presentations required such large crews and demanded such long rehearsal times that they were prohibitively expensive for all but those few blessed with nearly unlimited budgets. Even thus blessed, there was scant assurance of a perfect performance resulting from a manually controlled multi-image production. Projectionists are human, and humans are all vulnerable to doing monumentally dumb things when subjected to the inevitable pressure of "showtime jitters." And when a producer's audio-visual presentation – multi-image or otherwise – fails to reach the screen successfully, it is utterly worthless. It simply does not matter how well it was conceived, how good it was "in the can."

The Programmer

What was needed, urgently, was some kind of audio-visual programmer. A programmer is defined as a device designed to automate two or more things, and the whole projection problem of the multi-image production was that it always involved at least two – and generally far more than two – "things."

Not surprisingly, the earliest approach to the development of an A-V programmer was to take the concept of the synchronizer a step further. The idea was to develop devices that could recognize and distinguish between pulses of different frequencies. This required the development of tone-type pulse systems which necessarily had to respond to far more discrete types of signals than any device functioning as a synchronizer. It really did not matter if a so-called 1,000 Hz synchronizer, in actuality, would respond to any pulse whose frequency might range from 300 Hz to 2,000 Hz (as some did in fact), and this "sloppiness" might even be viewed as a safety factor in a syncystem involving low quality equipment.



Picture VIII-1

The Custom Electronic Programmer by DuKane Corporation was the first "mass-produced" programmer designed specifically for the A-V market.

Picture courtesy: DuKane Corporation

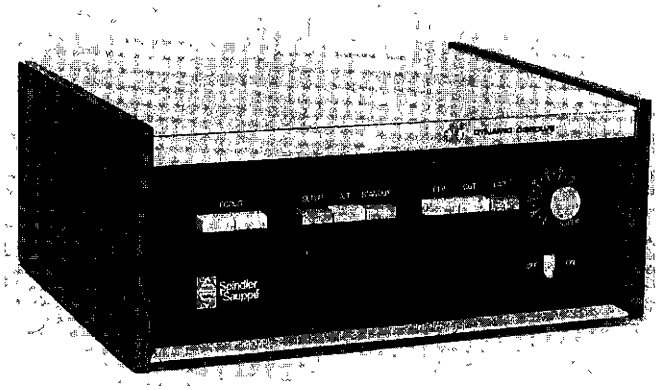
A multiple-frequency tone system would have to put out to a recorder and, subsequently, read back from it far more accurately "tuned" tones. Two developments of the late 1960s made this possible. The design of tape recorders was improved to eliminate any significant change in tape running speed when a change in the line power voltage was encountered. (Previously, when line voltage dropped, tape running speed slowed, and the frequency of the pulses would shift downward causing miscues.)

Rapid-fire developments in solid state electronics also made a major contribution to the reliability of tone-type programmers. In early, discrete component programmers of this type, changes of conditions in the environment (such as temperature or humidity) would affect individual components differently, causing unpredictable shifts in the original frequency settings. This meant that a unit had to be constantly "retuned" to perform consistently.

Contemporary tone-type magnetic programmers utilize integrated circuits which are affected equally by environmental conditions and avoid such shifts in frequency. Such programmers now boast an extremely high degree of stability and reliability.

While some A-V innovators were refining the concept of the synchronizer to serve the new requirements for a multi-tone controller, others explored the possibility of an altogether new type of pulse to be used for programming, the digital pulse. The digital pulse side-stepped the whole problem of tape-speed shift because it did not rely on a well-defined frequency to function properly. Frequency shifts which resulted from the normal aging of discrete components also created no problems for the digital pulse system.

The net result of these parallel efforts to create what might be called a "multi-channel synchronizer" was two types of magnetic tape programmers, both functioning essentially the same way, and both eventually achieving the same successful result. The sole significant difference between the tone-pulse and the digital-pulse programmer was the nature of the pulse itself, and, since they both arrived at a high degree of reliability, this was a rather academic distinction.



Picture VIII-2

The Dynamic Dissolve Control by Spindler & Sauppe was the first multi-speed dissolve control. It has five programmable functions.

Picture courtesy: Spindler & Sauppe

The Magnetic Tape Programmer

The magnetic tape programmer was (and is) the most straightforward, easy-to-use automating device available for multi-image productions. It looks and functions like a pushbutton remote control. Using it to program a presentation involves nothing more than literally running your presentation as

though the programmer was a remote control. The difference is that as you run your presentation manually using the programmer, you are simultaneously generating and putting out pulses to the tape recorder which will subsequently run the production automatically exactly as you just ran it manually.

If a mistake is made in programming, it is a simple matter to erase it and make a correction. Reprogramming may be done to improve one cue or an entire section of a presentation. Once perfected, the programmed presentation should run perfectly every time thereafter. Happily, programmers are not subject to "showtime jitters."

Magnetic tape programmers in their simplest form do suffer, however, from two sometimes significant limitations: (1) They must be programmed in "real time"; and (2) they do not lend themselves easily to incorporating "live" presentations.

The expression "real time" means nothing more complicated in this instance than that you must be able to run your show manually at least once, to use such a device because the programming phase itself requires a manual runthrough of the show. If your show demands, for instance, that at one point twelve different things (or combination of things) are to happen within a period of five seconds, you will have only five seconds of elapsed time to select and press the correct sequence of twelve buttons (or twelve combinations of buttons) in programming this section. In other words, programming must be done at show speed.

Because the tape recorder is an integral component of the magnetic tape programming system, the magnetic tape programmer is restricted to pre-recorded or "canned" multi-image productions. (There are exceptions to this generalization, and some mag-tape programming systems allow fairly easy integration of "live," remote single-image presentation with "canned" multi-image presentation, but this restriction applies to all mag-tape systems which represent an extension of the synchronizer approach to automation.)

Nevertheless, if a multi-image production is simple enough to allow one to run through it manually – although there will be no problems with false starts and subsequent corrections and it is, in fact, a "canned" presentation – no solution to the problem of multi-image automation serves more neatly, nor more simply, than the magnetic tape programmer, be it a tone-pulse or digital-pulse device.

Yet, what about those two limitations?

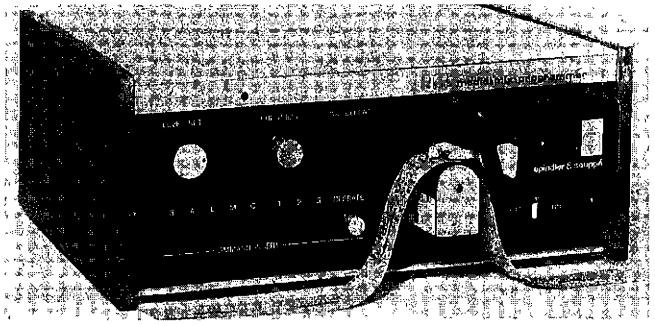
What if your presentation involves things that actually are too fast or too complicated to program in "real time"? Or what if it actually is to be a "live" presentation or (as is more often the case) "live" and "canned" presentation integrated together?

If the information we "store" on the pulsetrack of a mag-tape programming system is reduced to its essential components, it comes down to three catagories: (1) the sequence of events (what happens first, what happens next, etc.); (2) what those events are (a medium speed slide dissolve on the middle screen, a cut dissolve on the outside screens, a medium dissolve on all three screens as a motion picture comes on to the center screen, etc.); and (3) the time interval between these events (how long it is after cue No. 5 begins that cue No. 6 begins). In mag-tape programming the pulse themselves dictate the sequence of events and what those events are, and the space on the tape between these pulses establishes the time interval between these events.

The Punched Tape Programmer

The first A-V programming system to break up these categories of stored information (and, therefore, overcoming the two limitations of the mag-tape programmers), was the punched paper tape programmer. In a punched tape system, codes on the punched tape store only the first two categories of information, the sequence of events and what these events are. The punched tape does not determine the time interval between these events.

That is the function of either syncpulses recorded on the soundtrack tape (in a "canned" presentation) or the next time the projectionist (or narrator) presses a single-button remote control (in a "live" presentation). In this instance, however, the syncpulse or remote control is not operating projectors directly. Rather, it is operating the programmer which, in turn, is controlling the projectors, lights, and special effects.



Picture VIII-3

The Media Mix Programmer, by Spindler & Sauppe, was the first punched tape programmer to introduce a system of programming logic.

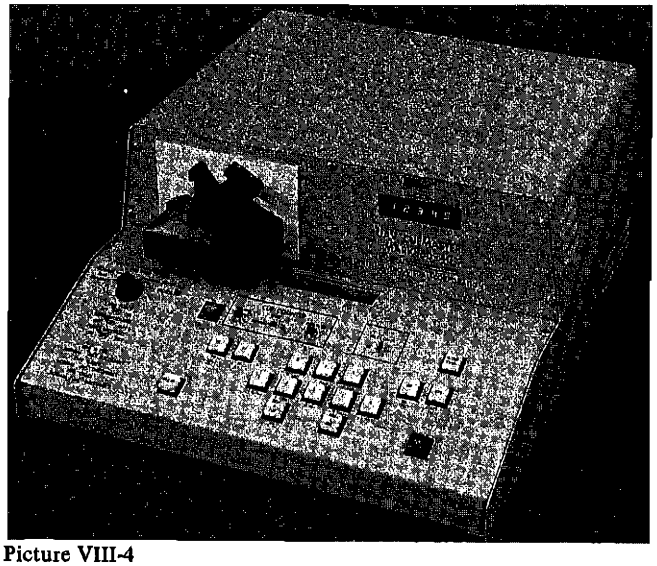
Picture courtesy: Spindler & Sauppe

This meant that punched tape programmers could automate presentations that were literally too complicated to program in "real time." A producer could punch his code holes into the paper tape for cue No. 35 and then take as much time as necessary to punch the exact combination of code holes for "things" that he wished to have happen during cue No. 36, even though cue No. 36 might follow cue No. 35 by only three seconds in the finished production.

It is true that once the punched tape is prepared, the final step of recording a synctrack is a "real time" job. But at this point all the complex decision making has been recorded on the punched tape, and recording a synctrack for a programmer is no more complicated than preparing one for a single projector sound-slide presentation. Just one button to press; just big red dots on the script to indicate when to press it.

The origins of the punched tape programmer are as cloudy as the origins of multi-image presentation itself. The very earliest units were all one-of-a-kind devices designed and built to meet the specific requirements of a particular production. A show was conceived first, and then the hardware was designed to control it.

It was not until the mid-1960s that the first programmer specifically designed for the audio-visual market was actually put into (somewhat limited) production. These early production programmers all utilized a straighforward coding system. Each hole position across the program tape represented one device which might be automated, and each time that hole was punched the corresponding projector would operate, regardless of whether or not other adjacent holes were also punched.



Picture VIII-4

The Cuemaster 60-40, by United Audio Visual Corporation, was the first electronic keyboard punched tape programmer.

Picture courtesy: United Audio Visual Corporation

Thus if the programmer accommodated eight-hole computer tape, it was an eight-"channel" device (meaning that it could automate eight projectors); if it used 22-hole tape, it was a 22-channel device. The number of programming hole positions across the width of the paper programming tape determined the number of channels the programmer made available. And the only way to increase the number of these channels was to increase the width of the tape.

But in the mid-Sixties even the eight channels available from standard computer tapeprogrammers were more than adequate for most multi-image presentations. After all, a show involving eight slide projectors on eight screens, or even a show involving both slides and movies on four screens, was a pretty elaborate production even by today's standards.

The event which abruptly created a need for far greater channel capacity in punched tape programmers was not actually a trend toward bigger and bigger shows involving more and more projectors. Rather, it was the appearance in 1969 of the multi-speed dissolve control. These devices gobbled up programming channels in a way that no other audio-visual device had before or, for that matter, has since.

The very first multi-speed dissolve control featured five programmable functions, consisting of three different dissolve rates plus two special dissolve effects. Each of these five functions required its own programming channel to automate it. Consequently, when this control was used in a multi-image production, five channels were needed just for changing slides on one screen. Obviously, eight-hole computer tape was hardly up to this new requirement. It could not even completely automate a two-screen multi-speed dissolve production with its eight channels.

Stepping up to wide tape formats, unfortunately, introduced new problems. As the tapes got wider, the programmers and tape punches got larger and more costly. The large format tapes were also far more difficult to proof. A new system for coding the program tapes became essential. This led to the development in 1970 of the first A-V programmer to incorporate a system of "programming logic."

As is true of much of our multi-image vocabulary, the term "logic" is one that was borrowed from the computer field. And in a sense, this new generation of programmers employed a primitive form of computer logic. As used within the multi-image community, however, the term "logic" does not actually mean anything very exotic.

In a coding system involving "programming

logic" hole combinations are used to create additional channels. It was pointed out earlier that the control of just three projectors involves a total of seven possible cues. By the same token, with three-hole tape there are seven possible code combinations that might be punched: (1) the No. 1 hole alone; (2) the No. 2 hole; (3) the No. 3 hole; (4) the No. 1 and No. 2 holes together; (5) the No. 2 and No. 3; (6) the No. 1 and No. 3 holes; and (7) all three holes together. (It is even possible to let the absence of any punched holes become an eighth code.) It is apparent from this that with eight-hole computer tape there are hundreds of possible hole combinations. But that suggests a problem: How can anyone learn all these possible combinations?

That is where the second half of what is meant by the term "logic" comes into play. Rather than making a random use of these hole combinations (which would result in a need to memorize them all), these combinations are organized in some orderly way so that by just learning a few of them you can figure out for yourself all the other possible combinations which you might ever require. In other words, by learning a small minority of them, you can logically work out all the rest.

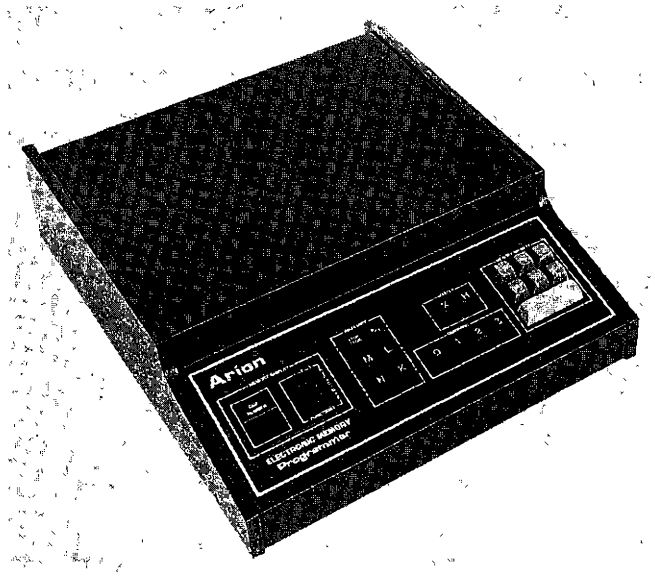
One simple example should serve to illustrate how "logic programming" works and how it achieved an enormous economy over the previously available "non-logic" programmers: The original multi-speed dissolve control had five programmable functions which means that to use it on three screens would require a programmer using 15-hole tape in a "non-logic system" (a hole for each function on each screen). The first programmer to use "logic programming" handled this same setup with standard eight-hole computer tape. It let five of the programming hole positions represent the five dissolve functions and the remaining three represent the three pairs of projectors. Thus, if you wished to program a medium dissolve on the outside screens, it was only necessary to punch the hole which represented medium dissolve plus the two holes representing the projectors for the outside screens.

The introduction of "logic programming" systems also carried with it the innovation of introducing timing codes which could be used to stagger a whole series of events to happen within a single cue. For instance, timing codes might be used to space out the steps of a three-screen slide change so that, rather than happening simultaneously, the changes would occur automatically at precisely one-quarter-second intervals. Timing codes also made it possible to create ultra-high speed effects that could not be programmed any other way, such as flashing lights effects that exceed anyone's ability to press buttons.

Much of the subsequent development in punched tape programmers during the first half of the Seventies concerned itself with increasing the speed and ease of the programming step itself. From the original, totally manual pin-type punches that were used with the first punched tape system, mechanical keyboard punches were made available, as were electric keyboard punches and duplicators which relieved the producer from being required to know all the intricacies of the programming logic employed.

Electronic Memory Banks

By the mid-Seventies, innovations in A-V programmers were coming on the market fast and furiously. Perhaps the most significant was the use of electronic memory banks to "store" programming information in much the same way that punched tape is used to store information. Again, the chief advantage of microelectronic memory banks as an alternative to punched tape is the ease with which information stored in the memory can be corrected and changed. With punched tape systems, deletions must be spliced out of the tape and corrections must be patched over and repunched. Changes in memory bank systems may be made by the pressing of buttons.



Picture VIII-5

The Command Performer System, by Arion Corporation, was the first to store programming data in electronic memory banks.

Picture courtesy: Arion Corporation

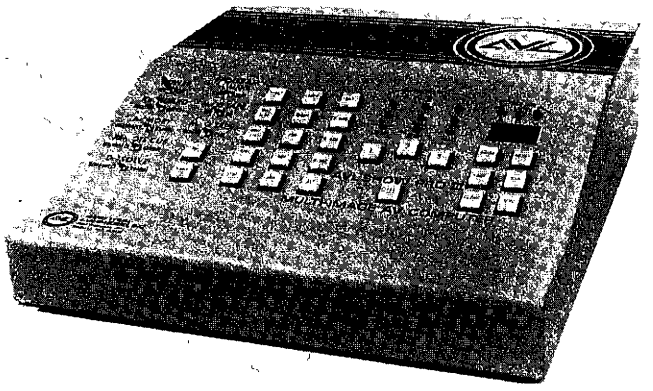
Although an entire show may be presented with the programming being fed directly from the programming device's own memory banks, a loss of power, either during the programming process or during playback from memory, immediately induces a case of electronic amnesia. Consequently, memory banks are not viable as a medium for the permanent storage of programming information. Such programming data must be converted to digital pulses and transferred on "dumped" (that is, recorded) onto audio tape to preserve it between showings. At present there are two approaches to "dumping" memory bank programming for storage. One is to record the digital data cues directly onto the soundtrack at the appropriate cue-points. In playback the programmer reads the cues in much the same way as a conventional mag-tape programmer does in far simpler systems.

The limitation in such a system is that it requires a relatively high level of quality in both the tape recorder and the recording tape to successfully record complex high-rate digital pulses reliably. Even with relatively high quality equipment and tape, each digital pulse must be repeated several times to assure the kind of redundancy that provides an adequate safety margin.

The alternate system dumps its memory information in a cluster onto a high quality, computer data tape which is an integral part of the programmer. This data tape is unrelated to the soundtrack tape, and its sole function is storage. It is subsequently used to re-enter the programming back into memory at a high speed for use during presentations. In this system, simple tone sync-pulses are placed onto the soundtrack tape to trigger the digital cues from the memory banks.

Still another system uses a memory that is kept alive by battery when the system is switched off. Infrared light-erasable memories and "bubble" memories are now available but so far have not been used to store cues in an audio-visual programmer.

Perhaps the most promising of all the new innovations to arise during the mid-1970s, however, was the wedding of a microprocessor to an electronic memory bank programming system. The full implications of this combination are now coming to be fully realized, but some are already conspicuous. The dramatic feature, without doubt, is the ability of a multi-image system to track the slide projectors automatically to any cue-point, or to automatically "home" to cue No. 1 at the press of a button. Multi-image control systems which can back up as well as advance on demand open up a whole new frontier of flexibility in this previously rock-rigid medium.



Picture VIII-6

The Show Pro III Multi-Image System, by Audio-Visual Laboratories, was the first A-V programmer to incorporate a microprocessor.

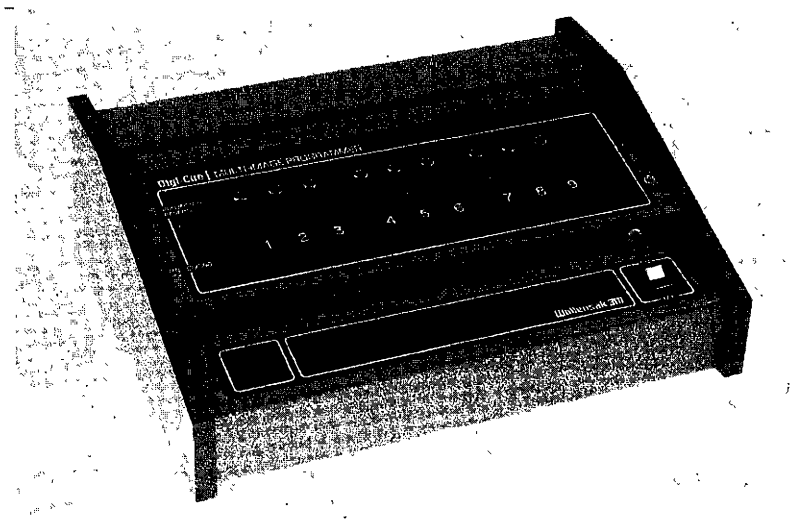
Picture courtesy: Audio-Visual Laboratories

Choosing What You Need

It is worth observing, in retrospect, that the entire development of the commercially available audio-visual programmer has occurred in something only slightly more than a decade. It has been less of an evolution than an explosion. It would be foolhardy to try to predict at this juncture just where it is ultimately headed, beyond, perhaps, suggesting that it is headed there very fast indeed. Yet, in this rapid-fire world of multi-imagery there is one consolation amid the confusion of hardware. To the question, "What is my first consideration in selecting a programmer?", there remains only one wise response: "Your show." If it is simple enough to use a mag-tape programmer, a mag-tape programmer is almost certainly your best choice. If it is a "live" multi-image presentation, a punched tape programmer may be the best for you. If it is but one of an on-going, highly complex series of productions, a computer based programmer may be the only choice. Although the difference between a show and no show at all has sometimes been a matter of the hardware, rarely if ever has the difference between a great show and a so-so show been a matter of the hardware.

When a great multi-image production comes to the screen, it reflects the creative juices of its producer in saying something honestly, judiciously, and aesthetically. He made the difference. All the programming system did was get it onto the screen for him.

Happily, most programmers today can at least do that!



Picture VIII-7
The Wollensak Digi-Cue is offered in two models—the Pro 6Q and Pro 9Q for 6 or 9 channel operation. Both programming and playback functions are performed in the single console. It enables the processing of massive quantities of information with high reliability.
Picture Courtesy: Wollensak 3M

CHAPTER IX
THE PHYSICAL ENVIRONMENT

Carl Beckman

One of the most overlooked aspects of multi-image production and playback is the physical environment in which these two activities take place. Without careful preplanning of the environment, production can be needlessly time consuming and the effect of the finished product diminished. If you are trying to produce programs within budget constraints or are in the business of making money by producing multi-image presentations, then production time becomes a critical economic factor.

It is easy to see why the physical environment is often overlooked; the two most exciting aspects of working with multi-image are production and playback. Most of a producer's energies are dedicated to scripting, shooting, assembling the slides and the audio segments and programming the final presentation. All of a producer's emotional energies are directed to the excitement of the eventual playback. Concern for the limitations imposed by production facilities frequently becomes an afterthought and in the rush to get the images on the screen critical compromises may be made.

The purpose of this chapter is to examine those physical and organizational aspects which can contribute to an efficient production process and which will help in attaining a quality end product, presented under the best possible circumstances.

This chapter is broken down into two sections, first a discussion of the multi-image production laboratory and then a discussion of the playback facilities. It should be understood that while this chapter does cover several areas of the physical environment it can not be definitive. However, this statement is not meant as a disclaimer. Multi-image is a rapidly growing field. Each day new discoveries are made which contribute to the general fund of knowledge about multi-image.

It is hoped that you will take what is written here, use it as a jumping off point, and expand your awareness of those aspects which are incorporated in the physical environment of multi-image.

The Multi-Image Laboratory

In all probability this section will be the most controversial. Each producer approaches the creative act differently. As a result, no hard and fast rules can be applied in setting up a production facility. This is not to say however that certain commonalities in organizing a workshop cannot be established. Agreement can be reached on several needed areas such as slide storage facilities, as well as facilities for sorting and copying slides, screening the presentations and rooms for audio recording. These five areas are the most germane to multi-image production. Separate facilities for slide duplication and film processing would be nice to have but are not absolutely necessary.

Slide Storage

Providing for proper slide storage and ease of retrieval is probably the weakest aspect of almost any production facility. I feel that I can say that without reservations. Most often slides will be strewn about or packaged into little bundles with rubber bands, and only sometimes are they collected into slide tray boxes. An incredible amount of time is wasted searching again and again through hundreds of slides looking for the right one. Unless you have a memory like a computer or a master librarian, you need to develop a slide storage and retrieval system.

Your first consideration is equipment. The Multiplex and Abodia slide storage cabinets are both excellent but extremely expensive. Depending on the model and storage capacity, each can cost from $450.00 to $800.00. The Multiplex is a functional storage system which features slide-out trays and a lightboard behind the trays. Each tray can hold up to two hundred slides. The Abodia

cabinets look like fine furniture (which they are) and also incorporate a tray storage system with a lightboard. The advantage of these two systems is that they both allow you to look at many slides at once thereby reducing search time. If these two systems are more than you can afford, then consider the system made by Neumade. Each cabinet has a capacity for 5,000 cardboard-mounted slides and consists of five drawers in a very compact steel box. The boxes are stackable and they come in different colors – each costs around $85.00. Each drawer comes equipped with separator tabs for five rows of slides.

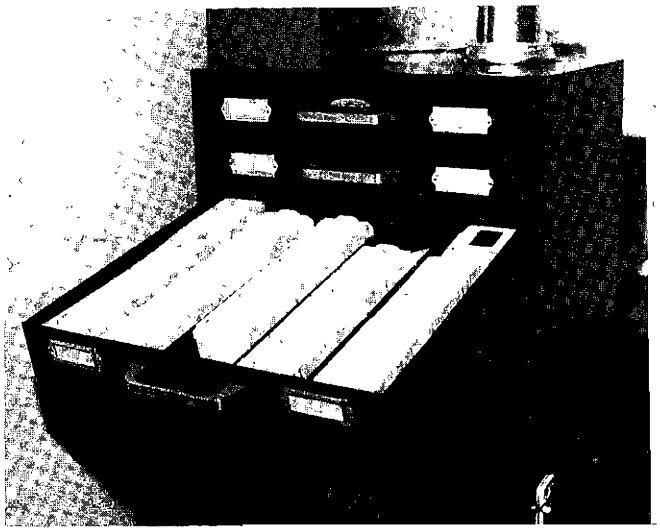
Few people realize the importance of proper slide storage. Dust, extremes of heat or cold, too high or too low humidity are the enemies of slides. When not in use, slides should be stored in a dark area. Light, over a period of time, causes the colors in slides to fade. Movement of dust will scratch the slide surface, causing a loss of resolution or image sharpness. Heat or cold will make slides brittle as will too low a level of humidity. On the other hand, too high a level of humidity can encourage the growth of a fungus which feeds on the emulsion. Many of the slides you might take now may seem to be of little value to you. Yet in the years to come, those same slides may well take on added importance and value. If a picture was worth taking, it is probably worth preserving.

The Neumade slide storage file system seems to offer a compromise between the very expensive Multiplex and Abodia systems and the small very inexpensive Smith Victor slide storage boxes. Although the Smith Victor boxes cost only around $4.00, they should really be used only for short-term production storage. Smith Victor boxes each hold around five hundred slides. I use them to organize all the slides that I shoot for a given production. Once production is complete, all the out-takes (slides not used) are filed and stored in the Neumade cabinet. My Neumade boxes sit on top of my four drawer file cabinet in the corner of my office. Since this office is located in my home which is air-conditioned in the summer and humidified in the winter, my slides are well protected.

Slide Cataloging

When preparing to write this section I talked to media librarians and did some research. The librarians, while trying to be helpful, only succeeded in confusing me with their classification schemes, the organization of knowledge, Anglo-American Cataloging Rules, OCLC, LC, and so forth. Next I turned to the fourth edition of *Standards for Cataloging Non-Print Materials*, published by the Association For Educational Communications and Technology. This book is somewhat less complicated but its system is still too sophisticated for my preference. Thus, I have decided to share with you my own personal cataloging system. It works for me and I trust it will work for many of you with some modifications.

It is important to remember that my system was designed to be compatible with the Neumade five-drawer (SF-5-S) slide file – which holds approximately five thousand cardboard-mounted slides. It is also important to understand that this system is primarily intended for the private use by you, the photographer. If others are to use the system as well, then it becomes necessary to go to a more complicated system.



Picture IX-1
A Neumade five drawer (SF-5-S) slide file.
AMI Collection

Each drawer has five rows for slides. On either side of the pull handle on each drawer (i.e., on the outside) are label tag holders much like those used with file cabinets. Each storage row in each drawer is assigned a number and a letter, L = left side, (the two rows on the left), C = center, (the single row in the middle) and R = right side, (the two rows on the right side). Each drawer itself is given a number, 1 through 5, starting at the top.

All of my slides are separated into one of four basic categories:

1. Vacation – All of those slides which were taken on a vacation trip with no particular purpose other than to record the scenery. In this instance, all of the best slides are put into Kodak carousel trays, each tray is labeled, and the box is labeled. The box with the tray is then stored on a shelf. The

out-takes left over from these vacation trip rejections are then filed in the Neumade cabinet;

2. Multi-Image Production – All of those slides which were shot for a specific production. Here again, the finished production slides are stored in labeled trays and the out-takes are filed in the Neumade cabinets;
3. Stock Slides – These are slides that were shot with the idea that at some time in the future they might be used in a production. These slides pertain to every conceivable subject. Such a category might well seem like a waste of money, but it is not. Stock slides actually do save money. At some point in time, during some upcoming production, you will need a slide of a certain subject. If you have it in stock, you have just saved valuable time and money.
4. Special events – These are slides taken at various folklife festivals, craft shows and other such public gatherings. Actually, since I attend many folklife festivals, I have a special category for this grouping, but I do consider it a subset of special events.

Using these four broad categories I have cataloged my entire collection of slides. Searching for any particular slide begins at the card catalog that I also maintain. I use a small 3"x5" steel card box with 3"x5" plain white cards and 3"x5" separator tabs.

Remember, each card can represent any number of slides which fall under a given category. (Some systems treat each slide as an individual book, which means a separate card for each slide – Such a system would take me years to catalog and is not necessary for my usage.) Note also, that it is equally feasible for some slides to be usable under several categories of cataloging. So, occasionally one slide may appear on several catalog cards – a process of cross referencing.

Cards for each of the four categories in my system look like this:

VACATION
R-1
BUD-H

Budapest, August 1975

Approach to Buda via Danube.
City scenes of Buda and Pest,
*Night scenes of Pest and Fishermen's Bastion in Buda, beggars, monuments, the zoo.

R-L = The right side of drawer #1
BUD-H = Main entry
Main Body = The series statement. This statement should be complete enough to jog one's memory.
* = These slides are deemed of unusual quality or may be extremely unique.

Example No. 1 of Vacation entries

R-3
CARIB

August 1972. An extensive three week trip to:

Guadalupe, Martinique, St. Kitts, Antigua, Dominica, Neva and St. Thomas, in the Caribbean.

Example No. 2 of Vacation entries

MULTI-IMAGE PRODUCTION
L-5
OT-WEL

"Welcome to Our Land,"
National Education Association,
1976, Washington, D.C.

Premier – out-takes from Washington, D.C. city scenes, various people, and important buildings.

OT-WEL – Out-Takes from "Welcome to Our Land."

In the main body appears the title of the show, for whom the show was done, and the year it was completed. Only one card was needed for the out-takes of this particular show since almost the entire show, except for the Washington, D.C. slides, was assembled from stock slides. If more than one card is needed, then it helps to put a "see also" notation at the bottom of the card. (For example – See also R-5.) This cross reference directs me to another row or drawer area, should I run out of room in one particular area for a series of slides.

STOCK SLIDES

C-5
COLO
Rocky Mts., summer and winter

Estes National Park, Georgetown, Golden Central City, Denver, Boulder.

See R-5 COLO

COLO-Colorado

R-5
COLO
*Rocky Mts. A Series

Photos of an old snow-covered barn in Georgetown.

See C-5

Example #2 Stock Slides

SPECIAL EVENTS

L-4
FL
Folklife festival held each year in Washington, D.C. on the Mall.

Pic's include people of all nationalities, folk dancing, eating, singing, also includes American Indians.

Listed by year 70, 71, 72, 73, 74, 75, 76

FL = Folklife

C-4
POL-F
Polish Festival, Baltimore 1974.

Dancing, singing, eating, *Senator Sarbanes speaking (several) – Past Senator Mac Mathias speaking, plus Polish ambassador.

Example #2
Stock Slides

POL-F = Polish festival

With this system you search by drawer position and not by subject, author, or title. Such a system requires intimate prior knowledge of the contents and is useful only to you the photographer, with your special knowledge. If you want to design a system that other people can also use, then I would suggest that you do use the system suggested by the *Standards for Cataloging Non-Print Materials*, published by the Association for Educational Communications and Technology (AECT).

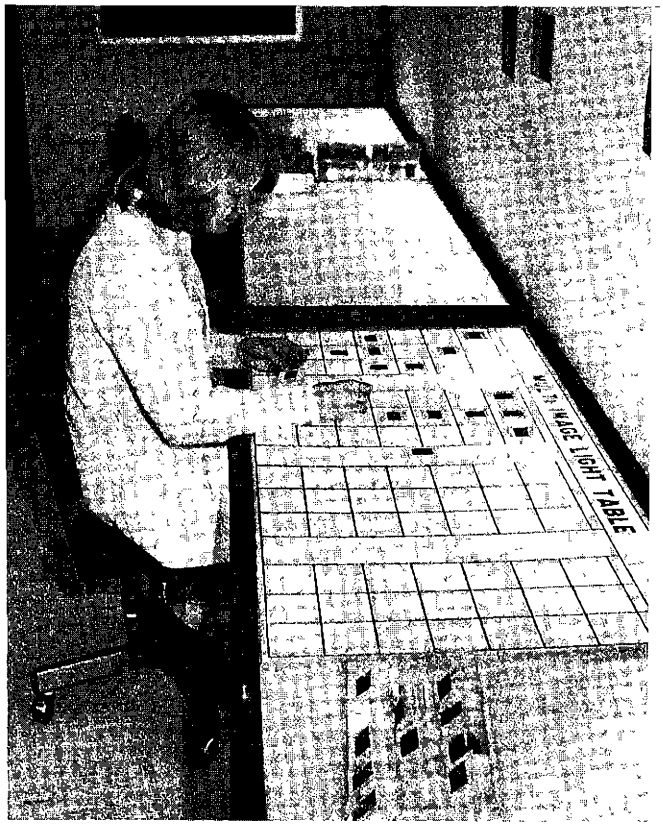
The ultimate value of any system is the speed and ease with which you, the user, can find the slides you need in order to put together a multi-image presentation.

Slide Sorting

Once you have located the slides you need to assemble your show you will need some light tables or sorting boards. This seems to be a weak part of most facilities, even the most up-to-date and professional of facilities. At least forty square feet of illuminated viewing space seems to be a minimum for adequate sorting and assembling. Most facilities have available less than 8 or 10 square feet of illuminated surface.

Leedal Inc. makes a combination storage and sorting board, but it too is expensive. Again let me emphasize that if you can afford it by all means seriously consider the Leedal light tables. They are beautifully designed and well built. Most people make their own from sheets of 2'x4'x1/8" translucent white acrylic plastic sheets. The light source may be one or two double tube 80 watt cool-white fluorescent fixtures. The plastic usually sells for $20.00 and the fixtures run $10.00 to $16.00. The crucial materials for forty square feet would thus cost $180.00. The actual cost, including necessary lumber, and so forth, may well

run substantially more, since obviously these sorting boards require some sort of support structure. (Figure 2).

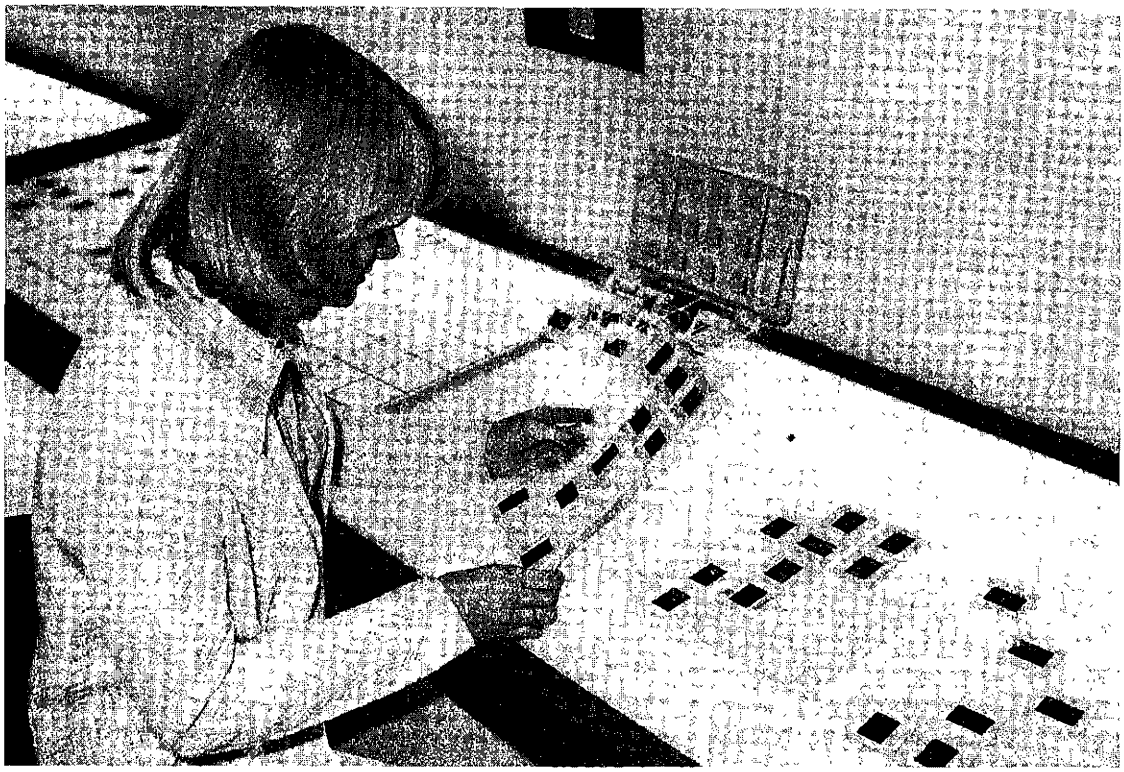


Picture IX-2 AMI Collection
A multi-image light table.

Using these boards would provide the producer with 40 square feet of space. This would in turn provide room for a theoretical maximum of 1440 slides (in actuality perhaps between 1000 and 1200) so that entire shows can be laid at one time. Such a system significantly speeds up the assembly and sorting process and reduces the likelihood of mistakes.

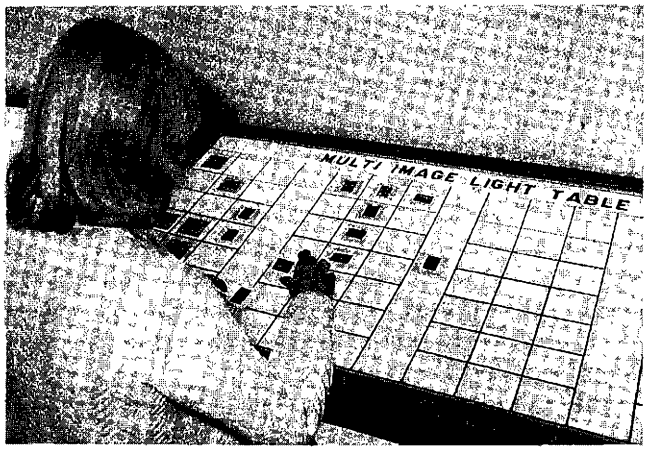
If the slides for any particular show must be removed frequently, in order to free up space for others to work on other shows, then slide pages are the answer. Each page is assigned a number and an entire show can be laid out and taken up in a matter of minutes. This approach allows several producers to assemble their shows using the same facilities with its sorting boards

The acrylic plastic is available from any commercial plastics dealer and the fluorescent lamps may be bought from hardware stores, building supply houses, or even from some drug stores.



Picture IX-3 AMI Collection
Using slide pages.

It is helpful to reserve some of the board space for all the slides that you think you will use in the show, whereas the rest of the board space would be used to actually assemble the show.



Picture IX-4 AMI Collection
Spacing slides on the board.

The opportunity to view large and entire segments of your show as finally visualized, at one time, is the major advantage of using large areas of sorting boards, such as suggested.

Attention to careful location of slide sorting boards is important to improve the efficiency of the entire production process. Thus, the boards should be located near the programming area or near the screening room, if the programming and screening facilities are combined.

Boards should also be located away from heavy foot traffic to avoid having entire assembled segments either bumped or distrubed by the curious passersby.

In-House Slide Production

Slide Production

There will be many occasions when you'll need to borrow slides or duplicate existing slides, or an entire show. (Remember that deliberate repetition of a slide is a frequent "device" used in multi-image programs.) Thus, consideration should be given to the purchase of a quality slide duplicator.

You can always have slides duped by a lab but they will be expensive and frequently take longer than possible. The least expensive commercial duplicates will cost .30 per single slide duplicated and may cost as much as $3.00 per slide. Slide duplicators usually pay for themselves. Before you buy, check out the duplication system. Slide duplicators usually incorporate a camera and a strobe mounted on a stand. The National Audio Visual Association (NAVA) *Equipment Directory* is a good starting point for locating slide duplicators as well as nearly every other piece of equipment you may need from time to time.

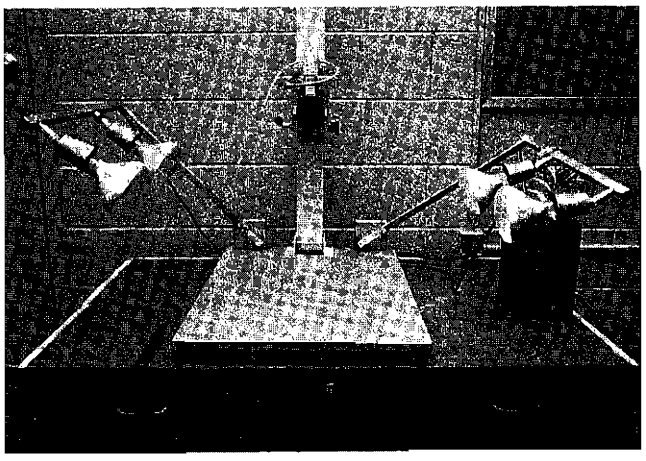
Slide duplicating devices offer several advantages. One can use them to correct for over and under-exposed slides, or one can even color-correct poorly illuminated originals. By using a series of filters you can add or subtract color. With some duplicating arrangements, you can also enlarge, crop, and make double and triple exposures as well as make reductions with more sophisticated equipment.

The slide duplicator that you should buy should be a precision instrument that provides you with expanded creative range and thus can become an important element in any multi-image production facility.

The slide duplicating setup should be located in an area where the room lights can be turned out without interfering with other on-going production procedures. Room lights can affect duplicating exposures enough to throw off precisely made exposure calculations.

Copy Stand Area

The copy stand for making slides from graphic materials need not be in a separate room. It could very well be located in the same room as the graphics lab. About all the facilities that it requires is a good stable and sturdy tablethat is much larger in surface area than the copy stand. This additional surface area can then be used to stack books and magazines from which slides will be made.



Picture IX-5 Photo by Duane Troxel
A copy stand.

Copy stands themselves come in all sizes and prices. Again, it helps to consult your *NAVA Equipment Directory* before buying a copy stand and to ask others what they think of theirs.

Graphics Laboratory

Making graphs, maps, charts, title cards, etc. is going to require some space. The graphics lab should be located in a separate facility. It could house the copy stand and if necessary the slide duplicator. The graphics lab should have plenty of storage space and a sink.

The graphics lab should be equipped with a large drafting table, paper cutter, drymount press, worktables, and storage cabinets. Here again it is best to look at other facilities before setting up your own.

Graphics labs should always seem too large to begin with. For some unknown reason they always fill up and overflow with the passage of time.

Audio Recording

More sophisticated multi-image production facilities will usually also have an audio production room and a rudimentary sound studio. This particular aspect of multi-image production can easily become very expensive.

Even if your budget is very limited or you are planning on redesigning an existing facility, you should make arrangements for at least a primitive voice recording studio. This does not have to be very big – in fact some such "studios" are little more than converted storage closets. A sound deadening rug on the floor, acoustical tile on the walls and ceiling, and a new solid door with a large and thick double-paned window is sufficient to get started. Careful research should be done before tackling the problem of building audio production facilities. Your best bet is to visit other major multi-image production facilities to see how they have done it and to listen to advice. By following their recommendations, you can avoid a lot of pitfalls that menace the beginning producer.

In some cases you will find that the recording studio is located some distance from the audio assembly studio. Production does not suffer from such separation, but combined facilities do make the producer's life easier.

Storage

As productions are completed, the resulting materials need to be stored. Metal storage cabinets are usually the best. Shelving could be built if desired, especially if the appearance of the room is deemed important. In any case, ease of access is important. In most facilities the program tapes are stored in a separate cabinet from which ease of retrieval is most important. Both of these cabinets should be in close proximity and segregated from areas where they could be easily tampered with.

Spare projectors, projector lamps, clean audio tape, microphones, headphones, blank slides, film, cameras and all the rest require space for storage and security. Security is very important since otherwise things begin to disappear. This is indeed unfortunate but remains a sad fact of contempory life. Equipment and materials storage facilities should be located in the most secure area possible.

The Screening Room

Careful attention should be given to the multi-image theater. If people are uncomfortable, the effectiveness of the show will be diminished and the audience's attention will wander.

Planning for a Screening Room

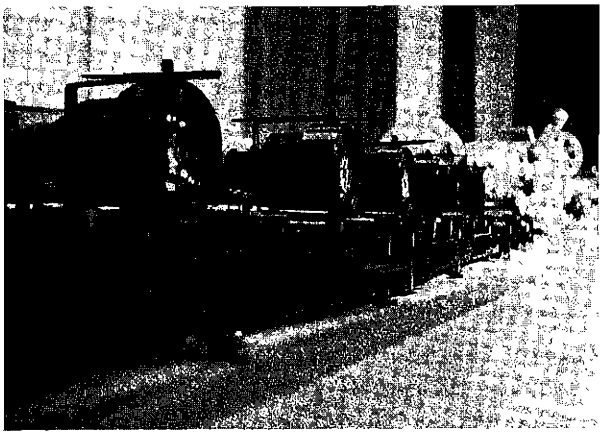
Proper room temperature and humidity are important for the comfort of the individual viewer. Air circulation is equally important. Even if there is proper ventilation, smoking should not be allowed for the comfort of non-smokers. Chair design is important. Chairs should be comfortable and spaced so as to allow unobstructed viewing of the screen.

An Ideal Screening Room

The most comfortable and handsome slide viewing theater I have visited is GTE's Telecommunication Center in Santa Monica, California. This theater features 16 overstuffed, swivel arm chairs on three-tiered levels. The curved screen will accommodate up to five images side by side and looks as though it floats. Each seat is the best seat in the house.

Projection is front screen and colored lights behind the screen are flashed on to the accompaniment of music prior to the start of each show. Wall-to-wall carpeting deadens any echoes and recessed lighting is employed to create a soothing atmosphere. After a few minutes in this room the viewer is relaxed and ready for the show. The sound system plays a quadraphonic sound track and the room's color scheme is dark brown combined with burnt orange which reduces spill light from the screen. The room temperature is carefully controlled and ventilation is more than adequate. The total effect is very pleasant and induces one to be more than ready to listen and see whatever GTE has to say and show its audiences. The end purpose of this room is to market GTE's services to its potential clients. By using such a facility GTE has given itself every possible advantage.

Such a theater represents an ideal. Your facility should be designed so as to incorporate as much as possible of such an ideal.



Picture IX-6 AMI Collection
A bank of front screen projectors.

Screens

Before deciding on the material to be used, you must decide between front screen projection and rear screen projection. If minimizing cost is not a factor in your decision, then choose the rear screen approach.

With rear screen projection all of the equipment is behind the screen and out of sight, and is thus not a distracting factor during the presentation. Rear screen systems work especially well in rooms with low ceilings and flat floors because the projectors do not have to be raised high above the heads of the audience. Nothing is more distracting than having someone's head appear in silhouette on the screen. With rear screen projection, people can be seated much closer to the screen than with front screen projection, which is especially desirable when you want as large a seating capacity as possible.

One very important consideration in setting up a rear screen facility is the use of mirror lenses on the projectors. This eliminates the need to reverse the slides in the trays when one needs to travel with the show and when one must use front projection.

Another consideration is to securely fix the projectors in such a way that they will stay in alignment. It is very bothersome and time consuming to readjust the projectors each time you screen a show. Buhl Optical of Pittsburgh makes a two projector template which does the job nicely.

For both front and rear screen projection, very careful attention should be given to the screen material itself. For front projection, screen reflectance and angle of view are two major elements to consider.

Screens are made of several different fabrics and coatings. A great deal of research should go into the selection of the proper screen. For example, if the seating arrangement requires people to sit far to the sides of the screen then a matt screen is the obvious choice. This screen affords the widest angle of view from optical center. Depending on quality and size, screens can become very expensive. There are many tradeoffs involved in screen purchasing.

Screen reflectance is a very critical factor in image quality. The better the coating, the sharper and brighter the image. Shows can be significantly diminished by poor quality screens. A screen's reflectance factor is measured by how much of the projected light it will reflect back on the audience. Remember that no matter how good the projected image, it can not compensate for a poor screen. It should also be noted that with rear screen projection a lot of light is absorbed while passing through the screen. Here again it is important to consider the type of material used to build the screen. A cheap material will result in heavy light loss and result in diminished image brightness.

The presence of ambient room lights can also diminish the effectiveness of a presentation. Much of the light that reflects off the screen "spills" over onto other objects. If the objects in the room, such as the floor, walls, and ceiling are light in color, they in turn will reflect back a lot of light in the form of "ambient light." This ambient light in turn diminishes the relative brightness of the images on the screen. Ambient light is obviously controlled by selecting screening room colors so as to provide low reflectance. The darker the color, the less reflectance. If you have control over the room's decoration, then you can choose these colors in several combinations such as orange and brown, blue and green, red and orange, and so on.

Sound Reproduction Considerations

The dispersal of sound is also a complicated subject and can only be dealt with in a cursory manner in this section. Some facilities are built with room acoustics in mind, whereas most viewing rooms are set up without any concern for acoustics whatsoever. Most of you will be confronted with the latter. With that in mind, loud speaker size, quality, and placement become the most critical factors.

If your screening room will accommodate more than six people, then ordinary book shelf type speakers won't do. For some installations that will house up to 20 people, the larger home speakers will suffice. For large rooms (more than 20 people) you should only consider auditorium speakers. Speakers designed for auditoriums permit the full range of originally recorded sound to be heard.

Turning the volume up on a small speaker won't help. Overdriving small speakers results in poor sound.

The best approach is to visit some already existing facilities to find out how they dealt with acoustics. In any event, you should do a good deal of research here. The purpose of all this attention is to produce good, clean, clear sound. You will find that as much as 50% of the impact of your show can be attributable to the effectiveness of the sound. If the sound quality is poor, your audience will very soon give up trying to listen. This will result in a very negative attitude toward your show no matter how well written the script or how good the visuals may be.

Some theater installations use as many as five speakers. This requires sophisticated amplification equipment, but the results can be spectacular. A major manufacturer of acoustical equipment that I know has a multi-image theatre in their factory. Five speakers are used and I have never heard sound reproduced that well before or since. The sound quality is so good that it in fact rivets your attention to the action on the screens. It was evident that a lot of thought went into the building of this facility.

Climate Control

Air circulation is an important factor in assuring continued audience attention. If the air circulation is poor, the carbon dioxide level can build up quickly and the audience will become drowsy. Even if air circulation is excellent, it is best not to allow people to smoke. While smokers themselves are desensitized to the effects of smoke, most non-smokers are highly sensitive. If you allow smoking, the non-smokers will not be able to enjoy the show and you may lose much of your audience.

Try to keep temperature and humidity at the optimal levels. Too much variation in either direction will distract from the viewer's attention span. In order for people to be receptive, they need to be comfortable. People cannot wait to get out of an oppressive environment.

Seating

The type of seating selected is also critical to assuring viewer attention span. Seats should be of the type that allow people to relax but not to the extent that attention wanders. Seats should obviously be arranged for unobstructed viewing. While all of this seems perfectly obvious when written down, it is often overlooked in actual practice. A flat floor creates the most problems. If bigger people sit up front, they will obstruct the screen no matter what. Tiered seating or a sloping floor are the best, but it is not always possible to achieve this effect if you have to work within an existing facility or have a limited budget. In any event, on a flat floor alternate the rows – don't ever place one chair directly behind another.

In classroom or instructional settings, fixed seating is not always desirable. Chairs in rows impede discussion and student interaction. It is a given fact that chairs arranged in a semi-circle stimulate interaction. If your shows are designed to provoke follow-up discussion, then serious consideration should be given to movable seating.

Since there is no one ideal seating arrangement, the best alternative is to arrange seating for the primary mode of usage.

Preparing the Audience for Your Presentation

Producers spend endless hours writing scripts, shooting slides, recording music, assembling, and programming their shows. These same producers spend little or no time at all in preparing or setting up their audience.

Any informal experiment will bear out the fact that audiences will gain a great deal more from a presentation if they are prepared for what they are about to see.

Audience preparation is extremely important if what they are to view is cognitive in content and emphasis. Audience preparation for multi-image viewing is somewhat analogous to the warm-up acts preceding the introduction of star entertainers on television. The star is supposed to be met with a sense of excitement and anticipation. Thus one or two short acts usually precede the star's entrance – what the broadcast audience is about to see is a reaction to something special. This same kind of feeling of anticipation can and should be built prior to the screening of a multi-image presentation. Tell your audience something about the show, but not so much as to give away a complete description.

One very common mistake that should be always avoided is the disclaimer. Never, never, never, apologize to the audience for what they are about to see – explain perhaps yes, apologize, never! If you do have to apologize, then you shouldn't be screening the presentation in the first place.

Techniques for preparing the viewers will vary with the audience and the type of show. Older audiences will generally need fuller explanation especially if the show is highly innovative and manipulates moods. First-time audiences need even greater explanation of what they are about to encounter in the technique of multi-image. Multi-image is still so new that many more people can be expected to be first-time viewers than repeaters.

Why Children Respond Well to Multi-Image

If the action is fast paced, most first-timers will find it difficult to follow. Younger first time viewers seem to have a natural bent for multi-image and are generally more accepting.

I have my own theories for this. Today's child grows up in a media-rich environment and is very much attuned to attending to more than one thing at one time. Children study with the stereo on or the TV on. Those of us who are older were taught to do and perceive one thing at a time. On the other hand, our children are not content to view long slow-paced shows. What they want is the fast-paced action that they've been conditioned to expect. Since today's children have grown up watching television, they have become sophisticated "visual experiencers." Most of a child's information is gained through the visual mode.

Children read far less today than they did a generation ago. Although television does employ verbal messages, the emphasis is always on the visual component. Multi-image is also highly visual and thus finds a natural and ready acceptance on the part of children. If the older generation is reluctant to embrace the medium of multi-image with less enthusiasm than their younger counterparts then look to television for an explanation.

For those of us over thirty-five, the world was linear and sequential when we grew up, because the books that we were exposed to were linear and sequential. One word followed another until meaning was established. Today's electronic environment is non-linear, non-sequential. It is largely simultaneous and multiple. We are bombarded by a multiplicity of stimuli from which we must make sense. We live in a world where "the visual is king."

This should be natural because we are able to process greater amounts of visual information then we are of verbal information.

For a while the new wave of non-linear films, plays, and teleplays swept over us with such intensity that a few voices were heard to cry out, "please just one story with a beginning, a middle, and an end." The experimentation in multi-image today is more in the hands of the technicians, the "button pushers," the "light freaks." The "button pushers" are more concerned with the "how to say" than the "what to say." Technique at the expense of content is the primary mode of far too many multi-image practitioners. Yet there are a few who have developed brilliant shows that offer far more via the multi-image medium than any other. These producers focus on content and are very concerned with message and meaning.

Tailor Your Audience Preparation to Program Content

If what you have to say is important and your show has content, then audience preparation is important. Multi-image can teach! If it is to be used for this purpose, you might want to develop a vocabulary list for your audience – the words can be gone over prior to the show. Important points should be brought out and stressed – let them know what to look for.

Should your show have an effective orientation then help establish the mood. Share your feelings with the audience. Give your audience some insight into why you think the show is important or significant. Give them a chance to relate to you on a more personal level.

Multi-image is an incredible, powerful medium for captivating and keeping the attention of both young and old. The show itself can be enhanced if you are willing to take a few minutes to prepare your audience.

After the show, any follow-up discussion might be difficult to initiate. This phenomenon is peculiar to multi-image. No research has yet been done to find out why audiences seem to refuse to express themselves. I suggest that it is due to phenomenon I call information overload. Since multi-image presents its information both in a simultaneous and rapid rate, overload will occur. As a result, the information that has been collected in the memory takes time to be processed. For first-time viewers, it might be best to delay any discussion of the presentation until another day. If this is not possible, then you must work hard to get the discussion going and even then one should not expect it to be substantive. I usually start off by asking for reactions. Once I receive some reply, I ask the responder to be more specific. In some cases I may give my reaction to a particular aspect in order to get them to react.

Follow-up is a good time to find out what about the program worked and what did not. In some cases you, the producer, might have made assumptions that just are not borne out. If this is so, then revision is called for. Probably the biggest failing on the part of producers that I know is their unwillingness to revise a show once it has been completed. Perhaps there is not enough emphasis on the revision aspect of production – there should be. The best shows usually undergo several revisions.

The Road Show

The time comes for all of us when someone writes or calls and invites us to come and bring our show. The producer, of course, is very flattered,

even more so if someone is willing to pay for it. So we accept the invitation with visions of hundreds of applauding people dancing in our heads.

If you are like most of us, the first time you go on the road you go with a bunch of assumptions about the setting. Most probably, when you arrive on the scene, you find that all your assumptions are wrong. For example, the room you are to use has windows and the curtains let the light pass through, and you are scheduled for 6:00 p.m. that evening instead of 10:00 p.m. as originally planned. On further examination you discover the room has chandeliers that hang too low and will have to be tied up because you are using front projection. While trying to figure out where the electrical system is, the hotel manager informs you that the American Lead Pipe Manufacturers Association will be meeting on the other side of the electrical folding wall, and you will have to keep the sound very low and the lights on because the lights for both rooms are on the same circuit. After the manager leaves, the local AV dealer calls to tell you that the three additional ektagraphic slide projectors you had reserved for rental are not available. While desperately trying to locate another AV dealer that is open on Saturday, the conference leader interrupts to inform you that your show has been moved back another hour so that people will have something to see right after an early dinner. As if this isn't enough, the management insists that you move your car from the street in front of the hotel lobby – "you can park behind the building and unload there, but the front must be kept clear."

Upon returning from behind the building, the thought occurs to you that your show was put together for rear screen projection and you will have to turn every single slide around for front projection. Back at the conference room you discover that someone has tipped over tray number four and all the slides are on the floor and your script is in the suitcase that went on to Denver after you arrived in St. Louis. Your stomach is beginning to hurt so you decide to go to your room for Maalox. You arrive at your room – the message light is lit. You call down and find that one message is from your wife. She has finally decided to divorce you – don't bother to call. The other is from your finance company, they are going to re-possess your car – please call!!

Now all of this might seem somewhat of an exaggeration, however, I can assure you that many "roadshowers" have experienced more than one of these disasters.

Before You Go

Before starting out on the road, there are several precautions which can greatly lessen the probability of failure. The first and most important is to find out what the physical facilities will be like. Do not depend on a general description such as, "Well, I think there are three or four electrical outlets." Find out exactly how many, where they are located, and how much load they can power. Find out the exact size of the room and if there is any flat wall space. If the show is to be done during the daytime, make sure the room can be adequately darkened. Find out how many people are expected to watch the show. If the floor is flat, make sure you will be able to get tables for your equipment in order to project well over the heads of your audience. Ceiling height must also be determined because it is important for screen location; I usually carry a 9'x36' rolled paper screen, and then use one half of the 36' length, giving me a 9'x18' viewing area. I will not work on a smaller screen size because image reductions can greatly reduce the impact of the show. It is foolish to compromise one of the key elements of the multi-image medium.

If at all possible, attempt to visit the site prior to the show. This will allow you to make accurate room measurements for projector-to-screen throw distance, and more important, to check out the power circuits. Of course, this is not always possible. In that case, get as accurate a description of the facilities as is possible. Also, determine what equipment will be provided at the site. If your hosts will provide carousel projectors, find out what focal length lenses they have in case you need to provide your own.

Now it is time to inspect your own equipment. Check out your own projectors, if you will be taking them. Have you remembered spare lamps, and adapters? Clean and de-magnetize your recorder and make sure it is trouble free. If any of your cardboard mounted slides are dog-eared, remount them. Incidentally, if you are using 140 trays, think how you might eliminate them. Trays for 140 slides cause nothing but problems; if your projectors are tilted up or down, you will get hangups, and there is nothing worse than a hangup.

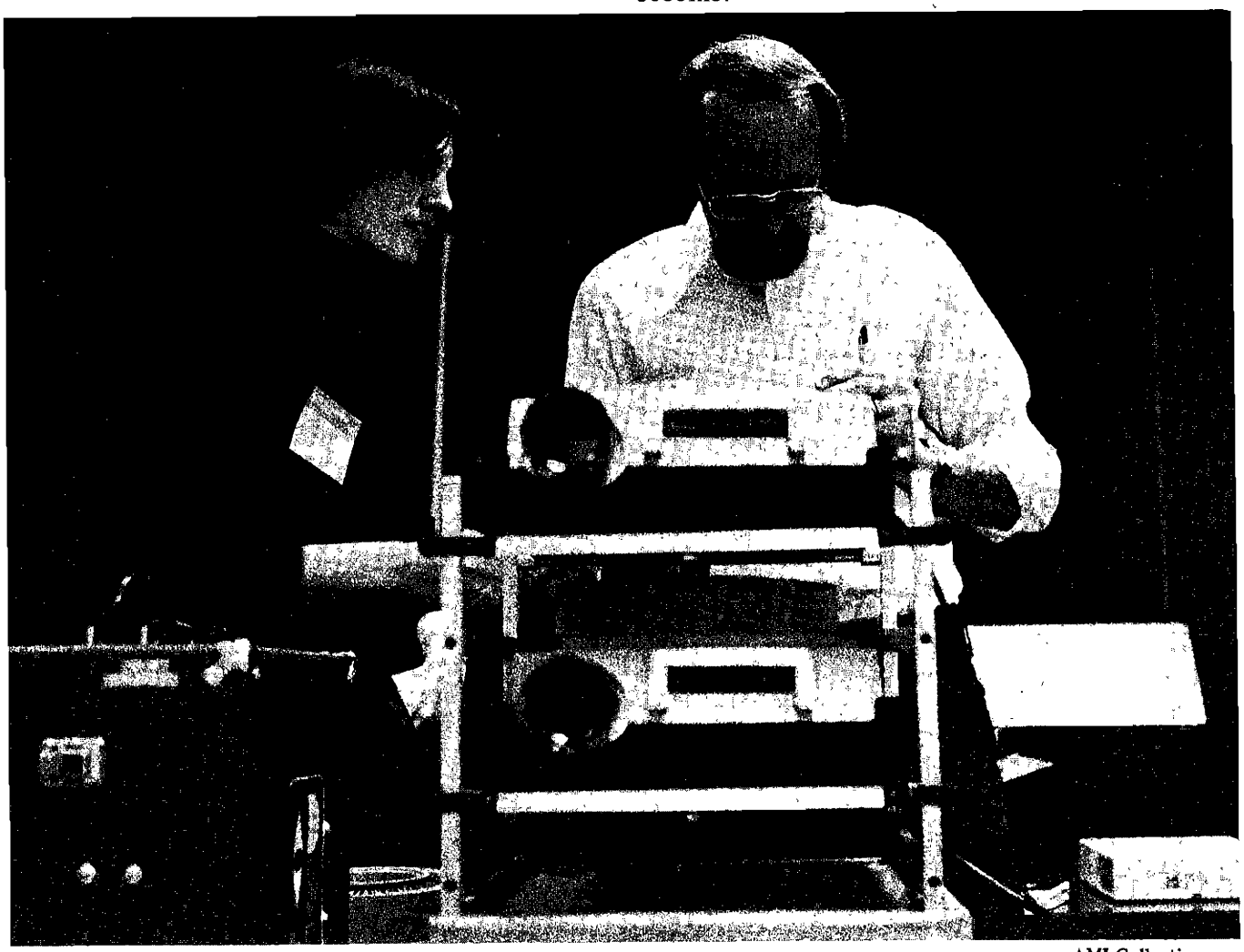
Sit down and make a list of all of the equipment and materials you are going to need. Be sure to remember spare lamps, spare blank slide mounts, masking tape, etc. When you are ready to pack, you can use this list to check everything off – this way you won't forget important items.

Setting Up

Set up time can be critical. Never agree to do a show where you will be allowed less than four hours to set it up. A good rule of thumb is that you have allowed enough set-up time when you're all ready to go an hour before the show. Then you have plenty of time to take care of any contingency. An example of this is what I encountered during a show I did a few years back. I had obtained what I thought was an accurate description of the physical facilities. When I arrived, I found the description accurate, except they forgot to mention the chandeliers. I had to have the hotel maintenance staff tie them up and that took time. But when five hundred people arrived, I was ready.

It Can Happen To You

Sooner or later you are going to experience equipment failure; most probably a lamp will blow during the show and when this happens, it can be "panicsville!" There is no way to avoid lamp failure unless you have a spare $300.00 for each projector for an automatic device that carries six lamps and requires just the flip of a switch to change lamps. The problem, however, is that all of your projectors must be modified to accept the gizmo. Multiply by six and you have just invested $1800.00 so that you can change a lamp in two seconds. Since very few of us have $1800.00 lying around, let's be a little more practical and replace every lamp before a truly important presentation, taking care to pre-burn them for 10 to 15 minutes after installation. If a lamp does blow during the show, your script is invaluable. Turn the tray to the 0 notch and remove it, pull the power plug and replace the lamp. Best use a glove or a handkerchief to handle the hot lamp. Force yourself to work slowly, because if you hurry you are apt to fumble and foul up. When you have replaced the lamp, power cord and tray, cue up to the next slide, and continue. Of course, it is quite likely that people will know you blew a lamp, but they are not going to boo you for it. It is a good idea to try out this emergency "fire drill" at home. You will be amazed at how skilled you can become!



Picture IX-7 AMI Collection
Setting up well in advance of the showing.

CHAPTER X
CRITICIZING THE PRESENTATION

Ken Burke

Communication and Criticism

Multi-image programs serve a variety of communicative purposes. Unfortunately, no schools of theory or criticism underlie the production of multi-image programs. There seems to exist no so-called "philosophical basis" for this form of communication. Perrin, writing in 1969, offered the only theory of multiple imagery to date. He said that simultaneous images on a large screen – or adjacent screens – create a pattern of information comparison and simultaneous visual montage; these visually-rich displays increase information density and seem to facilitate certain types of learning. No further elaborations on theories of multi-image communication have preceded the publication of this volume, nor have there been any critical methods suggested for application to multi-image programs.

One reason for the lack of critical statements may be the misconception of what constitutes a critical act. There are several types of practical critics, as opposed to scholarly critics or popular critics, who make vital decisions regarding multi-image programs. These practical critics include teachers, art directors, agency executives, and clients from various civic and governmental groups. Normally, they would not view themselves as critics; nevertheless, the results of their critical comments are directly applicable to the immediate value of specific multi-image programs. Such critical approval leads to good grades, agency acceptance or increases of salary. Critical rejection lead to the opposite. Thus, although the practical critic may not determine the historical worth of a message, as do scholarly critics, he or she does serve an important, pragmatic purpose in regulating the creation and use of multi-image programs. Except for some student projects, most practical criticism of multi-image programs occurs in a private session between producer and critic. Only after obtaining critical approval is the program shown to its intended audience.

Unfortunately, criticism of this type is totally individualistic and subjective since there exists no accepted system for criticizing multi-image programs. The purpose of this chapter is to offer a uniform system for multi-image criticism. In constructing such a system, it is proper to draw from existing schools of criticism and from existing knowledge about the uses of multi-image programs.

Functional/Experiential Criticism

Even if a particular school of analysis and evaluation is focused on the work of art itself, it is fair to say that the general concerns of practical criticism *and* scholarly criticism are *both* ultimately focused on the functional use that the message has for society or particular segments of society. Thus, it would seem proper to offer an overview of some systems of scholarly criticism in constructing a consistent method of practical criticism. Many of these systems are categorized in Figure X-1. The major schools of qualitative art criticism emerged during different centuries and are not really compatible in their emphases. Even the modern subdivisions that appear in Figure X-1 are firmly grounded in outlooks which cannot be reconciled into one total viewpoint.

Thus, while it is known that the various schools of scholarly criticism all offer some useful insights to the pracitical critic, none of them are ideally suited to the full situation of the multi-image program. The program itself should be examined, as in Objectivism; however, the functional purpose of the program and its potential effects on the audience should also be examined as in Pragmatism. Also, the expressive personality of the producer and the individual perceptions of the critic should appear in the account. It is quite necessary to consider the emotional response of the critic when constructing a system of criticism.

Emotional reactions may strengthen a critic's internal biases or misplace the critic's emphases which would hinder any attempt at objective

FIGURE X-1

Schools of Art Criticism

A. Type of Criticism:		Qualitative		Quantitative	
B. Focus:	nature, content	audience, style	artist, creative process	work of art, elements	linguistic structure	measureable social effects
C. Major School:	Mimesis	Pragmatism	Expressionism	Objectivism	Structuralism	Social Sciences
D. Some Subdivisions:			• Psychological Criticism			
	• Neo-Platonism	• Moral Criticism	• Auteur Criticism	• Instrumentalist Criticism	• Archetypal Criticism	• Sociological Criticism
	• Expressive Symbolism			• Formalist Criticism		• Historical Criticism
				• Semiotics		• Genre Criticism

Adapted from Abrams (1953), Adams (1971), Dickie (1973), Scott (1962), and Tudor (1973).

analysis. A critic must re-examine his or her reactions and be ready to re-evaluate judgments of value. The critic must try to balance feelings against observations. Every critic must be aware of one's responses, so as to minimize preconceptions. Taking all these considerations together, the critic should find her or himself examining: (1) the structure and style of a program, (2) the content of the program, (3) the potential value the program should have for a specific audience, and (4) the critic's own emotional reactions from observing the program.

The functional/experiential method of multi-image criticism is ultimately based on "phenomenology," which amounts to a description of primary interactions. Sender, receiver, message, and environment are the components of the total situation of communication. Interfacing between all these components must be accounted for when a complex channel of communication such as the multi-image program is involved. Functional examinations lead to analyses of the sender's intentions, the structure of the message, and the potential effects on the audience. Experiential observations emphasize the reaction of the perceiver and the influence of the environment. This environmental factor could refer to the creative influences acting on the producer, presentational influences acting on the critic, or the informational needs of the audience. This entire situation of multi-image communication should be examined in the process of practical criticism.

Functions of Communication

If a functional approach is taken to practical criticism of multi-image programs, there must be some clarifications of what functions any communication serves. The basic assumption is that these functions are somehow distinguishable. While any specific message probably uses elements from two or more functions, there is normally only one primary function being served. Thus, an informational program may use some persuasive techniques and some entertaining devices, yet remain essentially an informational experience.

In Figure X-2 the functions of communications are designated as information, instruction, persuasion, entertainment, and enrichment. (This designation derives from several writers on communication, especially Cavert (1974) and Schramm (1971).) Figure X-2 also includes the ideas of several writers concerning message types, functions, and purposes. (These specific message types are suggested by Wiebe (1971), while the message purposes are extrapolated from Carpenter (1973), Kaplan (1966), Lesswell (1971), and Wright (1959).)

One of the main characteristics that separates the various functions of communication is the applicability of quantitative measurement. For example, both instructional and persuasive messages can be measured on how well the specified goals are attained by the audience. Information is different from instruction and persuasion in that informational learning is not designed to be

FIGURE X-2

Types of Messages
as Related to the Functions of Messages

TYPE	ACTIVITY STRESSED	FUNCTION	PURPOSE
	awareness, attention comprehension	INFORMATION	surveillance
DIRECTIVE	acquisition and retention of data and skills	INSTRUCTION	cultural transmission
	yielding, acceptance, commitment	PERSUASION	correlation (politics, economics)
MAINTENANCE	stabilization, routine work and conversation	ENTERTAINMENT	ritual
	rebellion, vicarious sensory stimulation	ENTERTAINMENT	
RESTORATIVE	pleasure		
	expression, rapture, meditation	ENRICHMENT	discovery

Adapted from the writings of Lasswell, Wright, Schramm, Cavert, Carpenter, Kaplan, and Weibe, as cited.

measured against a precise state of previous knowledge and behavior. McGuire (1973) notes that instruction and persuasion can be differentiated further: instruction stresses attention and comprehension while persuasion stresses yielding. As Schramm (1971) notes, entertainment is quite similar to instruction, information, and persuasion in having definite: 1) structural qualities, in that all these messages require encoding, attention-gathering, decoding, and suppression of noise; 2) immediate effects, in that each functional message is used for a specific purpose; and 3) long-term effects. Entertainment messages are valued for their immediate emotional impact on audiences, but these messages also provide some measurable affective results.

The long-term results of entertainment messages can be assessed, but since producers of entertainment seldom implant specific items into their messages which can be tested later, audience reaction can only be validly measured as a kind of general social learning. Such measurement constitutes more of a psychological study than a criticism of a message or an evaluation of its effectiveness.

Enrichment encompasses diverse and subtle ideas which could be called spiritual, ascribing to it a general "metaphysical" quality, rather than offering a specific religious experience. In its full sense, enrichment includes the aesthetic experience, artistic insight, intellectual discovery, meditative tranquility, religious ecstasy, romantic love, platonic love, sensuality, and passion. Enrichment includes experiencing the discoveries associated with the fine arts; entertainment, and on the other hand, encompasses all the ritualized, stimulation-centered activities of the popular arts. A closer examination, such as performed by Kaplan (1966), shows that enrichment emphasizes spontaneity, challenge, intensity, and other similar types of involvement.

An understanding of the differences between each of the five functions will aid the practical critic in evaluating a multi-image program. Programs and messages serving each function will display certain structural and content characteristics that are necessary to that function. Critics must view each program in its functional frame-work when judging whether it has successfully attained its expressed goal. Specific characteristics of each function are detailed in Figure X-3. One can find these by looking up Burke's Ref. (1976).

The statements in Figure X-3 are part of a five-page evaluation form proposed by the writer. In addition to functional evaluations, this form also contains statements on the format, style, techniques, and presentation environment of the program as well as statements on the critic's experiential reactions. Since a detailed description and explanation of this instrument is available elsewhere (Burke, 1976), only the one-page short form of the instrument is presented here in Figure X-4. However, more explanation will be given here about the philosophy behind these proposed critical instruments.

FIGURE X-3

Specific Evaluation Criteria for the Five General Functions of Communication

Information – Characterized by Specified Locales, Persons, Dates, and Activities

Contents are clear.
Repetition is used for clarity.
Perceptual capacity of the viewer is respected.
Potential "noise" is overcome by emphasis and clarity.

Instruction – Characterized by Explicit Learning Objectives

Validity of the contents can be tested.
Unit could integrate with other units of an instructional package.
Unit reflects general goals of the instructional institution.
Content is appropriate to the objectives.
Content is appropriate to the educational level of the intended audience.

Persuasion – Characterized by Arguments and Explicit or Implicit Conclusions

Program indicates that the producer is competent.
Style of the argument puts the audience into a receptive mood.
Organization of the argument is clear, logical, and conclusive.
Argument is appropriate to the audience.
Style is conducive to the conclusions of the argument.

Entertainment – Characterized by Predictable Structure and Conclusions

Program's theme is familiar.
Program's structure and development are predictable.
Conclusions are generally expected.
Ambiguity and challenge are mostly avoided.
Program emphasizes diversion, fun, or change from commonplace "reality."

Enrichment – Characterized by Stimulation of Thought, Contemplation, or Internal Awareness

Program uses ambiguity to maintain interest.
Treatment of the theme seems original.
Message elements or conclusions are somewhat unexpected.
Content is more affective than cognitive.

Evaluation Instruments

One way to focus subjective, practical criticism would be to construct a qualitative evaluation instrument, similar to instruments of scientific measurement. However, the attempt to organize and clarify responses must not lead to scoring critical opinion as if it were empirical testing. Critical opinions cannot be scored for numerical validity in the manner of quantitative measurement. Even though numerical values can be assigned to responses, and response items can be validly related to each other, any total score obtained on a critical instrument would be relative only to the specific critic using the instrument. Personal opinions simply cannot be numerically equated to universal values. However, a *qualitative* critical instrument would be useful and proper in helping to *organize* and *record* a critic's responses.

A proper qualitative critical instrument should guide the critic to take into consideration all the relevant aspects of a multi-image program. Based on the functional and experiential concerns examined in this chapter, relevant questions about multi-image programs would include: 1) what function does the program serve? 2) what evidence justifies this choice of function? 3) how well does the program serve a specific function? 4) what technical and stylistic standards does this program achieve? 5) what are the critic's emotional responses to the work? and 6) what is the perceived value of the program for its audience? A useful qualitative evaluation instrument would require the critic to respond to each of the above points. Figure X-4 is an example of the proposed evaluation instrument, presented in the form of a summary checklist of the above ideas.

FIGURE X-4

Multi-Image Evaluation Instrument, Short Form

Where previewed: Date:

Name of Producer:

Title of Program:

At the beginning of the program what did you perceive to be the function of the program: (circle)

INFORMATION INSTRUCTION PERSUASION ENTERTAINMENT ENRICHMENT

Was that impression confirmed at the end of the program: Yes No

If not, what did the function seem to be at the end of the program:

INFORMATION INSTRUCTION PERSUASION ENTERTAINMENT ENRICHMENT

Respond to the following statements by assigning a value in one of the five appropriate blanks.

strongly agree | not certain | strongly disagree

The program's function was clear over 50% of the time.

The total experience of the program affirms the perceived function.

The program's structure enhances the function.

The style and technique of the program enhance its function.

Technical quality of the visuals (exposure, focus) is excellent.

Technical quality of the sound track (levels, lack of distortion) is excellent.

The presentation environment (light level, visibility, image size, screen positioning, audio volume) is excellent.

Aesthetic quality of visuals (composition, sequencing) is excellent.

Aesthetic quality of the sound (variety, editing) is excellent.

This program held my attention over 50% of the time.

This program aroused feelings in me that seem to support its primary function.

This program has high value for the (presumed) intended audience.

Comments (including suggestions for revision):

Overall rating:

superior above average average below average inferior

REVIEWER:

When using an instrument for criticism, such as the one presented here, the critic should be aware of certain concepts which will clarify the statements on the instrument. Foremost among such considerations is the idea that both the critic and producer have the goal of achieving a successful multi-image program. Thus, there should be a concentration on cooperation and full explication of the program in question. The producer cooperates by specifying all of the presentational data before the preview showing of the program. Function, title, running time, number of image areas (screens or areas on a large screen), number of audio channels, number of slide and movie projectors used, number of dissolve units used, and type of automated programmer used are among the items which the producer should specify to the critic. If the critic knows this information before viewing the program, he should be more aware of how a program's format enhances the total presentation.

How a multi-image program is conceptualized will often determine the final clarity and effectiveness of the message. The number of image areas and orientation of these areas, as well as mechanical considerations such as the arrangement of the loud speakers can all affect the total comprehensibility of a program. This does not imply that multi-image programs are required to have a specified one, two, or three image areas, nor is it necessary to have the loud speakers placed near the screens. Some program content might lend itself to cruciform (or X-shaped) formats; some content might be best delivered to the accompaniment of a quadraphonic sound track flooding the audience's entire aural environment. Similarly, image size can be determined by design considerations. Some ideas would be far better explored if one large image area were used for topic statement and smaller images areas were used for supplementary information. Pacing, sequencing, and overall length must also be appropriate to the program. Pacing should be slow enough to assure comprehension yet fast enough to sustain attention. Length should not exceed the time necessary to present and elaborate the message.

Reinforcement and juxtaposition of images and sounds can be used for such divergent purposes as clarity and irony. The redundancy of image and sound is very effective for attaining clarity, especially when related sound and visual cues are combined in the message. In addition, message elements can be used metaphorically to add further levels of meaning to a presentation. Verbal descriptions of farms accompanied by pictures of farms, farmers, and produce would be an example of audio-visual redundancy. Verbal descriptions of American crop surpluses accompanied by pictures of food and feasting suburbanites, contrasted to images of starving ghetto dwellers would be an example of multi-image juxtaposition used for ironic impact. Similar contrast in audio-visual juxtaposition would result when a soundtrack describes the rigors of a job while the accompanying images show a person loafing. Any of these structural devices may be used to enhance a message, but in any program some devices will be more effective than others. It is, however, worth nothing that little is more tedious than *obvious* redundancy – if the visuals include any text or text passages, having a narrative track that reads this text would constitute a very undesirable example of the reinforcement of sound and visuals.

Technical and aesthetic considerations about a program are often the most troublesome concepts for a practical critic. Those critics who are not producers themselves often do not feel competent to judge the production aspects of a program. An evaluation instrument can provide little help in gaining technical knowledge that a critic does not already possess. Learning about the production techniques will help, but only practice as a producer and judge can sharpen a critic's eyes and ears. Possibly the simplest distinction is that to be made between technically *recording* the images and sounds and aesthetically *arranging* these same images and sounds.

Thus, technical quality of the visual element requires sharp focus and proper lighting of the pictorial subjects. Technical quality of the audio element necessitates the recording and reproduction of the sounds with consistent volume levels with minimal signal distortion and background noises, and avoidance of any machine "clicks" and "hiss."

On the other hand, the aesthetic quality of the visual element depends on obtaining interesting composition and arrangement of the shapes, lines, and colors so as to lead the viewer directly to the content the producer wishes to emphasize. Such design considerations are necessary for both each individual image as well as for the composite arrangement of the multiple images. An aesthetically pleasing arrangement of the soundtrack includes imaginative choice of narrative or singing voices, the use of novelty as well as variety, the skillful editing and juxtaposition of the components and the trenchant use of silence. Sequencing of one sound after another, controlling the transitions between sounds, and assuring a proper balance between background and foreground sounds are all part of an aesthetic evaluation of a sound track.

Even if the soundtrack is simply one pre-recorded commercial musical offering, one can still comment on the aesthetic quality on how well the program producer has succeeded in living with his or her constraints and in making the visuals fit the given sound. In such a choice, the critic is free to minimize his or her comments on the aesthetic merit of the given sound track and concentrate instead on what was done with it. A similar situation occurs when the visuals are given to the producer as an accomplished fact such as when they are copies of commercial photographs or advertisements. Here again, the emphasis should be placed on the producer's technical skill manipulating the giver and in not degrading the quality of the original artwork.

Still another concern is the setting for the presentation. The producer and the person in charge of the presentation must provide: proper sightlines to the screens, images large enough to be seen by the most distant viewers, an ambient light level low enough to assure image clarity (but possibly high enough to allow note taking, where this is required) and a soundtrack loud and distortion-free enough to be heard clearly. Failure with any of these considerations could result in external noise sufficient to block the transmission of the intended message.

It is important to note that the private preview session offered to the critic may not be in the kind of optimum location as will be in the actual presentation. When this constraint is imposed, these environmental considerations must be taken into consideration and ultimate criteria cannot be evaluated adequately in the preview context. Still, the producer must demonstrate that he or she is aware of these presentational requirements and has incorporated them into the design of the program.

A final critical consideration relates to the basic nature of multi-image programs: these programs are composed of restructured time but they are nonetheless presented in actual clock time. Slides freeze actions and environments, allowing space and time to be seemingly re-arranged at will, especially in the multi-image format. Similarly, motion picture film is normally arranged into restructured time through judicious editing; similarly the sound track is also an edited, artificial, and manipulated product. Yet, this reconstructed, or "unreal" multi-image world is presented to the viewers in the real operational time of tape recorders and slide projectors. The critic should be aware of the inherent limitations of a medium where tape playback speeds, rotating slide trays, and advancing punch paper tape restrain even the most sophisticated automated programmer. A virtually miraculous mechanical ballet occurs when presentation technology is respected and used within its natural limitations. Therefore, the critic should not carp about noticeable slide changes, machine noises, and slight projection distortion ("keystoning") as inherent in this and only try to determine whether any discrepancies exceed an expected "norm." These minor inconveniences are going to occur whenever multi-image programs are presented in spaces which were not designed for such technical complexity. Consequently, mechanical distractions should be noted with disfavor only if they are significantly excessive.

A comprehensive evaluation instrument, even one as brief as Figure X-4, should cover functional evaluation, judgments or technical, aesthetic, an presentational qualities, and recognition of the emotional reactions of the critic. These experiential emphases are intended to guide the critic's internal examination of his feelings and reactions. It is hoped that concentration on these aroused feelings will clarify to the critic how his emotions affect his attention span and his evaluative judgments.

A Final Reminder

The scholarly critic determines the historical worth of a message. The scientific evaluator measures the effectiveness of a message. The practical critic makes an immediate personal judgment that affects the eventual use of a message. Practical critics are the necessary arbiters between producers and audiences. Through informed, responsible actions by such critics, audiences will benefit by receiving programs that are understandable, attractive, useful, and highly enjoyable.

Appendix A

Manufacturers of Program Control Devices

Programmers

As discussed in the chapter on Programming the Presentation, the so-called "programmers" are devices for generating and playing back projector (and other device) controlling information. Usually, a device qualifies as a programmer if it is capable of making more than two different sequential events take place. The higher-priced modern programmers can frequently cause dozens of different events to take place.

Programmers generally differ from synchronizers and dissolve units which usually do not include both signal generation and playback capabilities. However, as with most things, there are exceptions.

The list of manufacturers is a partial one since many new firms periodically enter and withdraw from the market. The way to use all of the following listings is to pick out names one finds somehow familiar and make inquiries for product literature. If the literature indicates that further pursuit of the item is in order, many manufacturers are glad to set up some kind of a demonstration or even a hands-on try-out of their equipment.

Arion Corporation
825 Boone Ave. North
Minneapolis, Minnesota 55427
(612) 544 8622

Audio-Sine Inc.
3415 48th Ave. North
Minneapolis, Minnesota 55429
(612) 537 8127

Audio Visual Laboratories Inc.
420 Highway 36
Belford, N. J. 07718
(201) 291 4404

AVTEK
28 Woodard Rd.
Walpole, Massachusetts 02081
(617) 668 6633

Bergen Expo Systems Inc.
1088 Main Avenue
Clifton, N.J. 07011
(201) 472 1154

Clear Light Productions Inc.
P. O. Box 391, 57B Chapel St.
Newton, Massachusetts 02158
(617) 969 3456

Columbia Scientific Industries Inc.
AVC Division
P. O. Box 9908, 11950 Jollyville Road
Austin, Texas 78766
(512) 926 1530

Dukane Corporation
2900 Dukane Dr.
St. Charles, Illinois 60174
(312) 584 2300

EEG Enterprises Inc.
82 Rome St.
Farmingdale, N.Y. 11735
(516) 293 7472

Electrosonic Systems Inc.
4575 W. 77th St.
Minneapolis, Minnesota 55435
(612) 835 5787

Fortune Audio-Visual
35 Bergan Tpke.
Little Ferry, N.J. 07643
(201) 440 2888

Impact Communications Inc.
P. O. Box 28639
Dallas, Texas 75228
(214) 327 9066

Intermedia Systems Corporation
711 Massachusetts Ave.
Cambridge, Massachusetts 02139
(617) 868 9880

The Klitten Company
1221 Ocean Avenue
Santa Monica, California 90401
(213) 395 5342

Mackenzie Laboratories Inc.
P. O. Box 3085, 5507 N. Peck Road
Arcadia, California 91006
(213) 579 0440

Modern Media
Rt. 3, Box 748
Apache Junction, Arizona 85220
(602) 986 0702

Montage Productions Inc.
9 Industrial Drive
Rutherford,N.J. 07070
(201) 935 5060

Motiva Ltd.
18 E. 50th St., 8th Floor
New York, N.Y. 10022
(212) 826 0920

Radmar Inc.
1282 Old Skokie Road
Highland Park, Illinois 60035
(312) 831 9000

Spindler & Sauppe Inc.
13034 Saticoy St.
North Hollywood, California 91605
(213) 764 1800

Technamics Company
2232 Gardner Station
St. Louis, Missouri 63109
(314) 832 9640

United Audio Visual Corp.
1730 Mojave Road
Las Vegas, Nevada 89104
(702) 457 8612

Wollensak /3M Company
Bldg. 223-5E, 3M Center
St. Paul, Minnesota 55101
(612) 733 9627

Synchronizers

A synchronizer may be as simple as the familiar old Kodak black box which translated the slide advance signal from the Carousel's remote control into a recordable sound which it then could retranslate during playback into a slide advance. More sophisticated Synchronizers are based in cassette recorders and provide the synchronizing circuitry internally to the recorder. Several such units have "expanded" to where they now too can control two separate projectors simultaneously and are thus encroaching into the category of programmers.

Electronic Systems Inc.
4575 W. 77th St.
Minneapolis, Minnesota 55435
(612) 835 5787

General Techniques Inc.
1270 Broadway
New York, N.Y. 10001
(212) 524 2557

Impact Communications Inc.
P. O. Box 28639
Dallas, Texas 75228
(214) 327 9066

The Klitten Company
1221 Ocean Avenue
Santa Monica, California 90401
(213) 395 5342

Optisonics HEC Corporation
1802 W. Grant Road
Tucson, Arizona 85705
(602) 792 1040

Philips Audio Video Systems Corporation
16 McKee Drive
Mahwah, N.J. 07430
(201) 529 5900

Radmar Inc.
1282 Old Skokie Road
Highland Park, Illinois 60035
(312) 831 9000

Sight & Sound Systems
5619 St. John Ave.
Kansas City, Missouri 64123
(816) 483 4612

Spindler & Sauppe Inc.
13034 Saticoy St.
North Hollywood, California 91605
(213) 764 1800

Teaching Dynamics Inc.
4441 Main St.
Philadelphia, PA 19127
(215) 482 7660

Pulse Generators

A pulse generator is a one-way device. It can produce either programming or synchronizing signals but cannot detect them during playback. Pulse generators must be used in conjunction with

a compatible playback unit. Their chief advantage is that they allow the producer to work directly with sophisticated reel-to-reel recorders (that do not have any internal pulse generation capability) for the development of master tapes from which later on cassettes may be mass reproduced for use with lower-priced cassette playback units.

American Professional Equipment Co.
2802 S. MacDill Ave.
Tampa, Florida 33609
(813) 839 5374

AVID Corporation
10 Tripps Lane
East Providence, R.I. 02914
(401) 438 5400

Charles Beseler Company
8 Fernwood Road
Florham Park, N.J. 07932
(201) 822 1000

Electronic Systems Inc.
4575 W. 77th St.
Minneapolis, Minnesota 55435
(612) 835 5787

Philips Audio Video Systems Corporation
16 McKee Drive
Mahwah, N.J. 07430
(201) 529 5900

Radmar Inc.
1282 Old Skokie Road
Highland Park, Illinois 60035
(312) 831 9000

Spindler & Sauppe Inc.
13034 Saticoy St.
North Hollywood, California 91605
(213) 764 1800

Tapeheads
4020 Beecher St. NW
Washington, D.C. 20007
(202) 338 6510

Dissolve Controls

The simplest dissolve control has a fixed rate of inversely varying the voltage directed to each of two projector lamps. When the lamp in one projector has been "turned all the way down," then the slide in that projector is advanced. Such dissolve units respond to only one incoming control signal – so as to initiate each half of a repeated back and forth dissolve cycle.

More sophisticated dissolve systems can control more than two projectors, have either several discrete different dissolve rates, or may even offer a continuously variable and even reversible dissolve rates. Many maintain the "off" projector's lamp at a low pre-heated condition to substantially increase lamp life. A few include dissolve signal generation and playback circuitry and consequently again overlap into the programmer category.

Usually, dissolve units are used as the power-handling interface between the programmer as synchronizer and the projectors. Thus although a presentation would be controlled by one programmer, it in turn may regulate many dissolve units – usually half as many as there are projectors.

Note that electronic dissolve units are suitable for controlling only the outputs of filament lamps. When using extremely high-powered arc-lamp illuminated projectors, it is necessary to resort to mechanical dissolve units such as those distributed by Leitz in Europe or available as built in features with some arc-illuminated auditorium projector systems.

Arion Corporation
825 Boone Ave. North
Minneapolis, Minnesota 55427
(612) 544 8622

Audio Visual Laboratories Inc.
420 Highway 36
Belford, N.J. 07718
(201) 291 4404

AVTEK
28 Woodard Road
Walpole, Massachusetts 02081
(617) 472 1154

Bergen Expo Systems Inc.
1088 Main Avenue
Clifton, N.J. 07011
(201) 472 1154

Buhl Optical Co.
1009 Beech Ave.
Pittsburgh, PA 15233
(412) 321 0076

Clear Light Productions Inc.
P. O. Box 391, 57B Chapel St.
Newton, Massachusetts 02158
(617) 969 3456

Columbia Scientific Industries Inc.
AVC Division
P. O. Box 9908, 11950 Jollyville Road
Austin, Texas 78766
(512) 926 1530

EEG Enterprises Inc.
82 Rome St.
Farmingdale, N.Y. 11735
(516) 293 7472

Eastman Kodak Company
343 State St.
Rochester, N.Y. 14650
(716) 724 4689

Electronic Systems Inc.
4575 W. 77th St.
Minneapolis, Minnesota 55435
(612) 835 5787

Impact Communications Inc.
P. O. Box 28639
Dallas, Texas 75228
(214) 327 9066

Montage Productions Inc.
9 Industrial Drive
Rutherford, N.J. 07070
(201) 935 5060

E. Leitz Inc.
Link Drive
Rockleigh, N.J. 07647
(201) 767 1100

Mackenzie Laboratories Inc.
P. O. Box 3085, 5507 N. Peck Road
Arcadia, California 91006
(213) 579 0440

Optisonics HEC Corporation
1802 W. Grant Road
Tucson, Arizona 85705
(602) 792 1040

RMF Products Inc.
P. O. Box 413
Batavia, Illinois 60510
(312) 898 4571

Sight & Sound Systems
5619 St. John Ave.
Kansas City, Missouri 64123
(816) 483 4612

Skirpan Lighting Control Corp.
61-03 32nd Ave.
Woodside, N.Y. 11377
(212) 274 7222

George R. Snell, Associates Inc.
155 U. S. Route 22
E. Springfield, N.J. 07081
(201) 467 2666

Spindler & Sauppe Inc.
13034 Saticoy St.
North Hollywood, California 91605
(213) 764 1800

Technamics Company
2232 Gardner Station
St. Louis, Missouri 63109
(314) 832 9640

Technicraft Division
Jackson Industries Inc.
P. O. Box 9098, 405 Greenlawn Dr.
Columbia, S.C. 29290
(803) 776 7000

Tempo Audivision Inc.
290 Larkin St.
Buffalo, N.Y. 14210
(716) 855 2032

3M Brand Polacoat Products
Visual Products Division
Bldg. 220-10W, 3M Center
St. Paul, Minnesota 55101
(612) 733 7001

United Audio Visual Corp.
1730 Mojave Road
Las Vegas, Nevada 89104
(702) 457 8612

Wollensak /3M Company
Bldg. 223-5E, 3M Center
St. Paul, Minnesota 55101
(612) 733 9627

Appendix B
Manufacturers of Audio Recording and Playback Equipment

Reel-to-Reel Recorders

Even though more and more consumers are switching to use cassette recorders, the reel-to-reel recorder remains the producer's main audio manipulation tool. This is not necessarily because the reel-type recorder offers that much finer fidelity (many cassette decks offer superb audio fidelity) but rather because reel-to-reel recordings may be recorded and re-recorded one track at a time. This is impossible with all but the specially designed synchronizer cassette units. Also, cut and splice editing remains the favorite of many who assemble sound tracks and doing so with cassette tape is outrageously difficult.

Also, more and more big production multi-image presentations rely on stereo or even three-channel sound tracks – this is attainable only with quadraphonic recorders, another feature not available on cassette recorders.

Ampex Corporation
401 Broadway
Redwood, California 84063
(415) 367 4161

Arriflex Company of America
25-20 Brooklyn-Queens Expressway, West
Woodside, N.Y. 11377
(212) 932 2403

Crown International Inc.
1718 Mishawaka Rd.
Elkhart, Indiana 46514
(219) 294 5571

GEL Systems, Inc.
1085 Commonwealth Ave.
Boston, Massachusetts 02215
(617) 783 0460

Otari Corporation
981 Industrial Road
San Carlos, California 94070
(415) 593 1648

Nagra Magnetic Recorders Inc.
1147 N. Vine Street
Hollywood, California 90038
(213) 469 6391

Philips Audio Video Systems Corp.
16 McKee Drive
Mahwah, N.J. 07430
(201) 529 5900

Revox Corporation
155 Michael Dr.
Syosset, N.Y. 11791
(516) 364 1900

SONY
Distributed by Superscope Inc.
8150 Vineland Ave.
Sun Valley, California 91352
(213) 767 9750

Tandberg of America Inc.
Labriola Court
Armonk, N.Y. 10504
(914) 273 9150

TEAC Corp. of America
P. O. Box 114, 155 Murray St.
Rochester, N.Y. 14601
(213) 726 0303

Telex Communications Inc.
9600 Aldrich Ave.
South Minneapolis, Minnesota 55420
(612) 884 4061

Wollensak /3M Company
Bldg. 223-5E, 3M Center
St. Paul, Minnesota 55101
(612) 733 9627

The cassette recorder, or deck, offers the great advantage of compact size, lighter weight, and to some extent lesser vulnerability when pummelled about. Stereo cassette decks – if of a high enough quality to assure adequate channel separation to minimize "cross-talk" between channels – can be used to play back monaural soundtracks with the other channel carrying the program control signals.

However, cassette machines are suitable only for the playback aspect of a production – the assembly of the composite audio and control signal tape is still best done using reel-to-reel equipment. When this product is satisfactorily complete it can then be duplicated onto stereo cassettes for playback "in the field."

Also, battery operated, highly portable cassette recorders are ideal for field recording of sound material for use with documentary style multi-image productions. Many superior quality portable stereo cassette recorders are presently available and offer quality nearly equivalent to that attainable with professional reel-type portables (such as the Nagra or Shellavox) costing three to five times more.

With the advent and expected further developments in the new ¼-inch Elcaset cassette format, much greater use of such cassette units can be expected in the multi-image production.

Akai America Ltd.
2139 E. Dal Amo Blvd.
Compton, California 90220
(213) 537 3880

Audiotronics Corporation
P. O. Box 3997, 7428 Bellaire Avenue, N.
Hollywood, California 91609
(213) 765 2645

Avedex Inc.
7326 N. Niles Center Road
Skokie, Illinois 60076
(312) 679 8210

AVID Corporation
10 Tripps Lane
East Providence, R.I. 02914
(401) 438 5400

Califone International Inc.
5922 Bowcroft St.
Los Angeles, California 90016
(213) 870 9631

Hitachi Sales Corp. of America
401 W. Artesia Blvd.
Compton,CA
Compton, CA 90220
(213) 537 8383

Nakamichi Research (USA) Inc.
220 Westbury Ave.
Carle Place, N.Y. 11514
(516) 333 5440

Newcomb Audio Products Co.
12881 Bradley Ave.
Sylmar, California 91342
(213) 367 1921

Telex Communications Inc.
9600 Aldrich Ave.
South Minneapolis, Minnesota 55420
(612) 884 4061

Panasonic Systems
P.O. Box 3980
Grand Central Station
200 Park Avenue
New York, N.Y. 10017
(212) 973 5700

SONY
8150 Vineland Ave.
Sun Valley, CA 91352
(213) 767 9750

V-M Corporation
P. O. Box 1247
Benton Harbor, Michigan 49022
(616) 925 8841

Wollensak /3M Company
Bldg. 223-5E, 3M Company
St. Paul, Minnesota 55101
(612) 733 9627

Cassette Recorders with Built-in Synchronizers

As mentioned under the discussion of synchronizers, there are many cassette recorders available which already incorporate internal circuitry for synchronizing a slide presentation to a sound track. The internal circuitry is both the greatest virtue as well as drawback to many such devices. It is a virtue since it offers simplicity of operation, it is a disadvantage since most units do not provide electronic access to the control track, thus restricting use to the specific unit in hand. The usual control output of such units consists of an internal switch closure, thus the output consists of a momentarily shorted circuit. This is ideal for advancing slides in a projector.

As indicated, many of these units offer additional control signals, thus it is possible to "program" them to stop automatically at specific points – this is very useful for individualized use of preprogrammed productions. Some recorders also provide two different outputs allowing for the control of either two projectors or four projectors coupled through two dissolve units.

Audio Visual Dynamics Inc.
92 Stuyvesant Avenue
Newark, N.J. 07106
(201) 371 3535

Audio-Visual Specialty Products (AVSP)
6061 W. 3rd St.
Los Angeles, California 90036
(213) 939 1185

Audiotronics Corporation
P. O. Box 3997, 7428 Bellaire Ave. N.
Hollywood, California 91609
(213) 765 2645

AVID Corporation
10 Tripps Lane
East Providence, R.I. 02914
(401) 438 5400

AVTEK
28 Woodard Road
Walpole, Massachusetts 02081
(617) 668 6633

Beacon Camera Division
Whitehouse Products Inc.
360 Furman St.
Brooklyn, N.Y. 11201
(212) 615 3570

Califone International Inc.
5922 Bowcroft St.
Los Angeles, California 90016
(213) 870 9631

Dukane Corporation
1900 Dukane Drive
St. Charles, Illinois 60174
(312) 584 2300

Educational Electronics of California Inc.
213 N. Cedar Avenue
Inglewood, California 90301
(213) 677 8167

Electrosonics Systems Inc.
4575 W. 77th St.
Minneapolis, Minnesota 55435
(612) 835 5787

Montage Productions Inc.
9 Industrial Drive
Rutherford, N.J. 07070
(201) 935 5060

Optisonics HEC Corp.
1802 W. Grant Rd.
Tucson, Arizona 85705
(602) 792 1040

Telex Communications Inc.
9600 Aldrich Ave.
South Minneapolis, Minnesota 55420
(612) 884 4061

Tempo Audivision Inc.
290 Larkin St.
Buffalo, N.Y. 14210
(716) 855 2032

V-M Corporation
P. O. Box 1247
Benton Harbor, Michigan 49022
(616) 925 8841

Wollensak /3M Company
Bldg. 223-5E, 3M Center
St. Paul, Minnesota 55101
(612) 733 9627

Appendix C
Manufacturers of Related Equipment

8mm and 16mm Motion Picture Projection Equipment

Motion picture projectors are the old standbys for instructional use. The biggest recent innovation is the introduction of the super-8 format. If very professionally photographed, these films are occasionally of good enough quality to be interspersed into multi-image productions. However the great discrepancy in screen illumination levels between 8mm and 35mm material makes the 16mm format the better option.

Note that 16mm and 35mm projections do not have the same aspect ratios. Thus, if your use calls for exactly matching the 16mm presentation into your slide format inquire with your distributor regarding possible modifications to the film "gate" so as to obtain the typical 2:3 aspect ratio characteristic of 35mm slides.

It is obviously desirable to look for reliability, but it also helps to consider ease of remote controlling and brightness of projected image when making the selection.

ELMO Mfg. Corp.
32-10 57th St.
Woodside, N.Y. 11377
(212) 626 0150

Eumig (U.S.A.) Inc.
Lake Success Business Park
225 Community Drive
Great Neck, N.Y. 10011
(516) 466 6533

Kalart Victor Corp.
P. O. Box 112, Hultenius St.
Plainville, Connecticut 06062
(203) 747 1773

Singer Educational Systems
3750 Monroe Avenue
Rochester, N.Y. 14603
(716) 586 2020

Viewlex Audio Visual Inc.
1 Broadway Avenue
Holbrook, L.I., N.Y. 11741
(516) 589 6600

Automatic Slide Projectors

By automatic projectors one means those in which an automatized mechanism changes the slides, thus allowing for remote control. The old standby for most U.S. users is the Kodak Carousel. However, it is by no means the only possible projector. There are many quality automatic slide projectors available besides the Kodak, a few cost less, most sell for far higher prices. In addition, there exist several modifications of the Kodak machine, done to increase light output, to change the illumination characteristics, or even to speed up the change rate.

Some alternatives to the Carousel offer a far cooler environment for the slide, some enable the continuous sequential showing of far more slides than possible with the Carousel's 140 slide tray and many offer greater edge-to-edge brightness on the screen.

In addition to alternative projectors, many manufacturers offer accessories for the Carousel, such as special lenses not available from Kodak.

Buhl Optical Company
1009 Beech Avenue
Pittsburgh, PA 15233
(412) 321 0076

Eastman Kodak Company
343 State Street
Rochester, N.Y. 14650
(716) 724 4689

Fortune Audio-Visual
35 Bergen Turnpike
Little Ferry, N.J. 07643
(201) 440 2888

GAF Corporation
A-V Products Division
140 W. 51st St.
New York, N.Y. 10020
(212) 582 7600

GAVI-GEN Audio-Visual Inc.
306 Hempstead Ave.
Malverne, N.Y. 11565
(516) 887 2825

Optical Radiation Corp.
6352 N. Irwindale Ave.
Azuza, California 91702
(213) 969 3344

Spindler & Sauppe Inc.
13034 Saticoy St.
North Hollywood, California 91605
(213) 764 1800

Tempo Audivision Inc.
290 Larkin St.
Buffalo, N.Y. 14210
(716) 855 2032

Sound Slide Projectors

Standard Projector & Equipment Co. Inc.
3070 Lake Terrace
Glenview, Illinois 60025
(312) 729 4200

Teaching Dynamics Inc.
4441 Main St.
Philadelphia, PA 19127
(215) 482 7660

3M Company
Visual Products Division
Bldg. 220-10W, 3M Center
St. Paul, Minnesota 55101
(612) 733 7001

Emde Products Inc.
2040 Stoner Avenue
West Los Angeles, California 90025
(213) 272 7394

Heindl Masks 'N' Mounts
200 St. Paul Street
Rochester, N.Y. 14604
(716) 454 5080

Eastman Kodak Company
343 State St.
Rochester, N.Y. 14650
(716) 724 4689

Visual Horizons
208 Westfall Road
Rochester, N.Y. 14620
(716) 442 3600

Wess Plastic
59 Schmitt Blvd.
Farmingdale, N.Y. 11735

Slide Mounts and Masks

Slide Making and Duplicating Services

E. Leitz Inc.
Link Drive
Rockleigh, N.J. 07647
(201) 767 1100

Oxberry Division
Richmark Camerica Service Inc.
517 Timpson Place
Bronx, N.Y. 10455
(212) 585 0730

Slidemagic System
2040 State Highway 35
Wall, N.J. 07719
(201) 449 3826

Stokes Slide Services
7000 Cameron Road
Austin, Texas 78752
(512) 458 2201

Talijon Inc.
P. O. Box 315
Woodmere, N.Y. 11598
(516) 569 6884

Slide Handling Equipment

Cabinets

Elden Enterprises Inc.
P. O. Box 3201
Charleston, W.V. 25332
(304) 344 2335

Leedal Inc.
2929 S. Halsted
Chicago, Illinois 60608
(312) 842 6588

Luxor Corporation
P. O. Box 830
104 Lake View Ave.
Waukegan, Illinois 60085
(312) 244 1800

Multiplex Display Fixture Company
1555 Larkin Williams Road
Fenton, Missouri 63026
(314) 343 5700

Neumade Products Corp.
P. O. Box 568
720 White Plains Road
Scarsdale, N.Y. 10583
(914) 725 4900

Light Tables

Leedal Inc.
2929 S. Halsted
Chicago, Illinois 60608
(312) 842 6588

Folders

Plastic Products Inc.
P. O. Box 1118
1822 E. Franklin St.
Richmond, Virginia 23208
(804) 644 2355

Plastic Sealing Corporation
1507 N. Gardner St.
Hollywood, California 90046
(213) 876 0062

Binders

Seary Manufacturing Corp.
19 Nebraska Avenue
Endicott, N.Y. 13760
(607) 748 7478

Wess Plastic
50 Schmitt Blvd.
Farmingdale, N.Y. 11735
(516) 293 8994

Projection Lenses

Buhl Optical Company
1009 Beech Avenue
Pittsburgh, PA 15233
(412) 321 0076

Projection Screens

Audio Visual Promotion Aids, Inc.
Room 815, 466 Lexington Ave.
New York, N.Y. 10017
(212) 679 4080

The George F. Cram Company Inc.
P. O. Box 426
301 S. LaSalle St.
Indianapolis, Indiana 46206
(317) 635 5564

Eastman Kodak Company
343 State St.
Rochester, N.Y. 14604
(716) 454 5080

Da-Lite Screen Company Inc.
P. O. Box 629
Warsaw, Indiana 46580
(219) 267 8101

Draper Shade & Screen Company
411 S. Pearl St.
Spiceland, Indiana 47385
(317) 987 7999

Knox Manufacturing Company
111 Sprice St.
Wood Dale, Illinois 60191
(312) 595 0300

Projection Tables and Stands and Racks for Alignment

American Professional Equipment Company
2802 S. MacDill Avenue
Tampa, Florida 33609
(813) 839 5374

Audio Visual Contractors Company
6875 E. Evans
Denver, Colorado 80222
(303) 758 4242

Buhl Optical Company
1009 Beech Avenue
Pittsburgh, PA 15233
(412) 321 0076

Columbia Scientific Industries Inc.
AVC Division
P. O. Box 9909, 11950 Jollyville Road
Austin, Texas 78766
(512) 926 1530

Fortune Audio-Visual
35 Bergen Turnpike
Little Ferry, N.J. 07643
(201) 440 2888

RMF Products Inc.
P. O. Box 413
Batavia, Illinois 60510
(312) 898 4571

Welt/Safe-Lock Inc.
2400 W. Eighth Lane
Hialeah, Florida 33010
(305) 885 6401

Audio Mixers

Lear Siegler Inc.
Bogen Division
P. O. Box 500
Paramus, N.J. 07607
(201) 343 5700

Shure Brothers Inc.
222 Hartrey Avenue
Evanston, Illinois 60204
(312) 328 9000

Sony Corporation of America
8150 Vineland Avenue
Sun Valley, California 91352
(213) 767 9750

Audio Tape Duplicators

Audio/Tek Inc.
P. O. Box 5012
San Jose, California 95150
(408) 378 5586

Cetec Audio Inc.
13035 Saticoy St.
North Hollywood, California 91605
(213) 875 1900

Dukane Corporation
2900 Dukane Drive
St. Charles, Illinois 60174
(312) 584 2300

Infonics Inc.
P. O. Box 1111
238 Highway 212
Michigan City, Indiana 46360
(219) 879 3381

Pentagon Industries Inc.
4651 N. Olcott Avenue
Chicago, Illinois 60656
(312) 867 9200

Recordex Corporation
1300 Booth Avenue NW
Atlanta, Georgia 30318
(404) 351 7062

Telex Communications Inc.
9600 Aldrich Ave.
South Minneapolis, Minnesota 55420
(612) 884 4061

Wollensak /3M Company
Bldg. 223-5E 3M Center
St. Paul, Minnesota 55101
(612) 733 9627

Appendix D
Sources of Information About Multi-Image

Associations

Association for Educational Communications & Technology
1126 16th St. N.W.
Washington, D.C. 20036
(202) 833 4180

Association for Multi-Image
947 Old York Road
Abington, PA 19001
(215) 885 2050

Colleges and Universities

Arizona State University
Audiovisual Center
Tempe, Arizona 85281

Los Angeles Community College
855 N. Vermont Avenue
Los Angeles, California 90028

Rhode Island College
Audio Visual Department
600 Mt. Pleasant Avenue
Providence, Rhode Island 02908

Santa Fe Community College
3000 N.W. 83 Street
Gainesville, Florida 32601

Southwest Missouri State University
Director Media Productions
Springfield, Missouri 65802

Temple University
Educational Media Department
Philadelphia, PA 19122

University of Georgia
607 Aderhold Hall
Athens, Georgia 30602

University of South Carolina
Instructional Service Center
Law Center
Columbia, South Carolina 29208

Utah State University
1681 E. 1400 No.
Logan, Utah 84321

Colleges and Universities Offering Multi-Image Courses*

Arizona State University
Tempe, Arizona

California State College at Long Beach
Long Beach, California

San Diego State College
San Diego, California

San Jose State College
San Jose, California

University of Southern California
Los Angeles, California

Los Angeles Community College
Los Angeles, California

University of Connecticut
Storrs, Connecticut

Indiana State University
Terre Haute, Indiana

University of Iowa
Iowa City, Iowa

University of North Iowa
Cedar Falls, Iowa

University of Maryland
College Park, Maryland

Boston University
Boston, Massachusetts

University of Massachusetts
Amherst, Massachusetts

Western Michigan University
Kalamazoo, Michigan

University of Minnesota
Minneapolis, Minnesota

Teachers College
Columbia University
New York, N.Y.

Indiana University of Pennsylvania
Indiana, Pennsylvania

Santa Fe Community College
Gainesville, Florida

Temple University
Philadelphia, Pennsylvania

University of Texas
Austin, Texas

Brigham Young University
Provo, Utah

Utah State University
Logan, Utah

University of Wisconsin – Stout
Menominee, Wisconsin

*Prepared by James Maguire,
Austin Public Schools
Austin, Minnesota

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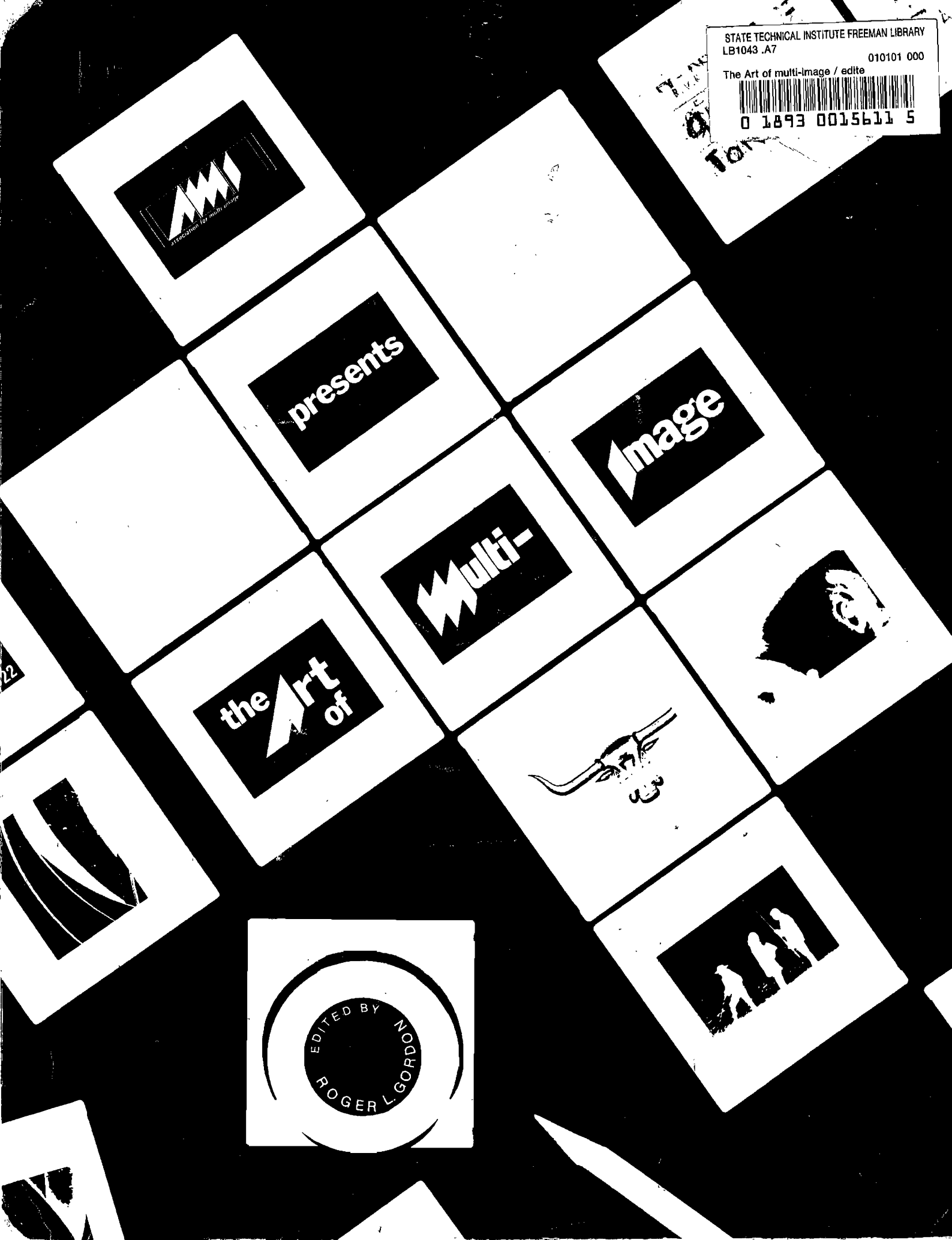

SECTION THREE

2010 | *Giclée Prepress* – *The Art of Giclée*

Giclée Prepress is an all-inclusive guide to the reproduction of fine art using the "giclée" printing process. You can read the story of how the book came to be in Volume Seven, starting on page 1648. Here's a recap: *Giclée Prepress* was written as a last resort during one of the three darkest periods of my life—the third time my ship sank. (Y'a gotta wonder, eh?) In 2010 the nation's economy had not rebounded from the 2008 financial disaster; in fact, things were getting worse.

When my AV business went down the toidey in 2007, I turned to fine arts as a new career; that actually started in 2005, when I heard about the fortunes to be made selling giclée prints as limited editions. (BTW, it's pronounced: gee-clay.)

Around the turn of the Century, a Japanese company called Epson came out with a seven-color inkjet printer aimed at the photography market; that changed everything, and the timing couldn't have been better. Digital photography had come of age; not so, digital print making. In fact, digital images were transferred to film so that photo prints could be made. Giclée prints were stunning; better than photo prints. They were so good that some people had a hard time telling the difference between an original and a giclée copy. Voila! A new market was created, for limited edition giclée prints. It was win-win. Instead of selling one original for $10,000 (who had that kind of money anymore?); sell ten giclées for $1,000 each---same result for the artist and nine more people get to enjoy the work. People used to buy art posters; giclées were posters on steroids—and they could be printed on canvas, closely mimicking 'the real thing.' So, I jumped in and bought an Epson giclée printer. The goal was to make wall art from my photo illustrations.

The fine-arts project got a head start by absorbing the best illustrations of the hundreds made for the Peppermill Casino's *Oceano* show. It just so happened that the pixel dimensions of the Oceano screen (3072 X 768) translated into a giclée print measuring 12.8 X 3.2 feet [3.9 X .97 meters]—a 4:1 ratio panorama. I made samples; shopped them around; and was accepted at a trendy gallery on Vancouver's trendy Granville Street. Stuff was selling; I invested more and more. Then came the Crash and everything stopped. The gallery went under and all my canvases were returned; every nook and cranny of my condo were stuffed with them; and nobody in Vancouver wanted them; the art market (such as it was, in Vancouver) was dead.

I moved the operation to my studio on Vashon Island; repurposed my gear and expertise. The result was Vashon Island Imaging; a resource for local artists. It took a little educating; but, word went through the (large) art community and, one by one, they decided to go the limited-edition route. But the economy kept sinking and by the summer of 2010, Vashon Island Imaging was under water. A few artists started making their own giclées; they weren't too good. That's when I decided to write a book; to teach the finer details of giclée printing—*Giclée Prepress – The Art of Giclée*.

Many of the repro techniques applied to giclée printing derived from my earlier careers, making artwork for magazines, and then multi-image slide shows. The serendipity of that has not eluded me. Print-production techniques spelled out in this book tie-in with those for multi-image slides, discussed in Volume Eleven, *Confessions of A Multi-Image Maniac.*

.

Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

By Douglas Mesney

Première Edition

Douglas Mesney Art Vancouver, B.C.., Canada

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The Art of Giclée

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The writer hopes that readers will inform him of discrepancies and/or information that may need further explanation or revision. Contact the writer at: www.gicleeprepress.com

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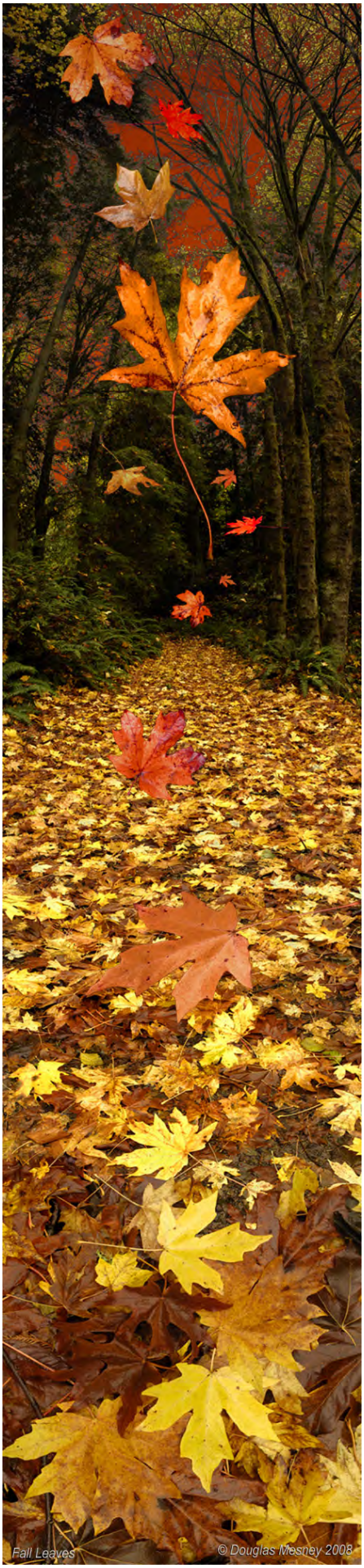

This book is for those who step into the dark to find light.

Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

Forward

THE ZEN OF GICLÉE

"Blue is gray and yellow white
And we decide which is Right
And which is an Illusion"

Those words from a *Moody Blues* song have stuck with me since I first listened to them four decades ago.

Is the world an illusion? We are what we think, after all, but what you think is not what I think. Or, is it?

We all ponder metaphysical questions like those. The answers are elusive and the quest is the stuff of Zen.

Zen is a personal experience, something that cannot be shared because it is a journey within. When we are alone with our thoughts the path is revealed. The fog of reality lifts, and other universes come into our reach.

People find their paths in different ways. Meditation is one. Art is another. Each provides a way to avoid the distractions of the world around us long enough to voyage into our deeper thoughts. To that extent, Zen is a form of escapism.

It seems that everyone is trying to escape, each in their own way. Escape from this world to a more perfect one. When things aren't perfect, people are disappointed and seek alternatives that are. When things are going right, people say they are... "Perfect!"

Producing the perfect giclée print is the Holy Grail of this book. The path starts with an idea and ends with its manifestation... making the journey a kind of manifest destiny.

There are no shortcuts on the way to perfection. My father used to say, "there's no 'Royal Road' to success." Instead, there is considerable tedium and trial especially if perfection is your goal.

Perseverance and an uncompromising attitude are important because in a perfect world, ninety-nine and a half just won't do. People value perfection because they know that it is hard to get. Perfection is about bringing out the "shine" in things. Like polishing the silver.

The accuracy facilitated by digital imaging puts perfection within grasp. The question now is, "What do you do when perfection is possible?"

What is perfect? That's up to you.

I can't tell you the entire answer. However I can tell you this: the longest path is the shortest route to Zen. Giclée prepress can be one of the most liberating experiences of your life. You can turn tedium into time travel.

The tedium I speak of is the repetitive nature of arts and crafts in general. Consider the art of origami where a simple object involves hundreds of folds. Similarly, making a detailed path in PhotoShop involves hundreds of carefully-plotted points. The time spent in such *detali* a can be seen as a blessing or a curse depending on your point of view. My father's advice on things like that was that we should "learn to like them." But how?

Setting perfection as your goal is how. Knowing and *appreciating* that every point on that path is a step closer to your goal, even if the path is a rocky one. If you have climbed a mountain you know of whence I speak. Zen is found in the climb. The journey becomes a test of one's spirit. And so it goes in giclée printing.

Giclée prepress can be as challenging as rock climbing, if you let it. Conquering printers and display devices can be your version of dragon slaying. PhotoShop is already like a real-life video game, after all. If your "*Compass of Desires*" points to perfection, escape with me now to the world of giclée printing and together we'll reach for the stars.

Moonstruck
© Douglas Mesney 1969-2010

Duck Pond

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Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

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Self Portrait

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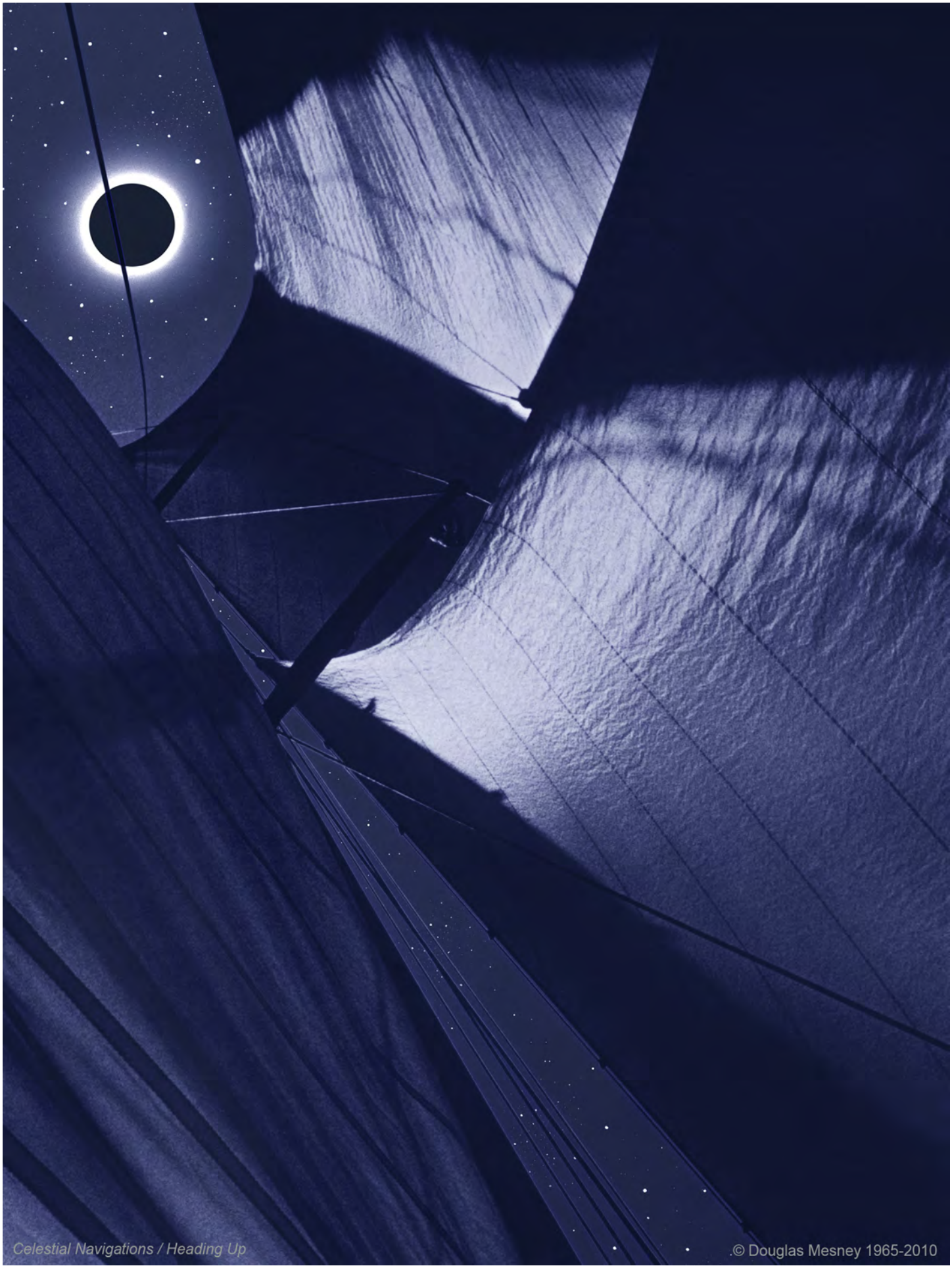
Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

INTRODUCTION

Giclée Is A Sea Change


Celestial Navigations / Heading Up
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Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

INTRODUCTION

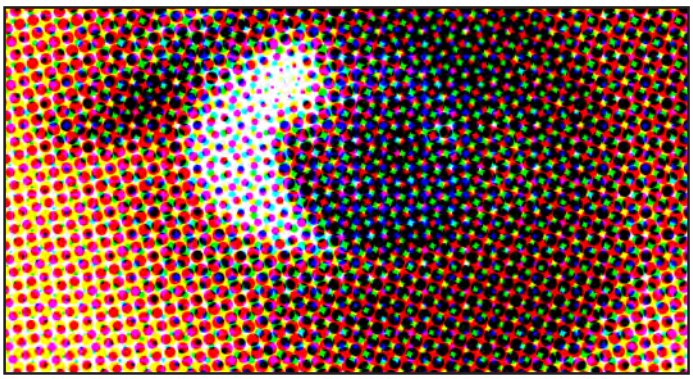
Giclée Is A Sea Change In Fine Art Printing

Giclée is a commonly used term in the art business today, but not so very long ago the word didn't exist. It's a French word that has come to mean 'ink jet'. But that term didn't exist either until the 1970's… ancient history now.

Compared to 'ink jet' the word *giclée* just rolls off the tongue, and that's the difference with the prints they make too. Giclée is high-end inkjet. Inkjet printers reproduce digital images by spraying variably sized droplets of liquid or molten material (ink) onto a page. There are three main technologies in use in contemporary inkjet printers: thermal, piezoelectric, and continuous.

The Difference Is In the Dots

All printing processes use dots to print pictures.



Look at this picture from 10 feet away and the eye will become clear because your eyes (probably) cannot resolve the individual dots from that distance. Resolution is closely linked to viewing distance. The closer the viewing distance, the finer the dots have to be.

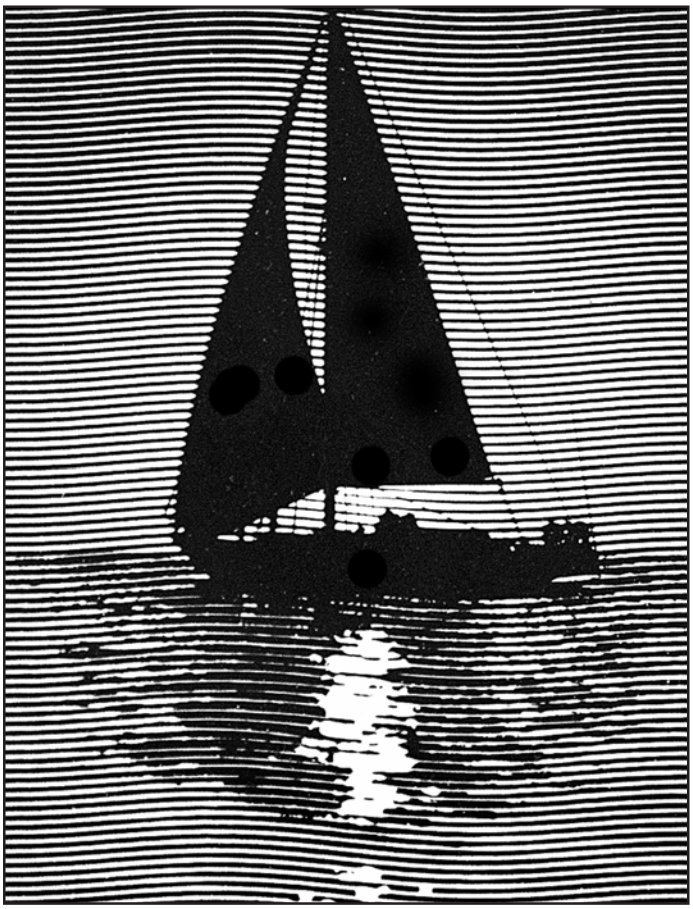
Dots are necessary to get many colors from only four (Cyan, Magenta, Yellow and Black – known as 'CMYK' and also referred to as "*process colors*").

Using dots to mix colors relies on a form of "*trompe l'oeil*", which is French for "fool the eye".

Printing with dots is called "*screen printing*" because a screen is used to create the dots from photographs or other *continuous tone* artwork. Photos and artwork are "*screened*" for printing. The number of dots per inch is called the screen frequency, or just *screen size*.

Continuous tone comes from the gray scale.

Gray scales display a range of tones from white to black. For fine reproduction work, the more tones the better.



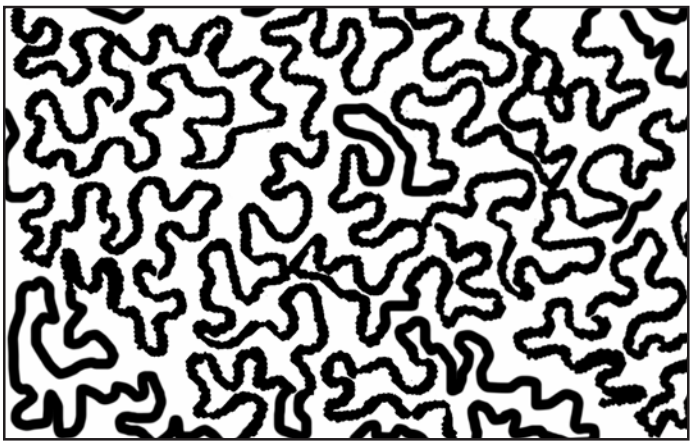
Before dots, printers obtained shades of gray different ways all called 'line art'. As can be seen in the illustration above, varying the width of the wavy lines creates the illusion of gray when viewed from a distance.

Solid color art with no shades is called "*line art*".

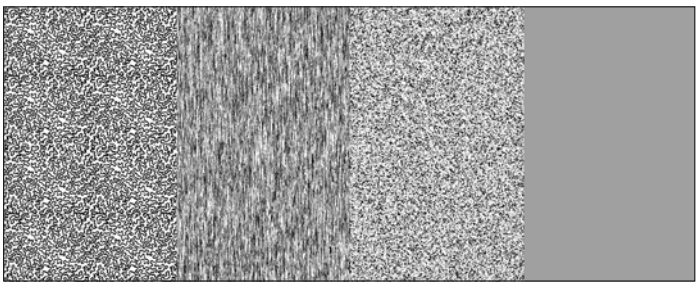
Line art can use different colors, although it is usually monochromatic. Etchings and steel engravings are examples of line art, as is calligraphy and drawings using a solid color.

Before photography, how could you draw gray if you only had black ink? Only by using the illusion of *trompe l'oiel.*

Traditional artists created gray using black ink by stippling, cross-hatching, pointilizing, and squiggle pattern known as "Cornelli" that is popular with stone masons and cake decorators.



Cornelli lace *is like a continuous squiggle which looks gray from a distance. Stonemasons use the cornelli pattern to decorate buildings and you also see the decorative pattern on expensive cakes.*



Line art screens like Cornelli *(left), brush lines (left-center) and mezzotint (center-right) create the illusion of gray using only black ink. A patch of gray ink is shown on the right for comparison. If you stand far enough back, they all look the same (more or less).*

Later, photo-mechanical printing screen techniques like *mezzotints* became widely used. Today graphic artists reproduce pictures with line art techniques more as an effect than from necessity. Digital imaging has added newer looks like those produced by PhotoShop's pointilize, crystalize, mosaic,and fragment filters, to name a few.

Line art effects can play an important role in prepress for giclée as you will discover later. Solid areas of color will be used for a wide variety of masks and well as to add tints and tones.

But back to dots….

Recall that it was Gutenberg's printing press that changed everything. The Gutenberg press prints by stamping. The parts to be imprinted stand higher, just like a rubber stamp. It was the reverse of the intaglio technique that he was familiar with in which images are made by carving then *into* a plate. Instead, Gutenberg carved them *out* of the plate.

Metal type stands out in relief. Ink is put onto the surface and then it is stamped onto paper or some other substrate.

Early forms of printing used copper engravings which required a lot of tedious handwork. Lettering and decorations were hand-carved into copper plates,

Gutenberg invented moveable type to make words quickly and easily and a machine to do the stamping. Since then, printing presses have evolved into four basic types, differentiated by the way they transfer inks onto substrates.

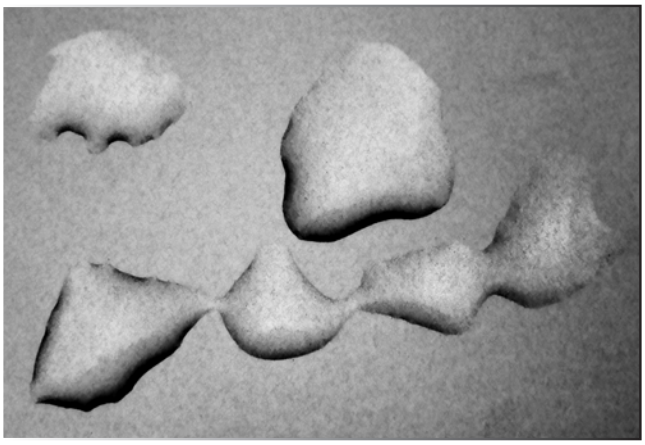
Types of Printing (Pardon the Pun)

Letterpress Printing

These presses work like the Gutenberg,,, metal plates carry images on raised surfaces which carry ink to be 'stamped' or 'pressed' (as in the name "letter*press*") onto substrates. Letterpress is an archaic form of printing which is not widely practiced anymore.

Lithographic "Offset" Printing

This process works because oil and water do not mix. If you drop water onto a polished metal or stone surface what happens? The water beads up and rolls off. But a drop of oil will stay in place. Hold that thought...



Water beads up on a waxed car because oil and water don't mix.

If you etch the surface by sandblasting or using a caustic solution like acid, a drop of water will spread by capillary action across the etched area and stay put… now, drop some oil on that and what happens? This time the oil rolls off.

Thus on a lithographic (offset) printing plate, the ink-bearing surfaces are not etched, everything else is. The ink is 'offset' onto the paper. The paper must have the right 'bite' to accept the ink without smearing, and a certain degree of absorbency.

Papers come in many different types. The qualities needed for one type of printing will not necessarily be appropriate for another.

There are two main types of paper, coated and uncoated. Coated papers are needed for fine arts printing because their hard and glossy surfaces produce good dot structure and contrast.

Dot structure refers to the crispness of the edges of printed screen dots. If the paper is absorbent, the edges of the dots soften, a situation called "dot gain" because as dots spread they get bigger. (See picture on page 16.)

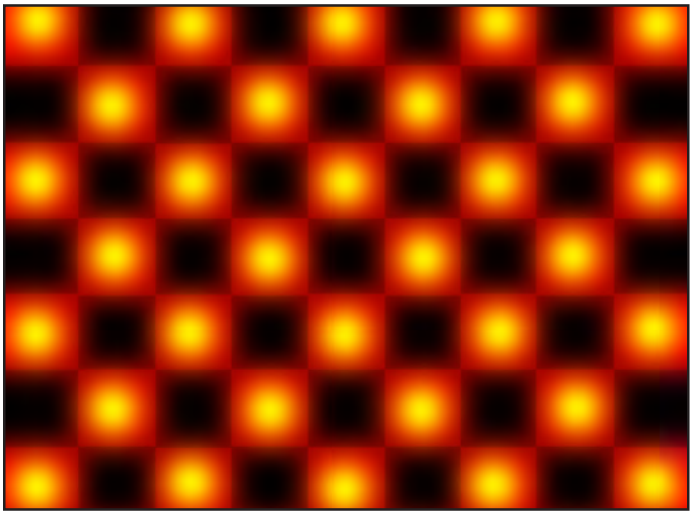
Soft-edged dots are actually a benefit for fine arts printing as you will shortly read about. Lithographic printing, also called just "*Litho*", produces clean-edged dots and for that reason the dynamic tone range is somewhat limited.

Coating surfaces range from matte to high gloss. Uncoated paper is more matte and more Eco friendly.

The surface of papers defines their ability to print fine details. The harder the surface of the paper the smaller the dots that can be printed on it. More dots mean more tones. Thus, different papers offer different dynamic tone ranges depending on the kind of dot structure they support.

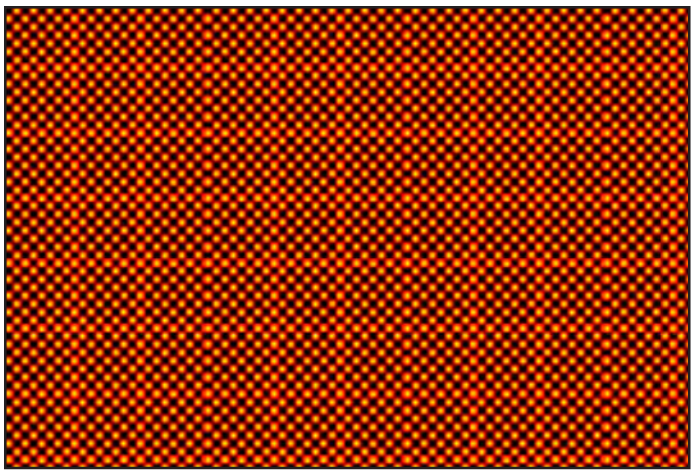
Xerography ("Xerox") Printing

Electrostatic attraction makes "Xeroxing" work.



Imagine a checkerboard with an electrical charge on the red squares and no charge on the black. Now, sprinkle electrically charged powder (ink) over the checkerboard. The powder only falls on and clings to the red squares

When paper comes into contact with the charged "platen" carrying toner on the "hot" pixels, the electrostatic charge dissipates and the toner is released onto the paper, after which it is melted onto the surface as it passes under a heat coil.



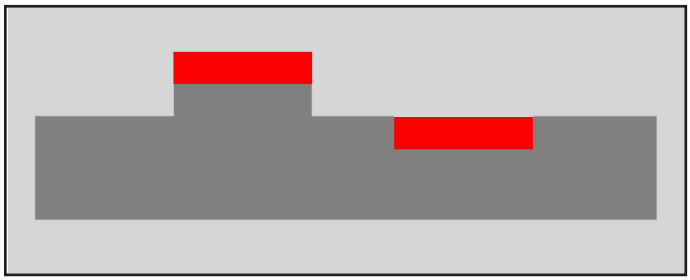
Now imagine thousands of checkerboards arranged on a grid and shrunk down until you get 600 or 1200 squares (pixels) per inch. By comparison this display (above) shows only 24 dots per inch.

Melted toner infuses into the substrate which provides for durability, but the resolution and dynamic tone range suffers in comparison to other printing methods.

Laser Printing

Laser printing works the same as Xerography except that a laser creates an electrical charge on the platen optically. From that point on it's the same… toner powder on a pixel grid is then transferred onto paper and bonded by melting.

Intaglio Printing (also called "Rotogravure")



Letterpress ink rolls onto raised surfaces that are etched away *(left) Intaglio ink is caught in "ink wells" etched* into *the surface of the plate.*

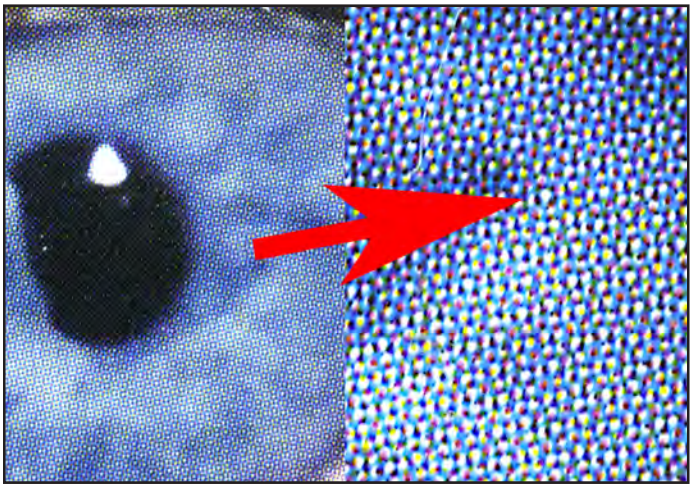
Inaglio is letterpress in reverse. "Ink wells" are cut into the plate surface instead of using raised surfaces. Instead of being stamped on the ink is absorbed out of the inkwells by the paper.

Special papers are required to absorb the ink, making the process more costly and thus generally reserved for art reproductions and special types of advertising materials.

The number of dots that can be printed in one inch is called "*DPI*", (Dots Per Inch). The dots are arranged on a grid and the grid angle is changed for each different ink color so that dots don't print on top of one another. By varying the *size* of the dots on the grid, more or less of each color is printed.

Drops of ink on copy paper are smaller and have sharper edges than the same dots applied to absorbant paper towels which allow the ink to spread out making the dots bigger, called "dot gain".

Printers have always struggled to get the dots smaller and smaller because that is the only way to get fine resolution and extend the dynamic tone range with lighter pastels.



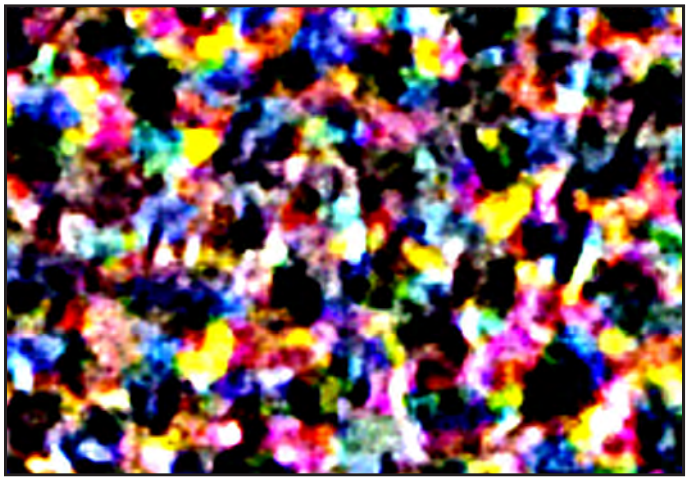
Offset dots have sharp edges so the spaces between the dots show as white (or the substrate color). Sharp-edge dots may be good for technical illustrations and business graphics, but not for fine arts.

In the beginning, small dots were especially challenging because printing plates were made from the metal lead. Although lead was easy to work with because of its low melting temperature, lead is soft so thin dots would deform when pressed against the substrate.

Copper plates provide greater dot strength. But even copper has strength limits. Small dots are like thin toothpicks and no matter how strong the plate material the limits are soon reached.

Rotogravure solved the problem by reversing the process, eliminating the toothpick effect by using ink wells.

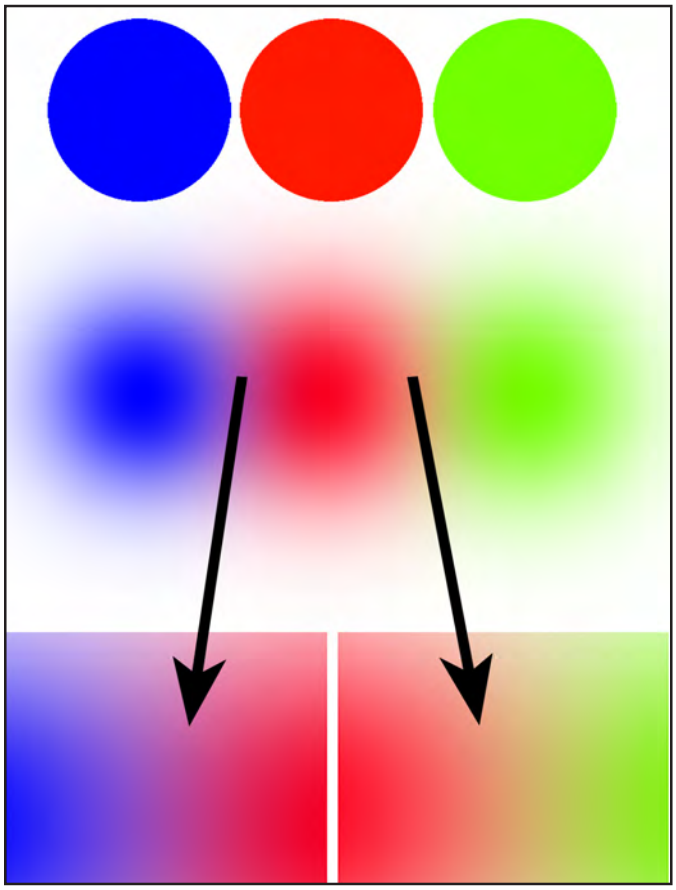
Rotogravure printing is finer than letterpress because the absorbed dots have softer edges than the stamped-on dots. Soft dots have less white space between them. Soft edges mean fine printing because they extend the range of colors that it is possible to print from the basic four process colors (CMYK).



Rotogravure dots spread together due to the absorbancy of the paper resulting in less paper show through than hard-edged dots.

Gradient-Edge Dots Extend Dynamic Tone Range

The dynamic tone range is extended because where the soft edges overlap a range of additional colors is derived from the blending of the gradients. The softer the edges the wider the tone range. Small dots with soft edges thus produce the widest dynamic tone range.



Hard-edge dots (top) have more "white space" between them than soft-edge dots. Sprayed dots are the softest of all and where they overlap additional tones are created. The extra hues and shades created by the overlapping gradient edges are called "rare tones".

Inkjet dots have the softest edges of any printing process because they are sprayed on instead of being stamped or absorbed.

Giclée dots are the finest quality that the inkjet process can deliver. Their edges are so soft that compared to screen-printing they aren't really dots are all. Thus the traditional ways of thinking about dot resolution don't really apply.

Inkjet 'resolution' cannot be directly compared with traditional dots-per-inch measurement scale because the DPI scale counts distinct, single dots. Giclée dots are not single dots but instead a clusters of micro-dots.

Recall that peizo inkjet printers explode bubbles of pigment into bursts of droplets that are so small that up to 2880 of them land on every inch. That is a far cry from the 300 DPI that is considered high quality in the world of traditional screen printing.

The droplet size of a giclée spray is measured in picoliters which are tiny (1/1,000,000,000,000 of a liter). Some inkjet printers can vary the droplet size.

Early inkjet printers had typical drop sizes ranging between 30 to 50 picoliters. Compare that to today's tiny micro-drop sizes of only 2 to 4 picoliters that are the new standard. This is comparable to the size difference between a softball and a ping pong ball. Smaller micro-drops produce smoother-looking prints because they make softer dots on the paper producing a wider tone range.

When an inkjet printer crosses the line from 300 or 600 to microdots into higher quality ranges of 720, 1440 and 2880 micro-dots it then qualifies to be called a true giclée printing machine.

Giclée offers the widest dynamic tone range and the highest resolving power of any 'mass' printing method. The importance of a wide dynamic tone range can be demonstrated by examining a *gradient.*

Gradients are edges that are soft.

This gray scale has only 10 tones. You don't have to be a rocket scientist to understand that the more steps, the wider the dynamic tone range. The more tones available, the smoother transitions can be.

This soft continuous-tone transition from black to white is an example of a gradient. Gradients and be wide or narrow and transition between any colors, not just black and white.

Giclée Is A Sea Change In The Art World

Sea change is a metaphoric term for a gradual transformation in which form is retained but substance is replaced, as with wood petrifying into rock.

Back in his day, Gutenberg fundamentally changed the world of art by making it …a 'world'. No longer were originals or etchings only to be seen by the well heeled. His printing machine put art and literature into the hands of almost everyone.

In a similar way, Canon and Ichiro Endo brought fine art to the people in a way never before possible when they invented 'bubble jet' technology in the late '70's.

By the 1990's inkjet technology was refined to the point that its dynamic tone range surpassed all other printing processes. That fact did not go unnoticed by artists and photographers who were themselves in the early stages of the transition to digital imaging.

By the end of the 1900's digital imaging rivaled film-based imaging and early in this decade even surpassed it in terms of image quality. Combining digital imaging and giclée printing there was suddenly a way to make copies of paintings, illustrations and other artworks that looked exactly like their originals.

Fine art reproduction has gone the way of desktop publishing. That is, companies like Epson, Canon, HP and others you'll never hear about have made high-end giclée printing inexpensive and ubiquitous.

Today the world is awash in giclée. Artists and photographers everywhere have bought giclée printers and are making limited edition prints. Oil painters even have reproductions of their works giclée'd onto canvas.

Giclée printing companies abound, along with an entire subset of industries making specialty papers and inks for giclée printing and finishing. Frame shops are getting in on the action by installing giclée printers for 'one-stop shopping'.

Like any other technology in the hands of the public, results are as various as the people who produce them. Technology is, after all, only that… technology. A laser drilling tool doesn't fix teeth, a dentist does that using the tool. There are good giclée professionals and others who may not be ready for prime time.

Having a good giclée-printing machine is mandatory but only the beginning. Being fluent in PhotoShop is a requirement, too. Even then, there's more to learn that is giclée specific.

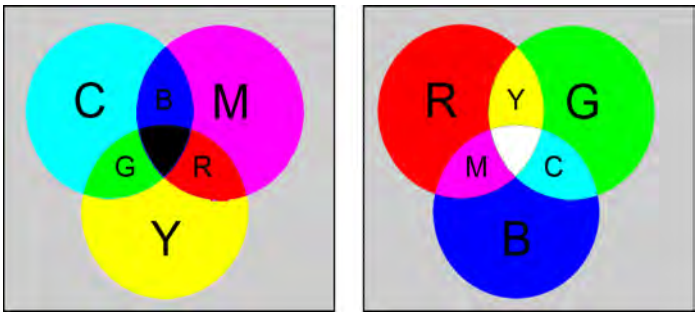
Today the biggest disconnect in digital imaging is between people and their printing machines. People have good cameras and they know how to perfect their pictures with programs like PhotoShop. So why are they so often disappointed with the way their pictures look when printed? It's because every output device needs a different version of the picture to maximize the 'look' within its own range of capabilities.

The image you make could be reproduced any number of ways. The printing requirements for a local newspaper picture are way different than for a canvas giclée mural. Likewise, different types of printing processes will deliver different looks A picture printed by rotogravure will look different than if printed by offset or letterpress.

In the end, all depends on the dynamic tone range that a device is capable of displaying, it's color "gamut". Prepress is about adjusting the dynamic tone range of the image to fit into gamut of the printing machine or display device.

There is basic prepress and also a high-end variety that uses advanced techniques to bring out tones in pictures where once you might have thought there were none.

Nine times out of ten there's stuff in the shadows or highlights of a picture that won't be visible in a giclée unless adjusted and manipulated to work with the 'look' that the output media can produce. For example, more rare tones will show in a glossy picture than in a matte one.



The "mistake" many people unwittingly make is an inadvertent one caused by working in RGB and printing in CMYK. RGB uses 'additive' primary colors, which you see on 'glowing' displays of emitted light like monitors and televisions (right). CMYK uses 'subtractive' secondary colors seen by reflected light (left).

RGB can produce more tones than CMYK and the tones look different (more saturated) because of the physical-world differences between light transmission and reflection as well as between additive and subtractive color.

Put more simply, while people are working on pictures in PhotoShop they see RGB. RGB can produce more colors than CMYK so it is easy to start working with colors that are beyond the range of a CMYK printer if you are seeing RGB.

Basic prepress is a technical exercise about taking the RGB look of the digital image file and tweaking it to get the closest match possible using CMYK giclée printing inks and media.

High-end giclée prepress goes beyond that and is more creative than technical. Artistic prepress work involves the discretionary manipulation of image tones directed by an interpretation of the artist's intentions and preferences.

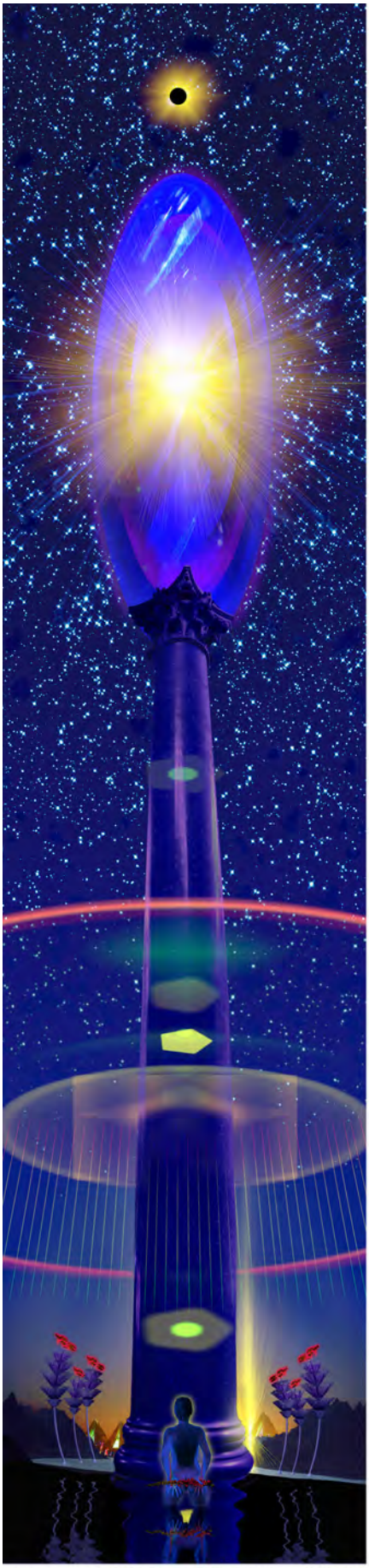
People have different color preferences. The look of many artists depends on the unique color pallets they work in. Some are muted and pastel, others saturated and vivid.

Perhaps your client likes solid shadows, or maybe bringing out shadow detail would be considered an improvement. Those kinds of creative and interpretive adjustments are what advanced prepress work is all about, and the subject of what you are about to read.

So let's begin… but where?

The Bible tells us that in the beginning, there was Light. We'll therefore begin with the study of light, which impacts everything you see and do as a giclée prepress artist intent on pixel-perfect printing.

Trio of 10-foot-tall illustrations made for the grand entry into an audiovisual firm's headquarters building in Reno, Nevada. Illuminated wall insets were made to frame the three pictures. They are themed on



Giving and Receiving, *the fundamentals of all Communications*

Shikara Sunset / Lake Dal, Srinigar, India

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Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

SECTION ONE

The Study of Light

Douglas Mesney Art Vancouver, B.C., Canada

Eclipsed
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Giclée PrePress
The Art of Giclée

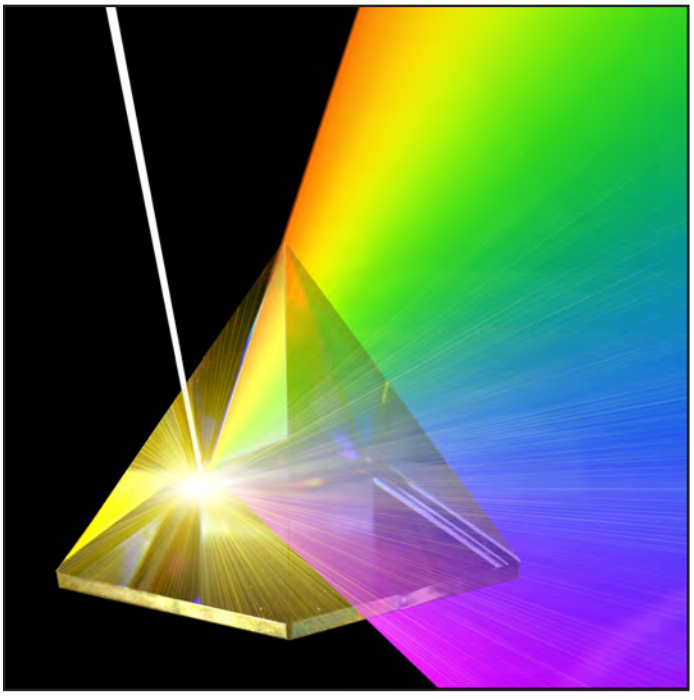
Theory and Practice of Giclée Printing

SECTION ONE

The Study of Light

Without Light There Is… Darkness

Deep in the ocean where there is no light, jelly fish and other creatures make light in mysterious ways. Everything we see is because light illuminates it. We have no sensors for darkness (or do we?).



All colors exist in light. When all the colors are combined, the result is white light. To get one color, all the other colors must be taken away.

The light we see is part of a larger spectrum of energy. If we put the visible spectrum in the middle, blue is on one side and red is on the other with green in the middle. The blues extend way out into ultraviolet then x-rays and beyond to spectrums as yet unmeasurable. The reds reach past infrared becoming radio and television signals. But its all the same, really. Your TV can dial in spectrum parts you can't see, and vice versa.

At the TV store you can see the problems of color clearly. Every display will be a slightly different color. Which is right? Why are they different?

One might think, "if they can put a man on the moon why can't they get the color right?" That is a good question and also the subject of this book.

Getting color right is what giclée prepress is all about. It is what any prepress is about, to say nothing of the color problems of the film and broadcast industries. There is a reason why the Coca-Cola logo appears the same shade of red right the way round the world, and that is called color management.

You manage color when you pick color swatches at the paint store. The color looks different outside than it does inside, but it's a start.

Color and light are interlocked. The study of one must intertwine with the understanding of the other. Managing one is pointless without managing the other. Indoor films for indoors, outdoors films for outdoors; that's color management, too.

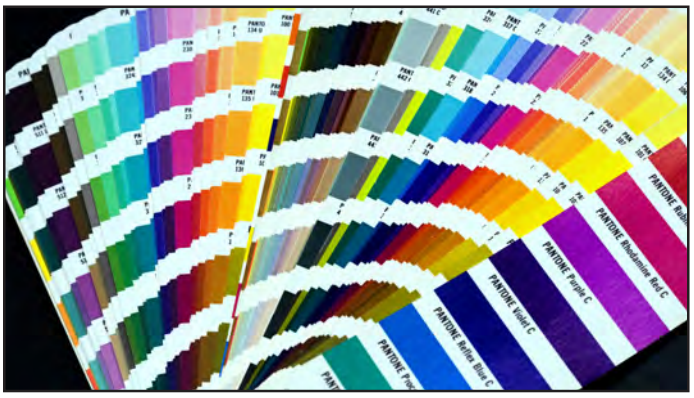
Today's color management systems and practices are sophisticated and obviously work quite well as can be noted just by looking around. It's easy to see when things are less than perfect.

When Color Management Fails

A recent episode reminded me that even with advanced color management systems, communication fails when people get involved.

On the other end of my phone was a client commenting on a color test strip for a giclée on canvas. We found ourselves at odds trying to make our color interpretations understandable to each other. The discussion revolved around the orange sky tones in a sunset picture. The client wanted the orange tones to be '30% less intense'… but, what does that mean?

Without a face-to-face meeting using test-strips and color swatches the discussion was challenging. Emailing a file wouldn't help because no RGB display can show CMYK color accurately enough to judge the dynamic tone range of a giclée print.



Pantone® *color system is one way to solve problems with communications about printed colors. There are similar systems, Each provides swatch books for matching colors and communicating descriptions.*

Using a color matching system is how the Coke logo always appears the same red wherever it is shown around the world. Users of the logo can reference the PMS number (Pantone Matching System) specified by Coca-Cola.

Pantone's system extends into digital media and the company's products include the tools needed to profile computer monitors and other digital imaging devices.

The Study of Color

Computers have the same problem people do when it comes to color. Just as I was asking my client, "what do you mean, 30% less intense?" a giclée printing machine might query a computer about the same thing.

The International Color Consortium (ICC) was established in 1993 to create order out of chaos in the digital imaging world. The ICC created a color identification system like Pantone's.

Pantone's system grew out of traditional printing, using CMYK colors. The ICC's system is based on RGB color and displays that emit rather than reflect light. (Note that Pantone caught up with digital imaging and now their color system extends into both RGB and CMYK colors.)

ICC color numbers can be discovered by using the Eyedropper tool in PhotoShop to sample any color. Notice that the sampled color becomes the Foreground Color shown on the Tool Bar.

Click on either color in the Tool Bar and the Color Picker dialogue box opens. There you can see the components of the Foreground and Background Colors as well as their codified ICC identification numbers.

While in Color Picker, notice that the color is defined four different ways: RGB, CMYK, LAB and CIE. Of the four, only RGB and CMYK are commonly used, although it is said that LAB is the most accurate way of measuring color, scientifically speaking.

Each of the four color measurement methods is geared for a different segment of the imaging market. RGB color is derived from emitted light. CMYK color derives from reflected light. Each of these has

a different color gamut, or range of colors that it can produce. LAB and CIE are more scientific in that they don't care whether the light is emitted or reflected.

Color measurement ranges from technical to sublime. The science of color is all about measurement, control and repeatability. The art of color is about involves emotions and sentiments that elude measurement or precise control. Science is universal. Art is personal. Science requires *a posteriori* evidence. Art is happy with the *a priori* kind.

The giclée prepress artist is more like a sorcerer… part scientist, part artist. To get the job done right, the prepress artist must understand color, what it is, where it comes from, and how to control it.

Scientific Color

The color of light is scientifically and technically measured in various ways to establish standards required by different trades, crafts and professions.

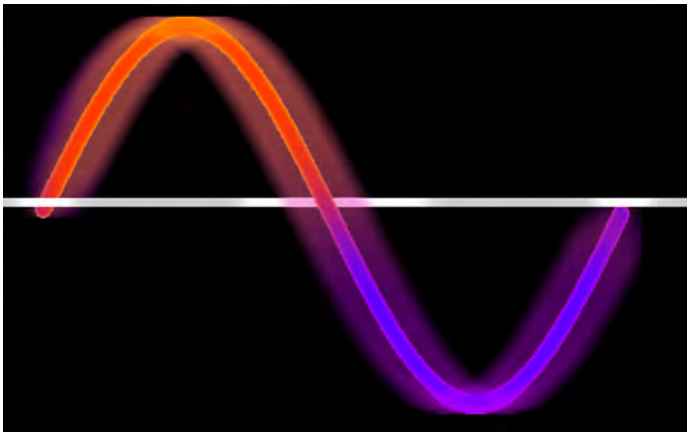
But what exactly are they measuring? What is light?

Light is energy. It is produced when chemicals interact. Burning produces light as fuel and oxygen interact. Phosphorescent jellyfish and fireflies produce "cold" light by interacting chemicals in their flesh.

Light is emitted from a source and reflects off the objects around it, making them visible. When no light is present thngs cannot be seen.

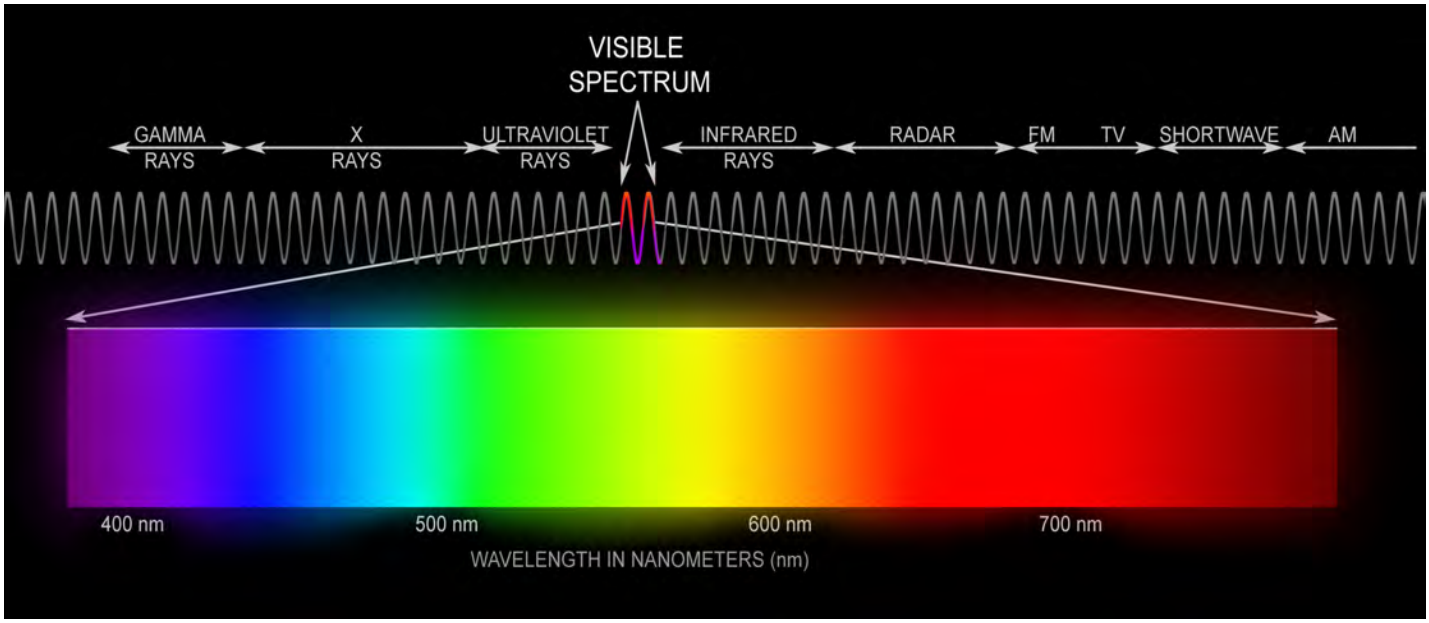
Light that is emitted is called "source light". It has more colors than reflected light. The object that the emitted light falls on absorbs some of the emitted light, and reflects back what is left. A leaf looks green because it absorbs away the red and blue from the source light.

Light is emitted from sources as waves that behave as both rays and particles. Light waves are depicted as a sine waves.



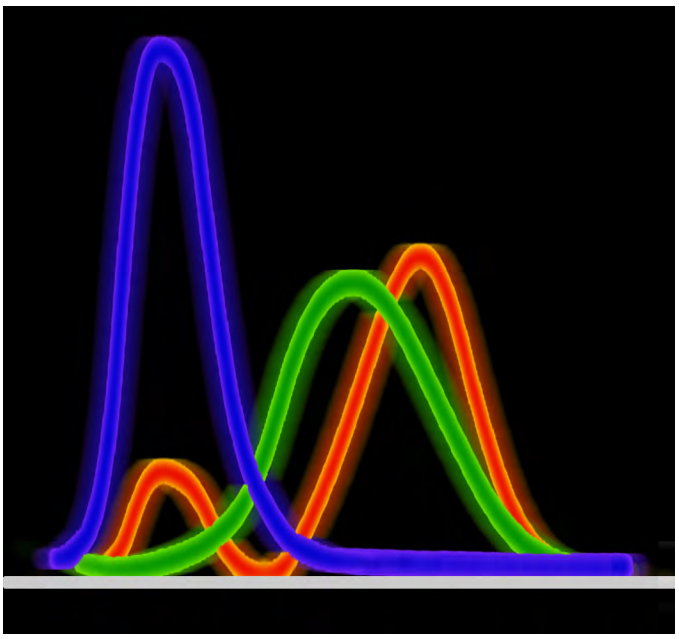
Sine waves cycle up and down, over and under an imaginary center line. The number of complete cycles in a given time or space is referred to as the frequency of the wave. Frequency is a way of defining the distance between the peaks (or valleys) and is also referred to as the length of the wave, or "wavelength". The unit of measurement is a nanometer, which is one billionth of as meter.

If we measure the colors in the rainbow, the nanometer numbers are lower at the blue end than they are on the red end. That is because blue light has longer wavelengths, red light shorter ones. Other colors fall somewhere in between.



Light waves extend far beyond the visible spectrum. Blue extends into ultraviolet light and eventually X-rays and gamma rays. Red light extends out into infrared, then microwaves, radio & television waves and beyond. We can't see this energy but we know it is there from instruments that can detect it. Using nanometer wavelength designations, visible and invisible light energy can be measured and described.

The longer the wavelength of light, the more 'power' it has. By power I mean 'inherent energy'. In the world of sound we know that base-end sounds go farther and penetrate deeper than treble sounds… which is why you can hear the thump-thump of your neighbor's stereo right through the walls.



Blue light has more energy than either red or green, and red has more than green. The relative amounts compared to one another look like this when plotted graphically. Any device that measures light by averaging will be fooled by pure colors because their strengths are so different when compared to one another.

The practical implications of this are that it is impossible to correctly expose all three primary components of light in a single camera exposure, unless the camera has algorithms to make the compensations necessary to even out the curves.

If you took a picture of a red balloon together with a green one and a blue one, if the blue one is correctly exposed, the red and green ones will be too dark. If the green one is correctly exposed, the red and blue will be too light.

This phenomenon extends throughout every step of the photomechanical reproduction process (including audiovisual) and the giclée prepress artist should be aware of that, look for it and make the necessary compensations if necessary.
But back to the scientific study of light…

In the study of the perception of color, one of the first mathematically defined color spaces was the CIE 1931 XYZ color space, created by the International Commission on Illumination (CIE) in 1931.

The CIE defined color by associating measurements with the way the human eye physically perceives color.

Tristimulus Values

The human eye has two kind of photo receptors. Cone cells see colors in the daytime and rod cells activate after dark but see a limited color range.

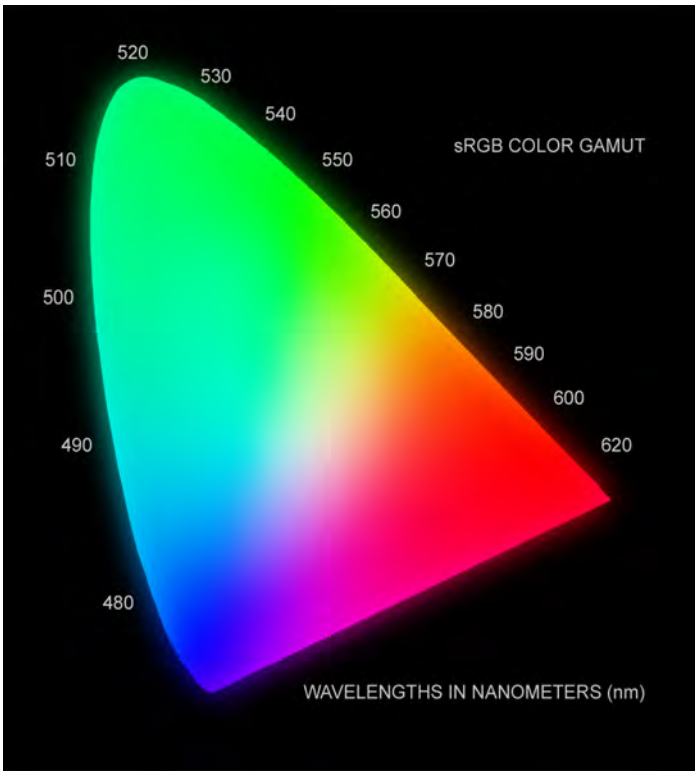
Cone cells are of three types. Each type sees one of the three primary colors of emitted source light: Some cone cells see reddish wavelengths of 420–440 nanometers (nm); the second type sees greenish middle wavelengths from 530–540 nm; and the third type sees blue wavelengths from 560–580 nm.

CIE descriptions of color sensations in the eye use parameters that are based on those three levels of eye sensitivity. The three parameters are called the tristimulus values of a color. The tristimulus values are roughly red, green and blue, hence the term "RGB". They are the amounts of the three primary colors -- red green and blue -- needed to create that color.

Color Spaces

Any specific method for associating tristimulus values with each color is called a color space. In other words, the space defines the range of colors available… the dynamic tone range.

Note that in the CIE color space the X,Y,Z values are not pure red, green, blue colors as they are in an RGB color space. Rather, they may be thought of as 'derived' from the red, green, blue colors. That is because pure primaries cannot create as many other colors as can slight mixtures that although close to being RGB are not pure.



This diagram of the sRGB color space displays the colors that can be produced by a computer monitor or television set. The outer curved boundary shows wavelengths in nanometers.

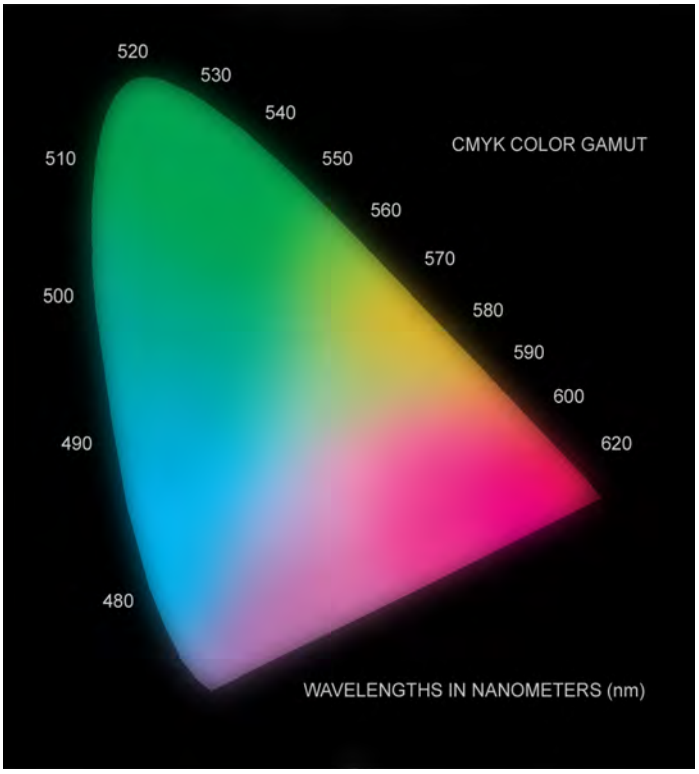
Compared to the sRGB color gamut for monitors and televisions the chart for pigment colors looks dull and lackluster. Pigment colors are less saturated than emitted-light colors because they are reflected instead of being emitted. Objects absorb parts of RGB source light and reflect back what's left, hence the name "subtractive' color.

Reflected-light pigment colors are referred to as subtractive colors because taking away primary light colors creates them.

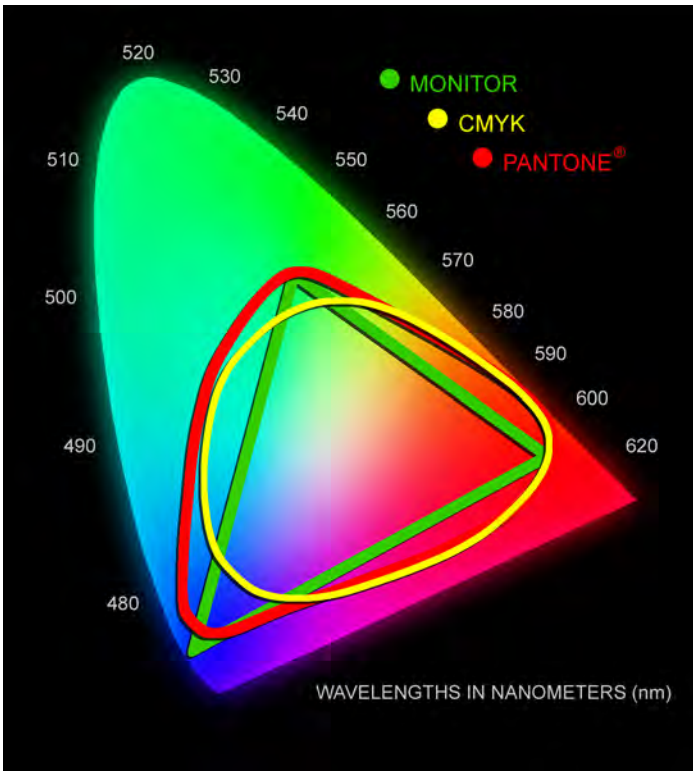
Primary light colors are called additive because adding one primary to another makes secondary colors.

When pure primary RGB colors are mixed together they create the secondary colors of magenta, cyan and yellow (CMY). These secondary colors are also the colors of the printing inks used in the four-color printing process.

The best way to see the color differences between the CMYK and RGB color spaces is to look at a color gamut comparison chart.



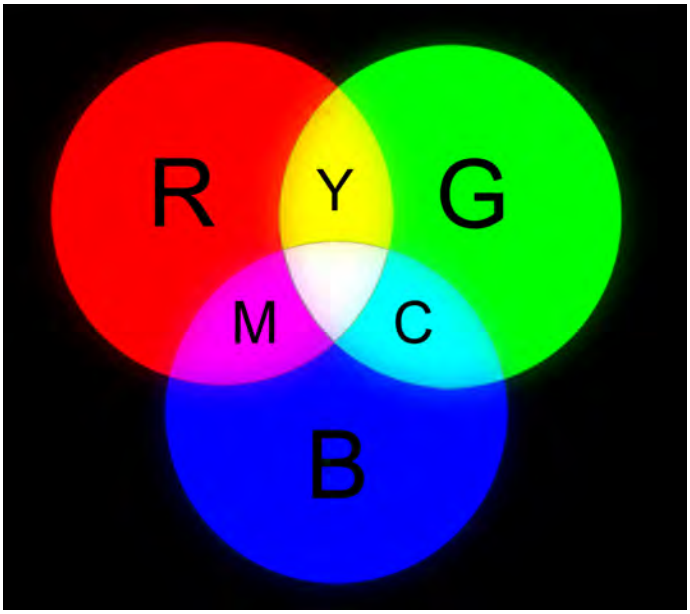
This diagram of the CMYK color space displays the colors that can be produced by 4-color process printing inks. Notice how different this gamut is compared to sRGB. Many sRGB colors cannot be reproduced using CMYK inks.



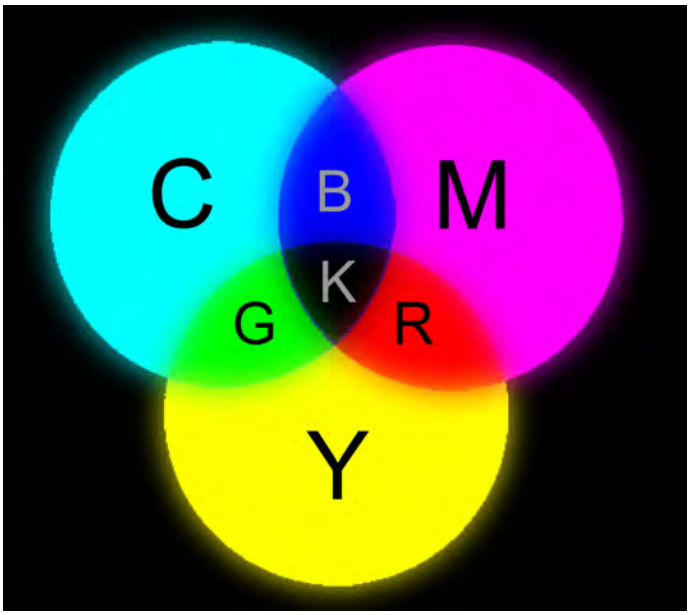
This chart shows the visible color spectrum and within it plots of CMYK, Monitor, and Pantone color gamuts. You can see that some of the Monitor color space is "outside" the CMYK space. All three gamuts show only portions of the visible light spectrum.

Additive Versus Subtractive Color

Transmitted light is called "additive" because if all three primary colors are mixed together the result is white (or gray).



Mixing combinations of the three primary light colors of Red, Green and Blue produces the secondary pigment colors of Magenta, Cyan and Yellow. Primary light colors equally blended result in white.



Mixing combinations of the secondary pigment colors of Cyan, Magenta and Yellow produces the primary light colors of Red, Green and Blue. Secondary pigment colors equally blended result in black (K).

Photography, film and video all record and display colors using RGB primary colors. Artworks and printed works use CMYK secondary colors.

Note that although cyan magenta and yellow can theoretically produce black in our less-then-perfect world the result is actuality dirty dark gray, so "K" (black) is used to achieve true black in printed material and artwork.

Subtractive color is so called because we see what is left after the object has subtracted by absorption all *other* colors. A red balloon absorbs green and blue light. A green leaf absorbs blue and red. A yellow banana absorbs some of the red and green light and just about all of the blue.

The Brightness Factor

Another way to measure color is to divide it into two parts: brightness and chromaticity. For example, the color white is a bright color, while the color gray is considered to be a less bright version of that same white. In other words, the chromaticity of white and gray are the same while their brightness differs.

Note that the chromaticity diagram cannot specify colors of objects or printing inks, since the chromaticity observed while looking at an object depends on the color of the light source as well. As you have probably experienced, a given color will photograph differently when lit by different kinds of light, or at different times of day.

RGB and CMYK achieve 'brightness' two completely different ways. White in the RGB world is created by equal parts of pure red, green and blue. The brighter each of those three is (i.e. more energy emitted by the source light) the brighter in resulting image.

CMYK achieves brightness by revealing or hiding the substrate media. The white you see in a watercolor painting or in a printed image is the color of the paper itself… there is no white ink. Lighter shades of colors have less pigment, revealing more paper.

The different types of paper used in printing have different levels of brightness as well as different colors and these qualities have impact on how an image appears when printed on them.

The surface of a paper also has characteristics that affect the perceived tonal range. Of greatest impact is the reflectivity. Papers range from very glossy to dead

matte. More gloss means more blacks. More matte means less black. Surface textures are a matter of taste, some like glossy but I prefer smooth satin and matte. The more pronounced the texture, the more reflectivity you get especially on the raised textural patterns.

A good example is gloss-varnished canvas giclées. At certain angles it is hard to see the picture through the canvas texture surface reflections. However the glossy varnish extends the dynamic tone range of the giclée because the blacks get darker.

The wider tone range revealed by gloss fnishes can be clearly seen in this comparison of Epson Glossy Paper and Matte Canvas. Matte finishes make "scatter light" which lightens dark tones, killing contrast.

Gloss finishes beef up dark tones and contrast by revealing finer differences between dark tones. Scandinavian bakers give their Danishes and pastries a gloss coat of clear gelatin to add depth to their colors.

As useful as all these measurements and definitions can be, they are mostly theoretical… they don't solve day to day problems like the constantly changing color of daylight.

Kelvin Temperature

As the sun arcs across the sky from horizon to horizon the color of its light changes from reddish at sunrise to bluish at noon and back to reddish at sunset. This phenomenon was recorded and measured by Lord Kelvin (William Thomson) in the 1800's.

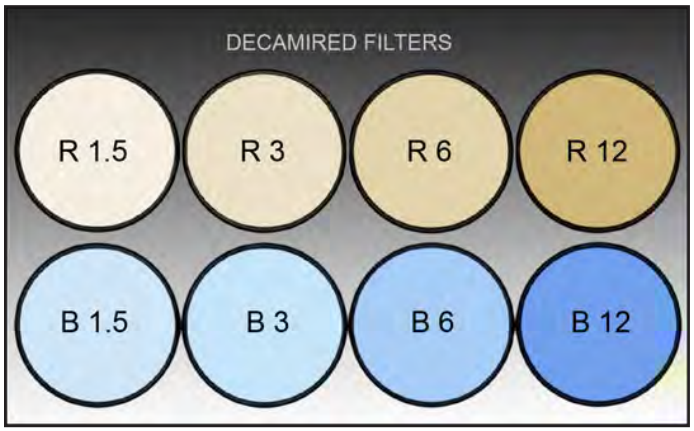
According to the Kelvin scale of color measurement, daylight is 5500 degrees… that's the color of daylight as measured at high noon on the equator. *Only on the equator at high noon* will daylight be 5500 degrees but that doesn't matter because all measurements do is provide bases for analysis and comparison, and a way to describe them to others understandably and with precision.

Other familiar Kelvin temperatures are incandescent lights 3200 - 3400 degrees; sunrise & sunset 4000 degrees; candlelight 2700-2900 degrees. As you get higher and the air thins the light gets bluer. The light in a spot shaded from direct sunlight is bluer as well, as is the light on a cloudy day. In an airplane the sky's light temperatures could get as high as 20,000 degrees K.

To accurately photograph an object's color under different lighting conditions photographers adjust light color to one of the three standard temperatures required by different film types.

Film is made for three different light colors. Daylight film is balanced for 5500 degrees. Tungsten films come in two types for either 3400 degree light (Type A) or 3200 degrees (Type B).

Examples of tungsten lights are old-fashioned filament-type light bulbs, photoflood lamps, and quartz lights. All tungsten lights burn redder as they age, making it nearly impossible to get 100% accuracy. Note: the term "tungsten" derives from the name of the metal used to make the glowing filaments of the original light bulbs.



Decamired (MIRED) filters solve the problem of matching the light color to the film's requirements. Bluish tones correct light that is reddish and vice versa. European KR & KB filters are based on MIRED values.

Decamired filters solve the problem of matching the light color to the film's requirements. Bluish tones correct light that is reddish, and vice versa.

The term mired comes from MIcro REciprocal Degree. The micro reciprocal degree value, or mired value, of any light source is the reciprocal of its temperature multiplied by 1,000,000. Some examples:

"Normal" Daylight = 5500°K. The reciprocal (1/5500) equals .00018181. Multiply that value by 1,000,000 and we have a mired value of 180 (we can round it to the nearest 10 and dispense with decimal places).

"DYS" Quartz lamp = 3200°K. The reciprocal (1/3200) equals 0.0003125. Multiplied by 1,000,000 equals a mired value of 310.

In open shade (a scene lit not by direct light, but by blue sky) or hazy conditions, the color temperature can be much higher (bluer) than 5500°K. If we were in the cockpit of an airliner flying at 35,000 feet the light temperature would be up to 20000°K with a mired value of 50.

The Decamired value is the mired value divided by 10. "Normal" daylight has a DM value of 31, the quartz lamp has a DM value of 18, and open shade has a DM value of 5.

Decamired or DM filters are unique in that they will have a predictable effect by imparting a mired shift of their value, regardless of the light source temperature.

Light Balancing Filters

Photographers also use the 81 and 85 series of Light Balancing (LB) filters for the same purpose as Decamired filters.

Besides their usefulness to bring light color into line with a film's requirements, these filters can also be used creatively to warm-up sunsets with more saturated reds and yellows, or to add coldness to a winter scene with a touch of pastel blue.

These filters don't just throw on a cast of color if they are used when a scene is originated. A cast of color is when an equal amount is applied to all other colors. If you look through pink glasses it is not the same as altering the source light with the same color. If you make the source light as pink as the glasses the effect will be different.

Different objects absorb different amounts of the three component colors of emitted light (RGB) resulting in a dynamic change in the tone range we see.

A color cast makes equal changes to all colors. Dynamic changes are unequal among colors, depending on the amount of the color absorbed by object.

Color Correction of Tints

Light balancing and Decamired filtration controls warm and cool tones by modulating two of the primary light colors, red and blue. Green is considered to be a tint, as are colors that "contaminate" the source light.

Photographers use colored reflectors to tint reflected light. The tinted light blends with the source light to make a hybrid, tinted mixture. Such tints are controlled with Color Correction filters.

Color Correction Filters are shades of primary and secondary colors, RGB and CMY. They range from pure colors to pastels measured on a 100-point scale. CC100Y is pure yellow, CC05Y is a pale shade.

To eliminate a tint of one color, its opposite is used. For a tint equal to CC10Y the correction is CC10B. The opposite of 30M is 30G, and so on.

It is not uncommon for a tint to involve two colors, requiring a filter pack that includes several CC filters.

Digital Light Balancing

Decamired filters solve the problem of matching the light color to the film's requirements. Bluish tones correct light that is reddish, and vice versa.

Today's digital camera can balance light without the need of external filters, thanks to algorithms that present the captured visual data in a way that looks correct. Artist and viewer determine what is "correct".

More expensive digital cameras offer the opportunity to set the Kelvin temperature. Less expensive cameras have presets with names like "Indoor," or "Cloudy", or "Night" and the like.

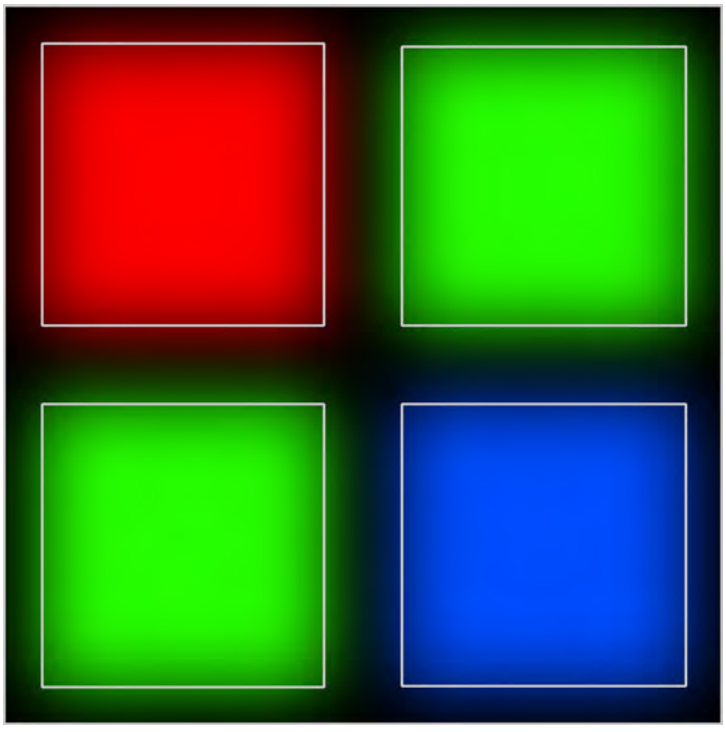
The presets assume an average light temperature for those conditions and apply the necessary MIRED or light balancing filtration electronically using algorithms.

How Cameras and Scanners Make Digital Pictures

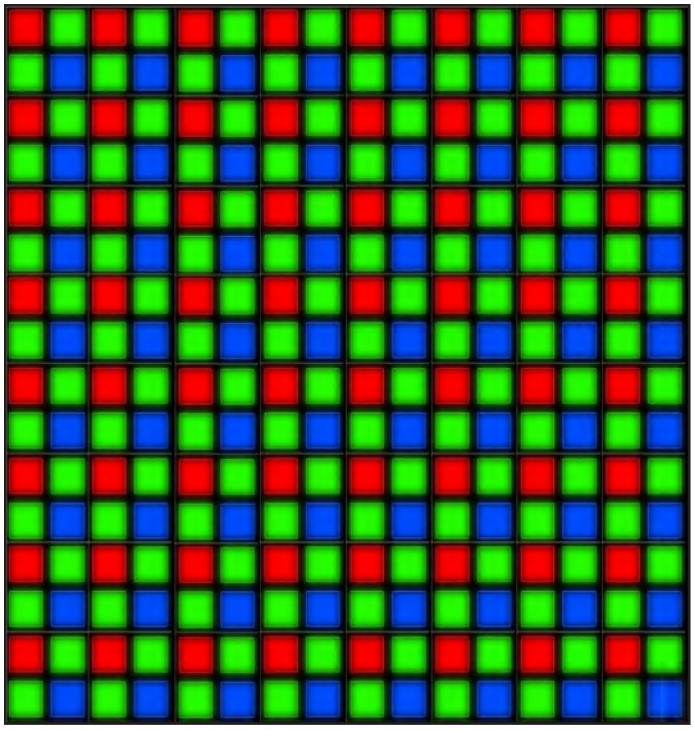
Algorithms are how digital cameras and scanners make pictures out of data. First an image is "captured" and the data recorded. Then algorithms process the data to produce images.

CCD (charge coupled device) and CMOS (complementary metal oxide semiconductor) image sensors capture the image.

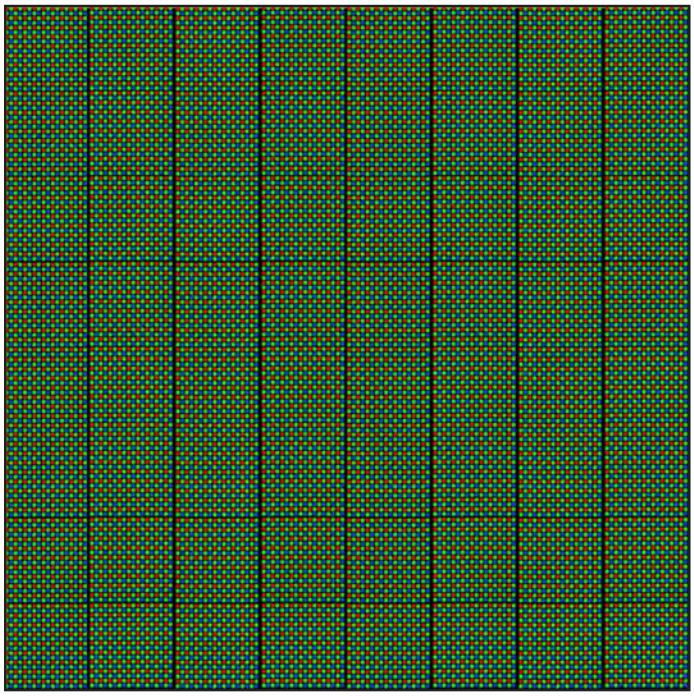
Each does the same job, converting light (photons) into an electrical signal (electrons). Actually, they convert the light into three signals, once each for Red, Green and Blue.



Single-pixel CCDs have one sensor each for Red, Green, and Blue light. An extra green sensor is sometimes included because the green component of ight has less energy compared to red and blue. Each sensor outputs an electrical signal with a strength proportional to the amount of light focused on the pixel by the lens.

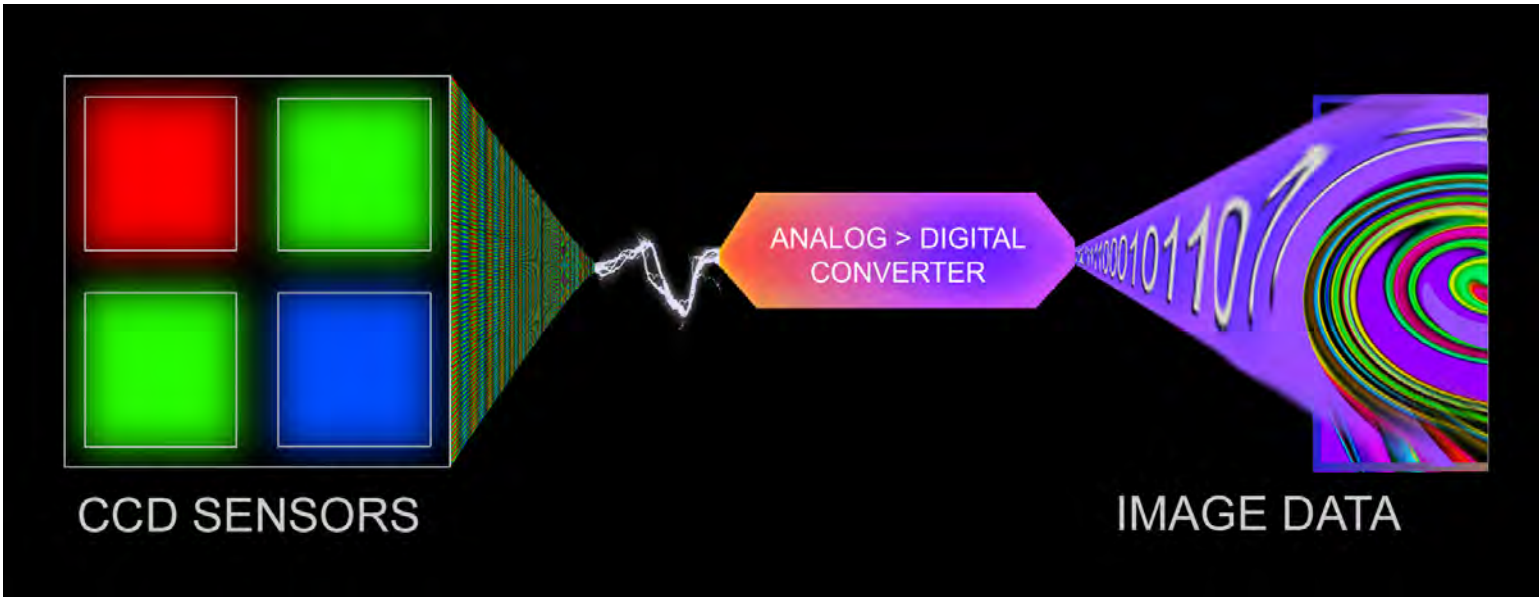


The pixel sensors are arranged on a grid, like a checkerboard. Each square represents a single pixel. This grid is 8 X 8 totalling 64 pixels.



This grid is 64 X 64 totalling 4,096 pixels. It would take 244 like the one above to equal just one "megapixel", which is 1,000,000 pixels. That's 4,000,000 distinct electrical signals (at least).

The next step is the job of a digital-to-ananlogue converter. Each sensor's individual signal is encoded into binary code. The code is then processed by algorithms, stored as a digital data file and finally reconverted back to an analog signal for display.



The main differences between CCD and CMOS light sensing devices is that a CCD sensor sends it's data off-chip to be processed by another, whereas a CMOS does more on-chip processing. Each has advantages and disadvantages.

Feature	*CCD*	*CMOS*
Signal out of pixel	*Electron packet*	*Voltage*
Signal out of chip	*Voltage (analog)*	*Bits (digital)*
Signal out of camera	*Bits (digital)*	*Bits (digital)*
Fill factor	*High*	*Moderate*
Amplifier mismatch	*N/A*	*Moderate*
System Noise	*Low*	*Moderate*
System Complexity	*High*	*Low*
Sensor Complexity	*Low*	*High*
Camera components additional common	*Sensor + multiple support chips + lens*	*Sensor + lens possible, but support chips*
Relative R&D cost	*Lower*	*Higher*
Relative system cost	*Depends on application*	*Depends on application*

Performance	*CCD*	*CMOS*
Responsivity	*Moderate*	*Slightly better*
Dynamic Range	*High*	*Moderate*
Uniformity	*High*	*Low to Moderate*
Uniform Shuttering	*Fast, common*	*Poor*
Uniformity	*High*	*Low to Moderate*
Speed	*Moderate to High*	*Higher*
Windowing	*Limited*	*Extensive*
Anti-blooming	*High to none*	*High*
Biasing and Clocking	*Multiple, higher voltage*	*Single, low-voltage*

*www.dalsa.com/corp/markets/CCD_vs_CMOS.aspx

There are two different technologies for capturing images digitally. Both types of imagers convert the photons in light to electrons which are collected to generate an electric voltage.

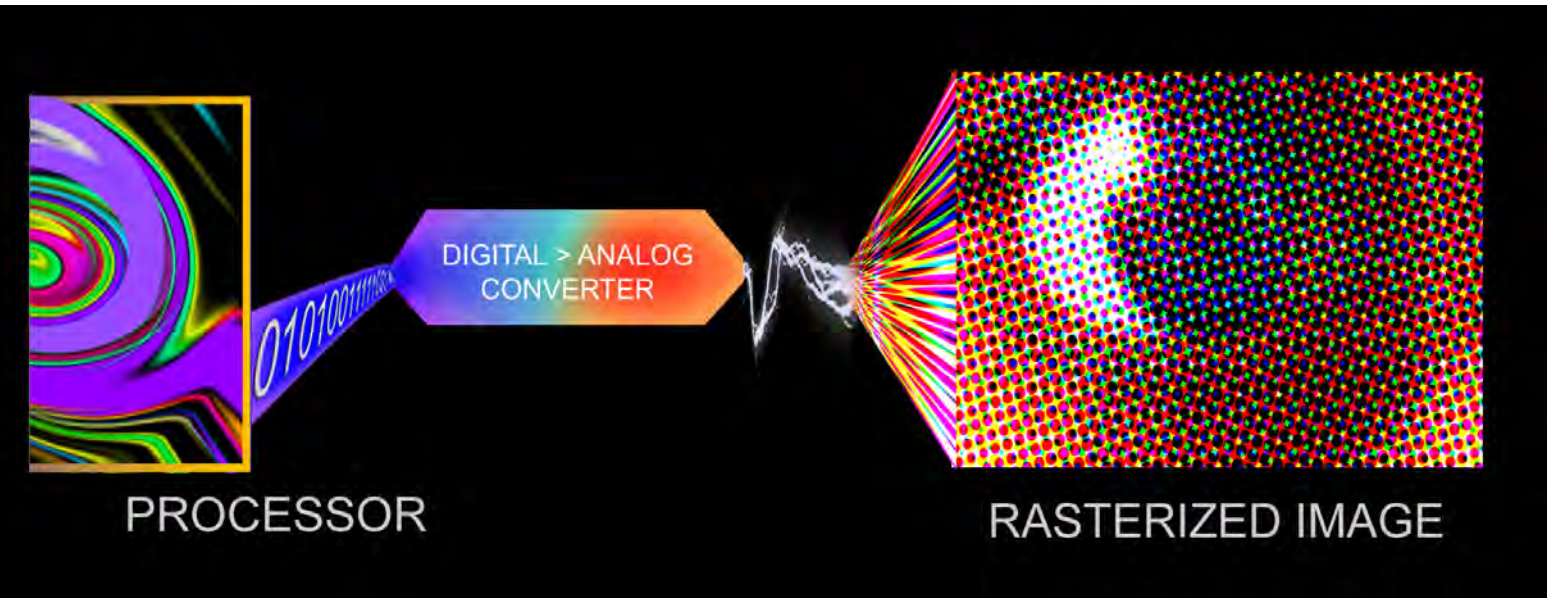
More light equals more voltage. Each pixel on the grid is a sensor that has three parts, one for each of the RGB primary colors. Each sensor catches its part of the light focused on it by the lens.

The photons in the light are converted into electrons and the collected electrons add up to a voltage, and the device holds that electrical charge. Thus, the pixel is either on or off.

If a pixel is on each of its three RGB sensors will have some or no measurable charge. The contribution of each sensor is what is recorded into RAW camera files after a series of algorithms has processed and "packaged" the information from the CCD or CMOS device.

RAW is an apt name for an image file at this stage because that is exactly what the data is… "raw". Something has to be done with it to make it into a picture that we can see. That is the job of additional algorithms.

An algorithm can be defined as a sequence of steps to get from one place to another. If you are familiar with Actions in PhotoShop algorithms are easy to understand. Actions record what you do so that you can perform the same series of steps over and over again at the touch of a button.



Actions are very handy. Suppose that your camera was set incorrectly when you took a series of pictures. Each of them would share the same fault. Actions allow you to record the correction for one and then apply it to all. That's what your camera does by virtue of algorithms.

Consider that the camera knows not what it shoots. There is no night and day for a camera. There is only light. For the pixel there is no picture, no recognizable scene.

Being a pixel on a CCD or CMOS is like being a sewer worker. Your view of the sky is the tiny spot of it seen through the manhole cover. Think about that… what would you know about the sky? Not much more than the color of the dot you see, possibly more blue, more reddish, or more gray. And so it goes for each pixel on the matrix that forms the grid of dots we call pixels.

It is we who recognize a blue sky as fair weather and a red sky as the beginning or end of the day. We also have our own ideas about what is a really good day or an extra special sunset. We remember bad ones too.

What the camera delivers is judged against what we know and we decide whether the picture is good or bad, right or wrong, too this or too that.

Algorithms determine how the "raw" data is stored and interpreted… they make the picture. The quality of the picture depends on the quality of the algorithms as much as the CCD or CMOS sensors.

All digital imaging is based on algorithms. All algorithms are sequences of steps to process data and convert it from one thing to another.

PhotoShop is all about algorithms. Every tool you use and every action you take is an algorithm. The newer the version of PhotoShop, the more algorithms there are… and the more "automated" the program becomes.

Depending on your needs, automation can be your friend or your enemy. To over simplify, its like having an automatic transmission compared to a standard shift. Each is good for a particular driving style. You wouldn't want an automatic in a rally race, nor would you want a stick shift in big-city traffic jams. PhotoShop® tools can be like that.

As for myself, I prefer as little automation as possible. I have high quality digital cameras all set to manual. In PhotoShop the number of tools I use can be counted on two hands... maybe only one. Manual manipulation of images is something I am comfortable with after years and years working with traditional photography and graphic design procedures.

When I discovered PhotoShop it was 1995 and I used Version 3 to begin with. Things were very elemental then because there were only a few tools. Since then digital imaging has matured and there are many more tools making possible much more control. But it is like making bread. You can make it from scratch (as I prefer to do) or buy it frozen and oven-ready.

Back to color…

The goal of the ICC back in 1993 was to standardize color definitions and nomenclature. The group developed standard device profile format used to characterize color devices. The result is what we now call color management.

Color management begins by profiling your monitor. An ICC color profile is a file that describes a device's color space… the variety of colors it is capable of working with. ICC profiles can be created for three types of devices: a display device (monitor or TV or video projection, for example), an input device (scanners and digital cameras), or an output device (printer).

ICC profiles can be either generic or custom. Manufacturers of devices provide generic profiles which are averages among a group of the same product. They do not describe each individual device's actual color space because that varies slightly from device to device, as well as by the working conditions. However, generic profiles are generally OK and they are what I use for the most part.

Custom profiles are made using color measuring instruments like a spectrophotometer or colorimeter, and software specific to the instrument. The instrument measures how your device displays or outputs a series of known colors and then calculates the deviancies. That information becomes the profile for that device. In that way different devices can understand each other's color space and gamut.

Colorvision (Pantone) "spyder" colorimeter attached to CRT monitor and sampling green light output. By measuring how the monitor displays colors it knows, the colorimeter software can calculate how far off your monitor is and make the necessary profile calibrations.

There are a variety of third party packages for profiling monitors. I use the original Color Vision "spyder" and software, which became a Pantone product. It has served me well over the years. Other packages allow you to profile the output of your printer(s) and the input of your scanner(s).

PhotoShop and other ICC-aware programs use the profiles for color accuracy throughout the workflow. The result is colors that look more accurate when printed or displayed on a variety of devices.

PhotoShop also uses profiles to better convert image files from RGB color space (monitors) to CMYK (for printed output), to display images from photo CDs more accurately, and to "understand" the colors input from scanners and digital cameras.

Monitor profiles also facilitate soft proofing which simulates the look of printed colors on the monitor screen. To use soft proofing in PhotoShop use View / Proof Colors and then set-up the view with the profile of the printer and media to which you will be outputting the image.

You can also create a profile for your monitor using Adobe Gamma for Windows machines and Color Synch or Display Calibrator Assistant in Mac machines. However, those are more rudimentary calibrations.

The Art of Color

How color is perceived is as much a black art as it is science. Advertisers know that certain colors are more persuasive. Package designers know that certain colors command more attention. Sign makers have their favorites, too.

Do colors evoke feelings because of our upbringing or do we carry genetic predisposition?…no matter. The giclée prepress artist is not concerned about what colors do to emotions so much as what they do to each other. How to maximize the dynamic tone range of a picture and match it to the requirements of the giclée printing machine and media, that's what prepress is all about.

Like the study of color itself, the giclée prepress artist's role has a scientific side and an artistic one. As the last step in the production cycle of an image, there are

as many creative decisions to be made as there are technical judgements.

Like the algorithms used to execute instructions and make changes, giclée prepress is a sequence of adjustments to adapt an image to the capabilities of the output device.

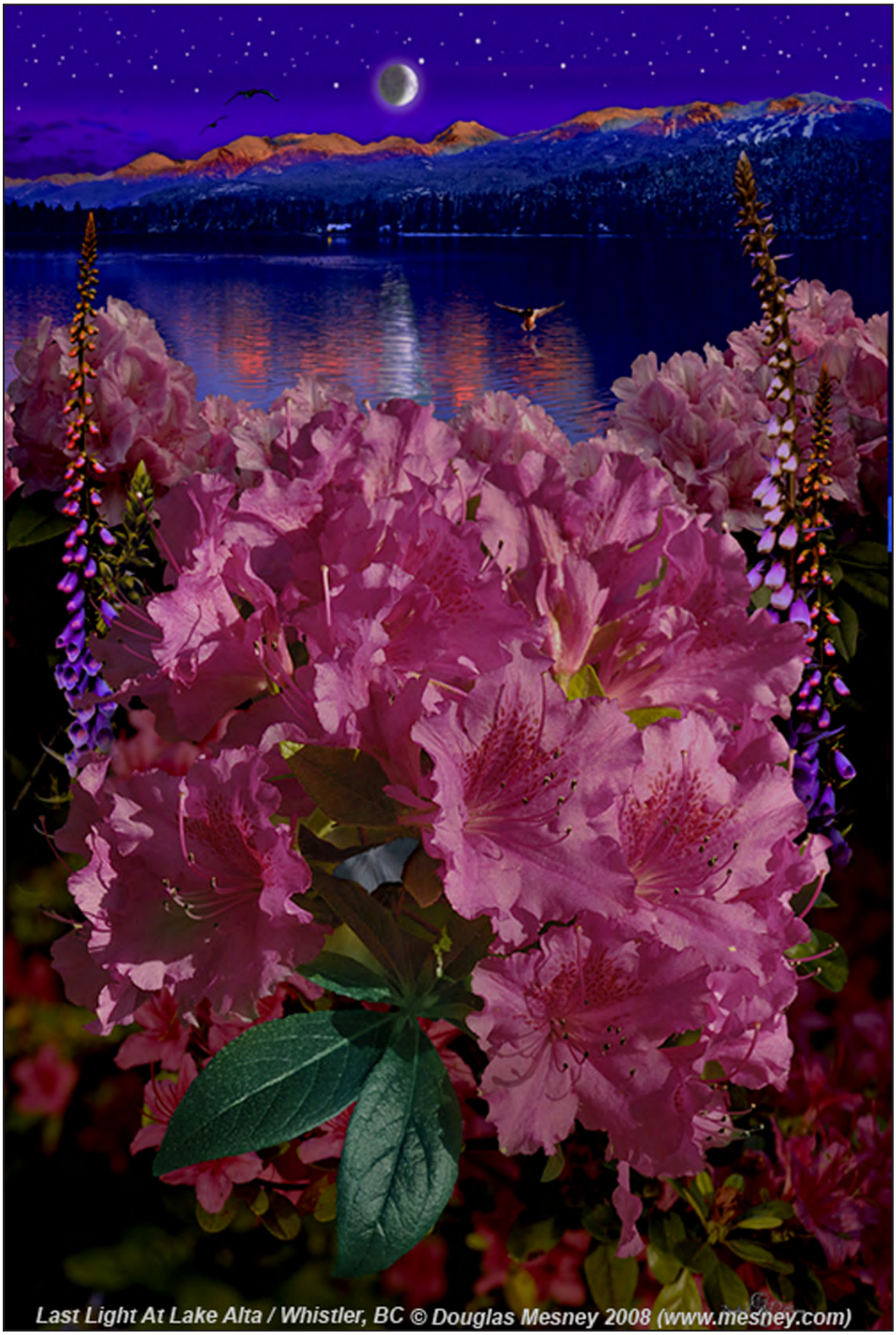
If an output device can show 1000 colors, there's no point in delivering a file with 2000 colors. You might think, the more the merrier… and you would be wrong. In this case, giving the device 2000 pixels causes it to interpolate your file and reduce your 2000-color gamut to its own palette of 1000 color tones. That may or may not be a good thing. For myself, I prefer to choose which colors to keep and which to dispatch.

Besides technical adjustments like that, the giclée prepress artist's most important job is to interpret the image file's RGB image on a monitor and be able to see it as a giclée. To do that requires an understanding of how printed CMYK colors differ from emitted RGB colors. That is the single most difficult thing to do and it is a skill that is fine-tuned with experience.

Although I teach prepress techniques to artists and photographers at seminars in my studio, they and I realize that the artist's job is to get the image to look right on a profiled RGB monitor. Then, let a competent prepress artist adapt the file to the capabilities of the giclée 'press' being used to print it. The prepress artist is or should be more experienced with how the printed output will look, how his or her printing machine interprets and displays colors. Making the leap off the monitor screen and onto paper or canvas is the single biggest challenge to makers of giclée prints.

The interpretation process itself can be divided into technical and artistic components. Begin the session by asking the artist to tell you what they think is right and wrong about their work as it is seen on the monitor. Then examine the image technically. Are the highlights blown out? Are the shadows clogged up? Is it borderline too dark or light? Is there a cross? Almost every image you print will require adjustments in these basic areas, even before you begin tone-range extension work and color interpretation.

The workflow for a typical prepress session is discussed in the next section.


Last Light At Lake Alta / Whistler, BC © Douglas Mesney 2008 (www.mesney.com)

Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

SECTION TWO

The Giclée Prepress Workflow

Thin Ice
© Douglas Mesney 1976-2010

Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

SECTION TWO

Like a river flowing from the source to the sea, giclée art flows from the artist, through your hands, to the world.

***W**orkflow* is a wonderful word and appropriate metaphor for this section of *Giclée Prepress.* The entire process of making giclée artwork is broken down into thirteen steps.

Depending on what you do, some parts are going to be more interesting than others, naturally. However, giclée art is a total package. All parts of the production process flow together to create the "look" of the art. Prepress and printing are the most important part, but the finishing and framing contribute a lot, like the icing on a cake. Even if you aren't the icing guy, the cake will be better if you know what everyone else has to do with the cake *you* bake.

These thirteen "steps to success" are the ones that I take at my own studio, *Vashon Island Imaging*. There are other ways to accomplish many of these things and I would be crazy if I said that I had tried them all. Hardly. But the procedures and techniques discussed in this section are ones that I have settled on by the process of elimination or simply because they work and nothing else was needed.

The Giclée Workflow

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- *Step Four: Setting Up the Job (Page 67)*
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- *Step Eight: Dark Tone Control (Page 89)*
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- *Step Thirteen: Finishing & Displaying Giclées (Page 147)*

Clown Fish
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Giclée Prepress Workflow

Step One
CLIENT CONSULTATION

It's All In Your Mind

Discovery and interpretation are the twin goals of the client consultation that should begin each new job. Perhaps you are your own "client"? Then you probably have an even tougher customer to please. Allow me to be your "Devil's advocate".

Before embarking on any new job, always remember these two things: every picture has a story and there's no accounting for peoples' tastes.

The consultation is all about discovering what the client likes and (especially) doesn't like about the image to be made into a giclée. Just be looking at the image, you will see things that *you* think need to be done.

But, what about the client?

And, what about the business and artistic arrangements between the client and you? Time is money and art takes time. How does that translate for this job?

On one side of the equation giclée prepress work can be strictly technical, and very interpretive on the other. Retouching is advanced prepress, or can be. However, the more interpretive or corrective the prepress work becomes, the more time that's involved with costs attached to that. Most times, the client may not even realize what could be done to bring out the soul of a picture. But for the moment, devote your attention to what your client has to say about the image.

Be sure that the lighting is correct, so that you can compare apples to apples. Your monitor should be profiled and nearby there should be a source of daylight illumination for viewing artwork (for suitable lamps see www.solux.net).

The brightness of the light illuminating the artwork should be roughly equal to the brightness of the monitor and large enough to fully illuminate what you want to examine and discuss.

Get the client's analysis of the picture, its strengths and weaknesses. This should include a discussion of the overall colors. Ask clients, "Would you prefer to see colors that are more vibrant or more subdued? Brighter or less bright? Do you generally like pastels? What are your favorite colors?" The questions may seem simplistic, but they begin conversations, which is the only way to get at the heart of the matter.

At the heart of it, the client must understand that the giclée will never be an exact copy. It can be very close, however. The closest are called "color match" prints and they are the most expensive because matching colors can be challenging (see more in *Step Ten*).

Only you know what this image can deliver and what will be needed to do that. In that sense it is a doctor-patient relationship. Any doctor knows that some patients complain a lot about their problems and with others you have to dig out the information. And so it goes for the giclée prepress artist.

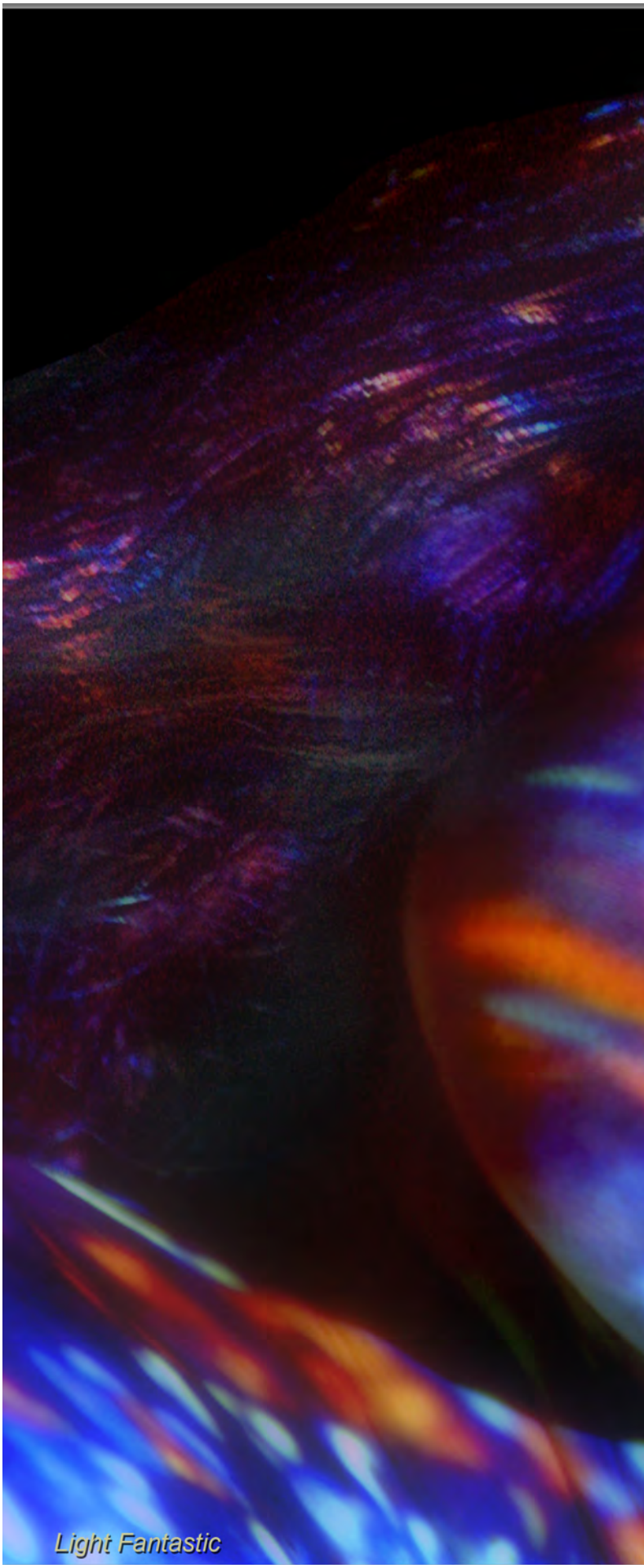
More often than not the client will want you to tell them, that's what they came to you for in the first place. But now you have some idea of the clients color preferences and general tastes. You are prepared to interpret the client's wishes and combine them with your skills as a technician to come up with prepress recommendations.

Throughout the consultation be aware of the client's level of sophistication when it comes to giclée printing. It can be worth your while to take the time to go through some of your creative and finishing services.

Many of our clients at Vashon Island Imaging start with little awareness of the different kinds of coatings available, how they look or which is best suited for their giclée. If you offer framing services in addition to giclée printing and finishing, the initial consultation is the perfect time to consider the whole giclée package. That said, most of our business is for "gallery wrapped" giclées that do not require framing.

Art is hard to define and price. Your giclée prepress, printing and finishing services should not share those qualities. Write up the order with the client present. Do the calculations right before their eyes.

It takes more than a pretty face to make a good looking giclée. It's beauty is in your hands, determined by your prepress adjustments.



© Douglas Mesney 2006-2010

Falcon / Avions Marcel Dassault-Breguet

© Douglas Mesney 1974-2010

Giclée Prepress Workflow

Step Two
TECHNICAL ANALYSIS

"If You Don't Look Good, We Don't Look Good"

Every kind of picture has a 'look'. Its not just the colors, although that is important. It also involves the media, which is the tactile part. Getting both right is the domain of prepress work.

For example, suppose your job is to reproduce an old photo. Photos acquire an old look as they age …what defines the that? Is there something you can do to keep that feeling in the new giclée? Or, would the client prefer the picture to be restored to its original colors?

An old photo looks and feels quite different than a watercolor painting or a digital-media creation. Depending on the original, a giclée can look more or less similar to the original depending on a number of factors.

If the original is a painting on canvas, you can print on canvas… a pebble-board illustration can be printed on textured paper. Matching the media helps a lot but the giclée will never be exactly the same as the original. To get as close as possible requires a technical analysis of the colors within the image, their inter-relationships and interaction with the surface reflections. Things like that.

For example, the more glossy the surface, the deeper the black and the greater the contrast range. Matte-finish surfaces scatter light creating a reduction of saturation and contrast. If the originals' colors look dull look, you can recreate that look in your prepress work. Or, you can go the other way and make the colors stronger if that's what the client prefers.

Avoiding Color Conflicts

Color scientists and artists alike know that how one color is perceived depends on its neighboring colors. Some colors "work" together, others clash. But which are which is all in the eyes of the beholder.

To avoid color conflicts, artists typically choose white, gray or black to surround their works so there are no conflicts or biases and their works color range can be seen "correctly".

Aberrations occur. Colors that look right under one kind of illumination can look different under another. Or, two light sources, made up of different mixtures of various wavelengths, may appear to be the same color.

This effect is called "*metamerism*" and it used to bedevil giclée printers more than it does today, thanks to better inks. Keep in mind that all pigments and colors metamerize to some extent, albeit unnoticeable when using the correct equipment and materials. Putting aside those issues, the main focus should be on the interrelationship of tones in the picture to be printed.

Tone interrelationships vary substantially. A colors in a *Kodachrome* slide of a brilliant, candy-apple red Corvette are way different than a pastel drawing of the same car. The differences have to do with the contrast between the colors and the contrast of the colors themselves.

Seven Kinds of Contrast

- Contrast of hue
- Light-dark contrast
- Cold-warm contrast
- Complementary contrast
- Simultaneous contrast
- Contrast of saturation
- Contrast of extension

Just as black and white represents extremes of light/dark contrast (brightness), red/yellow/blue represent extremes of hue contrast which artists refer to as primary colors.

The primary colors in photography are red/green/blue. Printing ink primaries are cyan/magenta/yellow/black Artists' primary colors are red/yellow/blue

The contrast of colors is diminished as the colors move away from the primaries red/yellow/blue. Orange/green/violet are weaker in "character" (brilliance, intensity and force) because they have less contrast.

Contrast of Light/Dark

Black velvet is probably the blackest black you'll see, and baryta the purest white. In our world, there is only one nominal black and one nominal white, with an infinite number of shades of dark and light gray creating a spectrum from black to white. The number of shades of gray distinguishable depends on the sensitivity of the eye and the type of display (print/film/video).

The contrast of light and dark influences the shading of color tones. They can be more/less black or more/less white all the while being the same color. These variations are controlled in PhotoShop by using Brightness and Contrast, Levels and Hue & Saturation.

To see the effects of light/dark contrast on a color, bring it up in Hue & Saturation and dial the Saturation (amount of black) and Lightness (amount of white). These influence the brilliance of the color(s).

Cold/Warm Contrast

Color sensation affects how you feel. Experiments have demonstrated that people will feel a thermal difference of up to 7 degrees between a workroom painted blue-green and one that is painted red-orange.

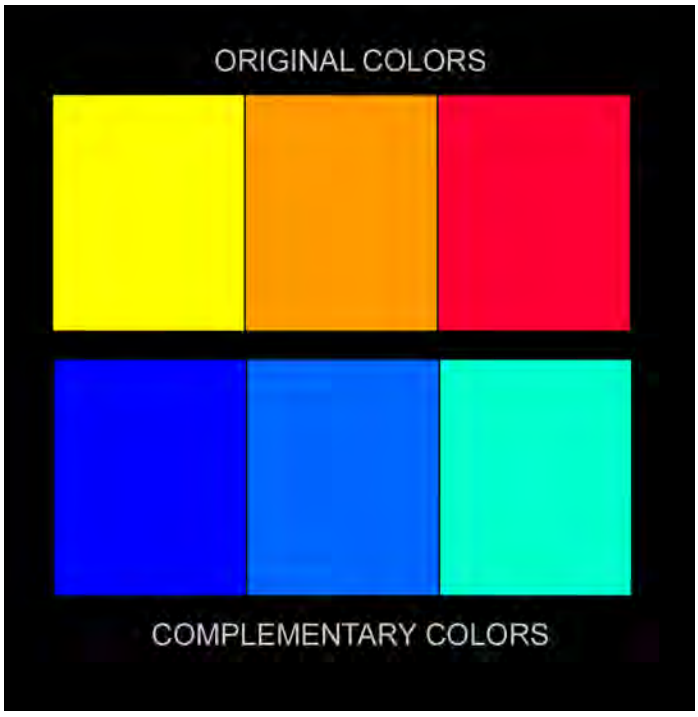
Animals react the same way. Horses in a blue stable quieted down after racing. Those in a red stall remained restless longer.

Going back to the color circle we see that yellow is the brightest and blue-violet the darkest hue. Those two have the strong dark/light contrast. At right angles are red-orange versus blue-green, the two poles of warm/cold contrast.

Cold/warm contrast doesn't just affect the feeling of warmth, it also impacts the feeling and mood of pictures. On a primal level, the night is dark and blue, the dawn yellow and bright.

In a landscape, distant colors take on a bluish, colder cast because of the ultraviolet light reflected off the intervening "thickness" of the air. In that way, tonality can be used to differentiate distance and nearness. These are subtle differences to be sure, but for some they are meaningful.

Complementary colors produce gray when mixed in equal parts because they diametrically opposed to one another. When next to each other they annihilate themselves. (Sounds like some people I know.)

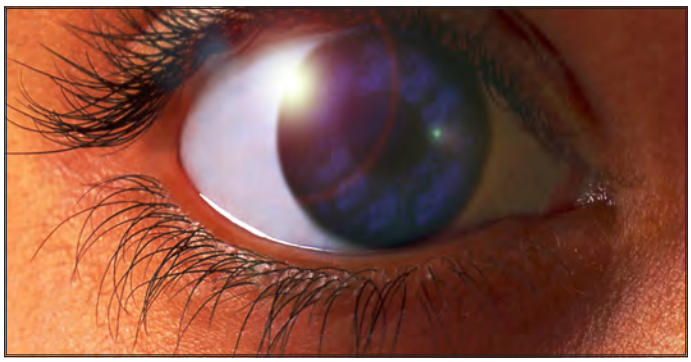


Complementary colors include pairs like yellow/violet, blue/orange, and red/green. Equal parts of complementary colors mixed produce gray.

(In the case of additive RGB light colors, *white* is produced when complementary colors are equally blended.)

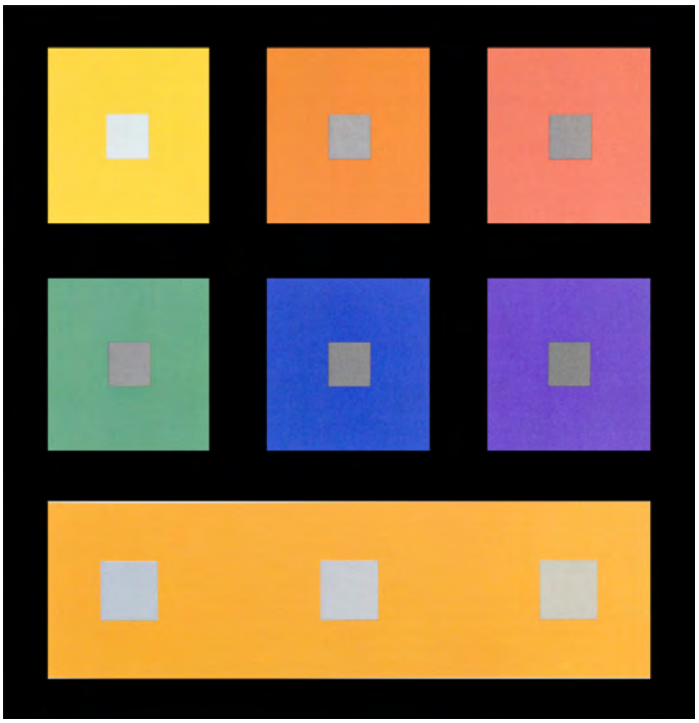
These types of contrast are most easily controlled using Image > Adjust > Hue & Saturation. Adjust the Saturation and possibly the Lightness as well, although I usually switch to the Levels or Brightness and Contrast tools to do those adjustments.

Simultaneous Contrast



Simultaneous contrast occurs when the eye "requires" the complementary color, or creates it where it doesn't exist. The effect cannot be photographed because the effect is a construct of the mind, as is all perception.

Simultaneous contrast occurs at the border between a block of one color next to neutral gray. It also occurs in after-images burned in to the retina and appearing in the mind's eye as inverted versions.



Each gray box seems tinged with the complementary color of the box it lies within. None of the grays do not look alike as a result of simultaneous contrast.

You can effectively boost or subdue one color by controlling an adjacent one.

If your client is selling gray sweaters, they better look gray… and it may not be the sweaters' nk color that needs prepress adjustment to make it look gray.

Usually, simultaneous contrast is not be noticeable or objectionable unless there is a significant amount of a strong color near or adjacent to the gray sweater. Assuming there were, your adjustment would begin by isolating the gray sweater with a selection tool, then copying the gray sweater to its own layer above the other colors. On either the gray-sweater or background layer, or both, use Image > Adjust > Color Balance to first alter the gray to make it look more gray. Failing that – or enhancing it – the adjacent block of strong color can have it's contrast reduced by adding a complementary color. Reduce blue by moving the Color Adjustment sliders towards yellow. Notice how the Color Adjustment tool is based on complementary (opposite) colors. Magenta reduces Green, Cyan reduces Red, and Yellow reduces Blue. Further adjustments to Levels may also help, as might Brightness and Contrast.

Contrast of Saturation

Saturation refers to the purity of a color. Pure colors are undiluted, fully saturated and rich.

Pure colors can be diluted four ways:

- *White* renders colors colder. Adding white cools yellow whereas the character of blue is hardly changed. Dark violet can seem menacing whereas adding white for a shade of lilac is more pleasing.
- *Black* deprives a color of its brilliance and makes it "dirty". Some colors can "take" black more than others. Blues are easily extinguished by just a little black, whereas black with yellow can provide its own sub-spectrum (but eventually is deadened by the black).
- *Gray* reduces the intensity of colors. A saturated tone mixed with gray may have the equal or even greater brightness but still is less intense.
- *Complementary colors* move towards gray, as noted above. Blending combinations of complementary colors with white or black produces an infinite spectrum of rare tones.

Adjustments to saturation and lightness using Hue & Saturation will accomplish this adjustment.

First the hue has to be isolated. Use Select > Color Range and sample the hue with the Eye Dropper then adjust the "*Fuzziness*" (sensitivity to similar colors and shades) to zero in the selection to isolate the hue to be adjusted. Further adjust your selection's size and feathering as desired.

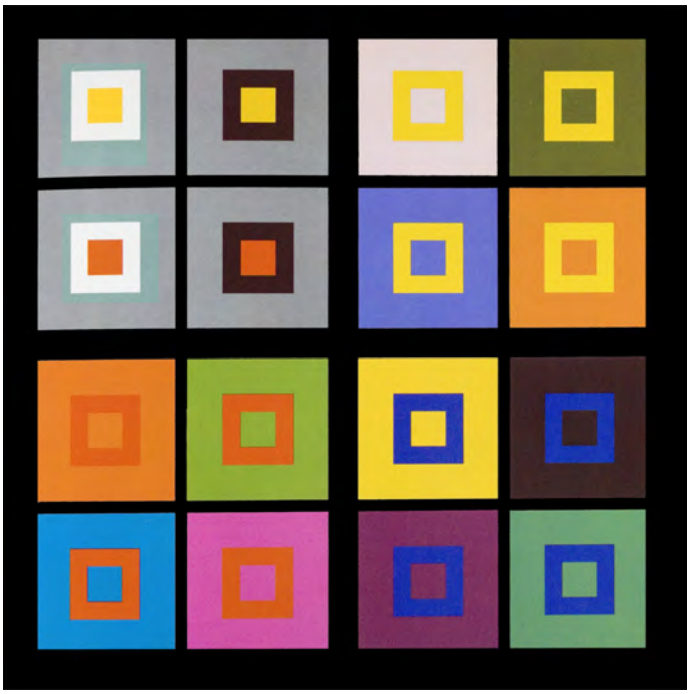
Finally copy and paste to a new layer. Labeled the layer with the Color Number. To find the color number use the Color Picker. Double click the Foreground Color (which should be the color you sampled).

With the desired hue now on its own layer, it is easy to control the saturation and brightness of that layer.

Contrast of Extension

Two factors influence the "force" of a color. Brilliance is one and "extent" is the other. Contrast of extension modifies the effect of any other contrast and involves differences in quantity… much versus little, big versus small. The proportional amount of complementary (and other) colors in an image creates contrasts of extension.

Contrast of extension applies to giclée prepress in the sense that as the look of the original and giclée will differ, so will the contrasts of extension.



Notice how the contrast between red and green changes with its proportional dominance in the image.

For example, if the illustration above were going to be made into a giclée the contrast between the red and green will differ. If that contrast is important enough, one or another or both of the tones are going to have to be modified to achieve the desired visual contrast balance.

An example of the foregoing might be an ad illustration for a lady-bug distribution company showing a little red lady bug on a big green leaf. Without proper contrast of extension, the lady bug might be less noticeable.

Contrast of extension can be most easily controlled in PhotoShop using Hue & Saturation to adjust the saturation of the colors involved until you get the amount of "pop" desired. Another quick fix is to beef up the contrast of that hue using Brightness & Contrast.

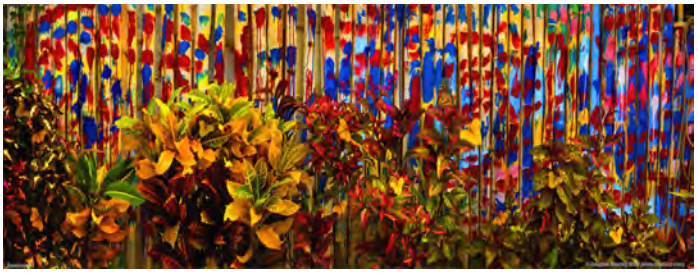
As you've likely noted, you can control just about everything by first isolating the element(s) and adjusting their Levels, Hue & Saturation as well as Brightness & Contrast.

Dynamic Tone Range

The result of all adjustments is the *Dynamic Tone Range* of the picture. Actually, you start with one too. Hopefully the one you finish with is wider than the one you started with.

Dynamic tone range capabilities and requirements change with every type of device and media, giving the prepress artist some job security.

This snow scene has a short range of tones, primarily blues and blacks.



This picture has a long tone range involving many shades of many colors spanning the entire range of any gamut used.

Every different kind of input device (camera/scanner), display or output device only produces a limited range of colors. Some can make or show more than others. *Gamut* refers to the total number of colors available and is another way of referring to the dynamic tone range.

No matter the length or depth of the tone range, the extreme ends are what you should pay attention to… the Highlights and Shadows. "Highlights" means all light tones and "Shadows" means all dark tones.

Use the Eye Dropper tool and sample the whitest whites and the darkest black… the White Point and Black Point. Open the Info Panel and observe the RGB and CMYK numbers for the Highlights and Shadows.

If the Highlights are 255 they are "blown out". There is no ink (or data). 255 offers nothing to work with, nothing to adjust. To get back control, highlights will have to be made (see *Step Seven: Highlight Control*).

Although making highlights is not a big deal, there's still some time and effort involved. It's something you should get used to doing, because most of the files people send you will have this problem.

If the dark tones are zero or near zero that's another dead end. Zero is the end of the line. As the song goes… "black is black". 100% black may over-ink your print, clogging up shadows and hiding detail in the dark tones. The dark tones become "lost in ink". It's no big deal to fix (see *Step Eight: Dark Tone Control*) and is another very common flaw in the pictures you will be asked to "giclée". (The word giclée is not a verb, strictly speaking. But I use the term as a verb as "slang" usage. It's more fun.)

Besides these kind of problems, the artwork you will be printing may have colors that are outside the gamut of your giclée printing machine.

Traditional printing processes can fix problems like that by adding a "spot color" which is a specially mixed color applied with a separate printing plate.

Colors that must be a 100% match to a PMS color are printed using spot colors. Separate plates and spot colors are also used for tones that cannot be accurately reproduced in the four-color process (and there are many).

However, giclée prints don't use plates so spot colors are not an option. But don't fret because there are ways to get very close even if you can't be matched 100%.

Make a test print of the picture on the selected media. Compare the colors to the original, using full-spectrum lighting, either Daylight or equivalent. Identify which colors are off, and what the issues may be (hue, saturation, brightness).

To get ready for making adjustments, duplicate the picture layer in PhotoShop. Put the copy layer on top and turn off the original picture layer. No work will be done on the original. It will stay at the bottom of the layer stack in case we need to refer to it later. The copy layer becomes the new working master.

Make the necessary adjustments for basic problems on the working master and then a second test print or test strip of that adjusted file. Identify which colors are still off, and what the issues may be (hue, saturation, brightness).

If a range of similar colors is the culprit, you may be able to make global adjustments to the entire picture or selected areas by using Levels, Hue and Saturation, as well as Color Balance. But what if one or two colors are still wrong?

Segregate the offending colors onto separate layers for individual adjustment using the same tools.

Duplicate the working master layer and label it with the number of the color being adjusted.

Use Select > Color Range. Sample the color that needs to be corrected. Define the precision of your selection using the *Fuzziness* setting. Wherever that color appears in the picture, those areas will be selected.

Enlarge the selection by one pixel using Select > Modify > Expand. Feather the selection at least 1/2 pixel with Select > Modify > Feather. The slight feathering helps the blend and the slight enlargement gives you some "cushion" that you can leave or erase away later if need be.

Invert the selection and delete what has not been selected. Or, without inverting it, copy the selection from the working master layer and paste it onto a new layer bearing the name of the color.

All instances of the defective color should now be on a layer and can thus be individually adjusted using Levels, Hue and Saturation, as well as Color Balance.

Repeat this procedure for as many offending colors as you have, with only one color per layer. Now, as you make further test prints or strips, you will be able to individually control the inking for those colors until you get them just right. After a while you may see that certain colors always need a push or a shove one way or another. That's the color "character" of your printing machine.

Every imaging device has certain colors that it does better than others. Some devices can really over do it. Usually the problems will involve one of the three primary colors.

There`could be more than one problem. Reds might be characteristically too strong while greens could have another chronic problem. If the picture being printed depends on the problem colors you may be able to use the procedure just outlined to isolate the trouble making colors and adjust them individually.

Forest Pond
© Douglas Mesney 1957-2010

Giclée Prepress Workflow

Step Three

MEDIA SELECTION

The Touch and Feel of Giclée.

Your initial consultation with the client will include a discussion of media for the giclée print. Most clients have some idea what they want but might not be aware that only some types of papers and canvases are qualified for giclée printing. They are ones that have been treated with a "ground", a coating that will accept giclée inks.

Giclée printing equipment manufacturers like Epson, Canon and HP all sell media with grounds that have been formulated for their inks. You will get the "best" and most consistent results staying within a particular brand. In my shop we use Epson technology.

Art-paper companies like Hahnemuhle, Moab, Arches and Cason have also offer a wide range of fine-art papers and canvases properly coated to accept giclée inks.

Each media has a color Profile that should be used to "soft proof" during giclée prepress work as well as to print the giclée. Soft-proofing involves the computer adjusting the monitor display colors to approximate the look of the media selected. You do that with View > Proof Colors and you select the profile with View > Proof Setup.

Any paper or canvas can be prepared for giclée printing by treating it with a ground coating. *Golden* paint company offers three kinds of grounds.

Three Grounds from Golden

In the words of the manufacturer, here are their qualities:

"Digital Ground White (Matte) is a porous, opaque, white ground, for use on a multitude of surfaces. Like other porous ink-jet coatings, it allows prints to dry extremely rapidly, making it the safest choice for use with unmodified desktop printers that still have 'pizza wheels' or ejection rollers. It is also an ideal starting point for the first-time user looking for the most trouble free application on a wide range of materials.

"Digital Ground Clear (Gloss) is a clear ground with a gloss sheen for use on most absorbent surfaces, allowing the underlying material to show through. Similar to other ink-jet receptive coatings that swell, prints dry much more slowly, which can present problems for desktop printers that have ejection rollers or 'pizza wheels'. While there are rarely if any problems when used on very porous surfaces like paper, we do not recommend using relatively non-porous substrates coated with the Digital Ground Clear on a desktop printer unless the printer's 'pizza wheels' or ejection rollers have been removed. However, such modifications of your printer are at the users risk and may negatively affect printer performance or void the printer warranty, etc.

"Digital Ground for Non-Porous Surfaces is similar to the Clear type described above but optimized for increased adhesion and performance on non-porous surfaces such as aluminum or plastic. We do not recommend using the Digital Ground for Non-Porous Surfaces on a desktop printer unless the printer's 'pizza wheels' or ejection rollers have been removed. As before, such modifications of your printer are at the users risk and may negatively affect printer performance, void printer warranty, etc."

Media Qualities Affect Giclée Prints

Papers vary in color, texture, weight, surface and size. The qualities that most effect the giclée print are color and surface.

Color Determines White Point

It's easy to understand that if you print a picture on pink or yellow paper it will look different than if it were printed on white paper. The important thing to remember is that the color of the paper is going to be the white point in the giclée print. Unlike silk screen printing, vinyl inks and other specialty printing techniques, there is no white ink.

It follows that all colors "needing" white (virtually every non-pure color) will shift. Thus, the "function" of white in the dynamic tone range is anchored in the whiteness of the substrate media, be it paper, canvas or film.

Although art papers and canvases aren't pink or yellow, each has a unique warmth or coolness, and a few are "white" white. (To properly manage color be sure to acquire and install the appropriate profiles for the media you will be printing on.)

Surface Creates Look

The look of a giclée comes in part from the media it is printed on. The same picture printed on different media looks and feels different. Together, the media's weight, fiber texture and surface qualities a giclée its "character". Glossy prints have a totally different character than on rough surface watercolor papers or the woven texture of canvas.

Glossy surfaces provide the finest detail and widest dynamic tone range. Technical illustrations and scientific pictures benefit from the greater resolving power of glossy stocks. (Resolving power is the number of fine lines per inch that can be seen.)

Glossy surfaces also provide more tones because they have the darkest black point. The black point is darker because the ultra-smooth surface produces no scatter-light. Scatter light produces the same effect as fog… it reduces contrast.

Scatter light is not always your enemy. Hollywood lighting directors use fog to be able to extend the dynamic tone range captured by the motion picture camera. By adding a small amount of fog to the air in a room, blacks become dark grays and all tones are slightly 'lifted'.

The effect is minimal in the foreground because the fog isn't too deep. But the background is seen through a thicker layer of fog, and so the contrast reduction provided by the fog increases with the distance from the lens. It is a neat trick to add shadow detail in the background while bringing out the foreground with comparatively greater contrast.

A popular printing technique is to use glossy varnish on some parts of a page and matte varnish on others. The blacks in the glossy parts make it pop out more than its (matte) surrounds. This technique can be mimicked when coating giclée prints with liquid laminates or varnishes.

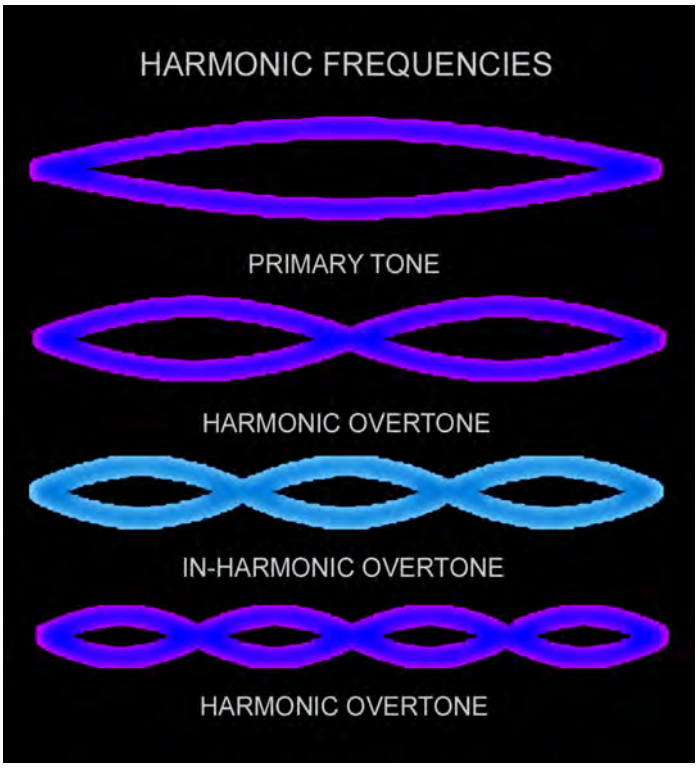
Prepress for glossy-finish giclées is all about extending the dynamic tone range as far as you can. No other media type provides the visual depth of a glossy finish. It's the difference between looking into a clear pond or clouded water, and always a matter of degree. Depth comes from "rare tones".

Rare tones are to pictures what overtones and harmonics are in music. Overtones are multiples of the base frequency of a sound. Multiples that are "whole" are called *harmonic.* When whole multiples are divisible by the original tone frequency, they are harmonious and called *harmonics.*

Overtones can also be *inharmonic.* Inharmonicity is the degree to which the frequencies of the overtones differ from whole multiples.

Every sound frequency has an opposite that "cancels" it. That is the principle behind sound-cancelling headphones and car interiors. The same phenomenon occurs with color opposites. Color opposites are called *complementary colors.*

The sounds we hear are combinations of harmonic and inharmonic overtones. The uniqueness and specificity of the overtone combinations allows us to differentiate between one violin or another, or two song birds. The combination of overtones unique to an instrument is called its *timber.*



Harmonic tones are whole multiples of the original frequency (1-2-4-8-16, etc.). Odd multiples are inharmonic to the prime frequency.

Rare Tones Are Visual *Timber*

Timber is a musical term that involves harmonics. Harmonics are mathematical multiples of a basic frequency, as seen in the illustration above.

Frequency is the measurement of a wave's cycle pattern. One wave is measured from peak to peak. The number of waves per second is the frequency of a wave.

Light is a wave, just like sound, so the same illustration can be used to show what "*rare tones*" are, that is the mathematical multiples of colors. Some colors work together and others don't (which work and don't work is in the eye of the beholder).

Saturation, contrast, brightness and hue influence rare tones more "normal" tones. This will become immediately apparent as you start working on any scene that has a dark-on-dark or light-on-light character. Without prepress to work-up the rare tones in the shadows and highlights the print will have less "life".

Rare tones are what fine printing is all about. It is the rare tones that extend the dynamic tone range. Extending the total number of tones adds *depth* to the image.

Suppose you took a picture of a clear pond. How deeply can you see into the water in the giclee? The wider the tone range, the deeper you'll be able see.

Your job as a prepress artist is to bring out the rare tones, to reveal them the way darkroom printers do in photos when they burn and dodge to reveal shadow and highlight details.

First, extend the dynamic tone range of the original to bring out the widest dynamic tone range, and then "translate" that to match the capabilities of the giclée printer and media.

After getting the file into the chosen color space, you can build rare tones that possibly don't even exist in the original but which would significantly improve the look of the giclée. Now, *that* is the 'art' of giclée.

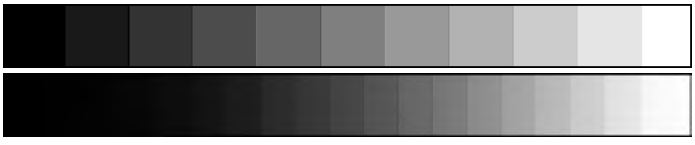
Averaging Is The Root of All Evil

Averaging is what nearly every kind of imaging device does in an attempt to deliver the highest quality. Unfortunately, averaging also wipes out rare tones that lie in the highlights and shadows. That is why you have to manually extend the dynamic tone range, putting back what averaging took away.

Even the best cameras and scanners can't capture all shades of all colors. Each has limitations. Shooting into the sun has given us all experience in this kind of limitation. You can see into the silhouettes but the camera can't.

Hollywood goes to great lengths to light-up *exterior* shots, to be able to see into the shadows and capture the rare tones. Many cameras have built-in fill-flash to balance the tone range by adding light in the shadows.

To achieve rare tones requires adjusting the dynamic tone range of the object being photographed to fit within the recording limits of the camera.



Consider these two gray scales. One has 20 steps and the other 10. What if your camera's color space only has 10 shades of gray. What will the 20 step gray scale look like in a 10-step space?

It will look like a 10-step because the "other" 10 shades are rounded up to the nearest available shade. The 20 shades are rounded up to "fit" in the 10-shade gamut. The rounding up is done by *averaging*.

Averaging involves an almost limitless number of algorithms because the camera has no idea what it is seeing.

Your camera is clueless whether it is on the beach in Rio or deep in Howe's Cavern. Highlight detail is needed on the beach, but shadow detail is needed in the cave. Granted that those are extremely different situations, one very bright and the other dark as night. But that is the point: extremes are not treated well by averaging because extremes aren't... *average*.

Most recording devices take the middle of the road approach and must be manually controlled and adjusted to take on extremes of any sort. Programs and other automatic functions that are built-in cannot handle extremes, losing detail in the highlights and shadows.

Worse, many programs "help" by automatically adjusting the color, contrast, saturation, sharpening and any number of other image-critical characteristics, all in the name of good pictures. These "features" may be helpful for the technically challenged and Luddites among us. However, they are likely the source of the prepress problems you are working on now or soon may be. Fortunately there are some quick and easy procedures to put tones where none exist in the original. (See *Steps Seven and Eight* for more on this.)

As the camera exposure is reduced less light reaches the sensor or film. As the light is reduced the Black Point moves and subtle shades of dark gray are rounded up into black.

It only takes one bright light or object in a scene to throw off an automated exposure system. Reacting to the bright source light, it reduces the exposure which puts the dark tones in jeopardy.

As the lighting is lowered or the camera exposure shortened more and more dark shades fall into the oblivion of blackness... lost in the shadows.

The same effect occurs with inking of dark tones, even a small adjustment of ink levels in the dark tones can reveal or wipe out rare tones.

Many of your clients probably shoot in automatic mode and may not be aware that their dynamic tone ranges are "clipped". Later, working in their digital darkrooms, many are thrown off by working in RGB on a light-emitting monitor.

Images have stronger colors and more contrast on monitors than printed versions will have. If you are outputting to AV devices like projectors and monitors that's OK, then you are looking at what your viewers will see.

But in the case of giclée prints, the monitor image is quite different and only after considerable interplay between printed pictures and their monitor avatars will you get a real sense of how to make prepress adjustments.

There are almost always more tones that can be milked out of the image file. Extra 'information' is lurking in the shadows, which can be developed into rare tones which extend the total range of colors.

Making slight differentiations in the highlights also extends the dynamic tone range. Light tones and highlights are more problematic than dark tones because many capture devices clip them due to overexposure. Remember averaging? The lightest tones are rounded up to white. These kinds of problems can only be fixed by adding tones where none exist in the file. Something from nothing... that's the magic of giclée prepress.

Nuancing the rare tones out of a pictures highlights and shadows is time intensive work and you may choose to charge for your services beyond the basic amount included in the file set-up, which is discussed in Step Four.

Prepress Requirements Vary With Media

Different media types require different amounts of prepress. That is because each media presents a different dynamic tone range, particularly in the dark tones and blacks. In fact, if you line up the same picture printed on matte, satin and glossy stocks you will immediately see that only the glossy surface print has true backs. The others will be shades of gray in comparison.

Prepress adjustments must cater to the look that the media is capable of presenting. There is no point in developing rare tones in areas that won't show. Or is there? Perhaps intensive prepress is needed *because* of that deficiency.

Knowing where you are and where you're going is the best starting point for any project. In this case, you need to know what's in the image file data and the dynamic tone range of the media.

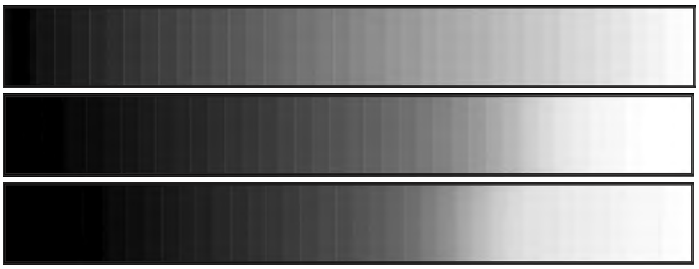
Even if you will be making a matte-finish giclée, you can make a test print on glossy stock to see what is in the file, what you have to work with. Although you can also do this on your monitor, it is a good idea to make the print because you see more shadow detail on a monitor than on paper. You need to see the actual inking levels because that is what your prepress work is going to be controlling (unless your output is audiovisual).

Glossy Finish Media

Glossy surfaces reveal the widest dynamic tone range. That is why publications, printers and others involved in photo-mechanical reproduction prefer photos and art on glossy paper.

Photo-mechanical reproduction processes build contrast every time another copy is made. The artwork you send the printer is photographed to make a printing negative, the negative is printed onto the plate and so on. Every step of the way, contrast builds and the dynamic tone range is truncated as a result.

Contrast eliminates tones. If we use a 40-step gray scale to describe the truncation, every photo-mechanical procedure eliminates one step on each end, on average. Ten copy-steps later you're down to about 20 steps and higher contrast as a result.



Using traditional analog photo-mechanical reproduction materials (film & chemistry) every step builds contrast, reducing the tone range. Starting with a 40-step gray scale (top) the first copy steps strips away the lightest and darkest tones (center). By the second copy step (bottom) the dynamic tone range has been squeezed noticeably.

The squeeze on the dynamic tone range is why publishers and printers always want glossy prints... they want to start with as many tones as possible.

This effect does not occur when digital files are copied however it does start to creep in when any kind of optical system is involved, like a camera or scanner lens.

Although most giclée clients aren't interested in glossy stocks you'll want some on hand to make technical analyses of images destined for output on other media.

Glossy paper is also good to learn with because its overall look is the closest to what you see on the monitor. That makes it easier for you to see the results of your prepress adjustments to color and contrast, etc.. If glossy paper isn't available, use the closest thing. Luster finishes are good. Satin is closer to matte and less desirable in terms of dynamic tone range width.

Pay the most attention to saturation and contrast which are the biggest differences between monitor color and printed color. Monitor colors are saturated with strong contrast. Printed colors are less saturated and flat looking. Judging an artist's pastel original on a monitor is an acquired skill for a prepress artist.

Soft pastel tones that are very light and deep rich dark ones are the best to use for learning prepress adjustment of color. Even slight variations of any image adjustment controls (Brightness and Contrast, Levels, Hue & Saturation, Curves) will be visible where they would not be on stronger more saturated tones.

The way colors change using image adjustment controls is somewhat counter intuitive. To move light tones in the direction you want may require tweaking the dark tones, or vice versa. You may need to adjust the contrast before adjusting the color, particularly in the case of light tones. Generally, work on the shadows (dark tones) first, then the highlights, finishing with the mid-tones.

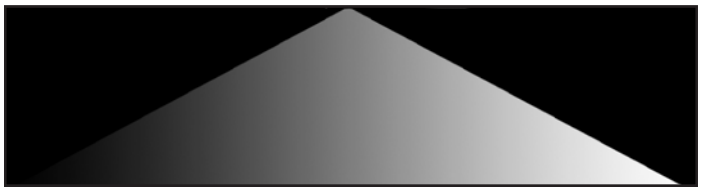
To make color adjustments begin with Levels. Use these adjustments to get the overall "exposure" correct. The objective is to get a good looking *histogram.*

Histograms are the road map to your dynamic tone range. The historgam shows you the tone distribution in your image. It makes it easy to see if your range is out of whack.

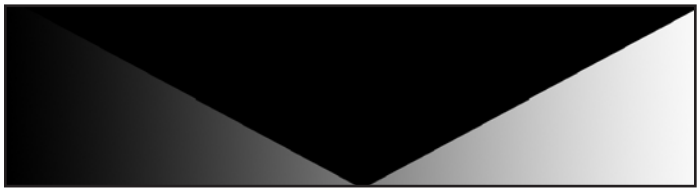
Histograms are used to determine which parts of the dynamic tone range are included in the image. You can see at a glance whether there is too much white or black. Where light tones slip away into white, or dark tones into black can be easily seen.

The basic idea is to center the shape of the histogram on the horizontal scale. If the picture is predominantly light or dark, accommodation must be made for that by adjusting the exposure to favored the desired parts of the dynamic tone range. Those can be seen in the peaks (or valleys) of the histogram curve.

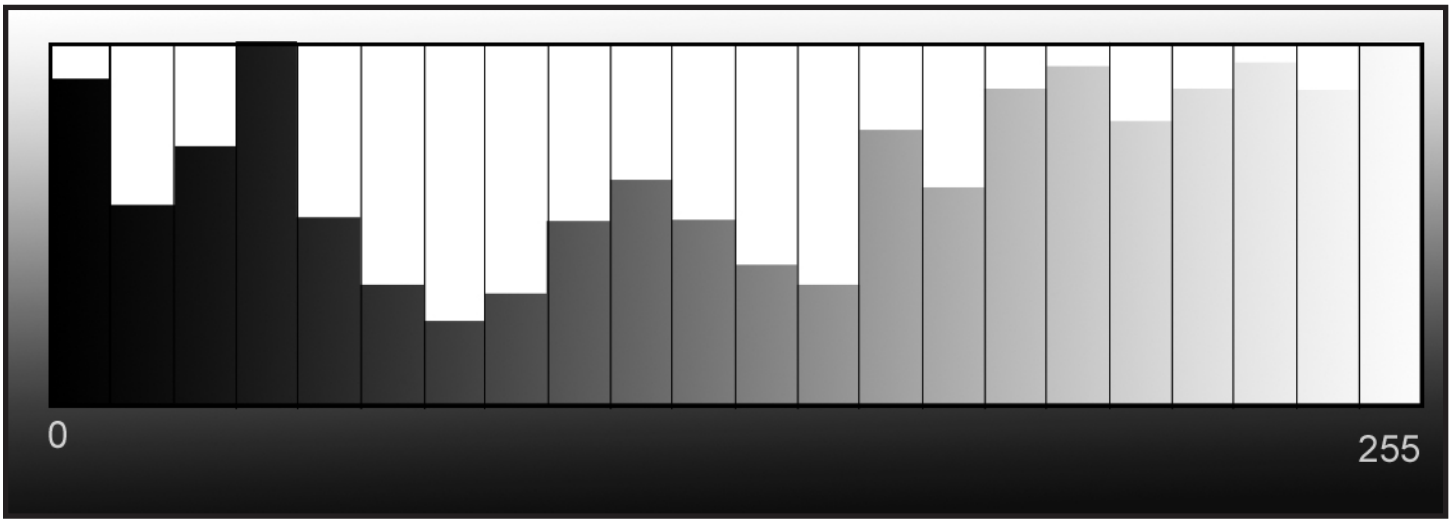
Histogram scales are divided into 256 steps which are shades of gray ranging from black (0) on the left to white (255) on the right. The image is interpreted as a black-and-white version rendered in 256 shades of gray (4-bit color). The number of pixels of each gray shade is calculated and plotted as a graph along the 0-255 scale. The height of each bar indicates the number of pixels of that shade.



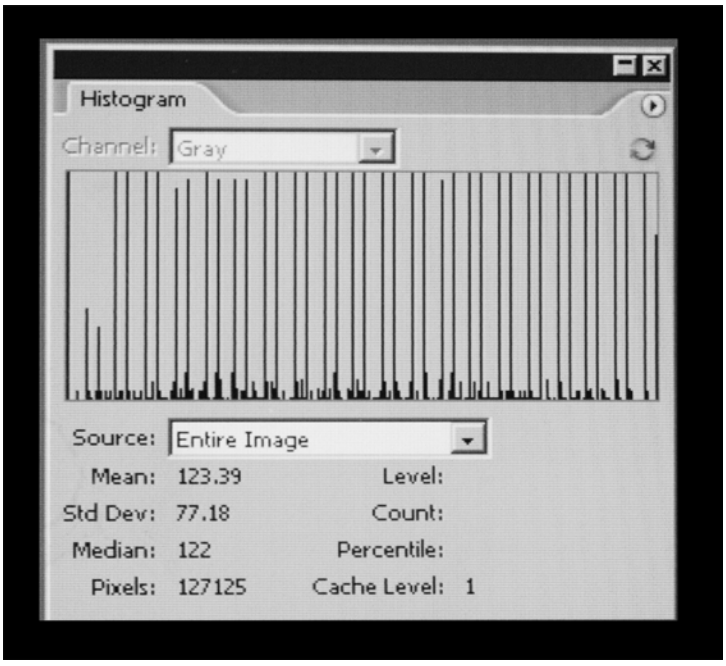
Mountain shaped histograms (above) indicate lots of mid tones and few light and dark tones. Valley shaped histograms (below) indicate few mid tones and lots of light and dark tones.



This very oversimplified version of a histogram (below) gives a better sense of how each bar represents a pixel quantity for a particular shade of gray.

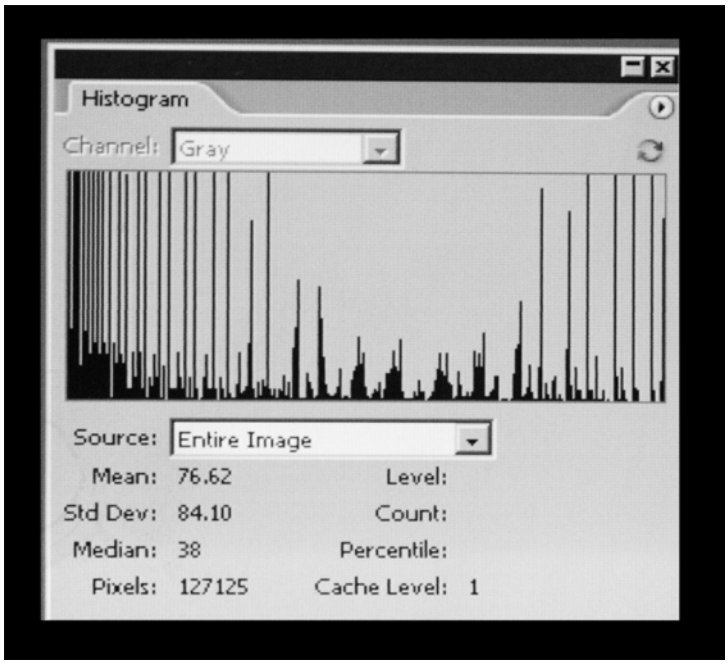


This 40-step gray scale (above) appears on a histogram (below) as 40 tall bar lines. There is one bar for each shade of gray.



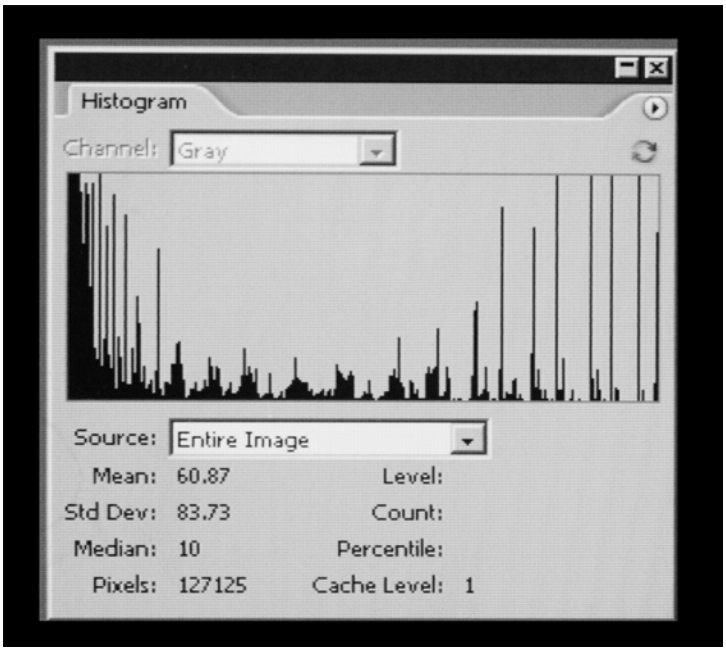
Histogram for 40-step gray scale predictably shows 40 distinct tall spikes representing the 40 shades of gray. The slop along the bottom are the other shades of gray that occur along the borders between the 40 wedges.

Below is the histogram for a 40-step gray scale (above) suffering contrast build from one step of photo-mechanical copying.



Notice that compared to the original histogram the mid-tones region has the shape of a trough revealing that there are fewer mid-tone pixels ...those shades were lost in the first photo-copying step.

After the second photo-copying step even fewer mid tones remain on the gray scale. More dark tones have slipped into black, as seen below.



The loss of mid tones is clear to see in the histograph of the gray scale fter a second photomechanical copy has been made.

Histograms reveal the fundamental dynamic tone range. They are used to judge exposure and make sure that important data in shadows and highlights isn't clipped.

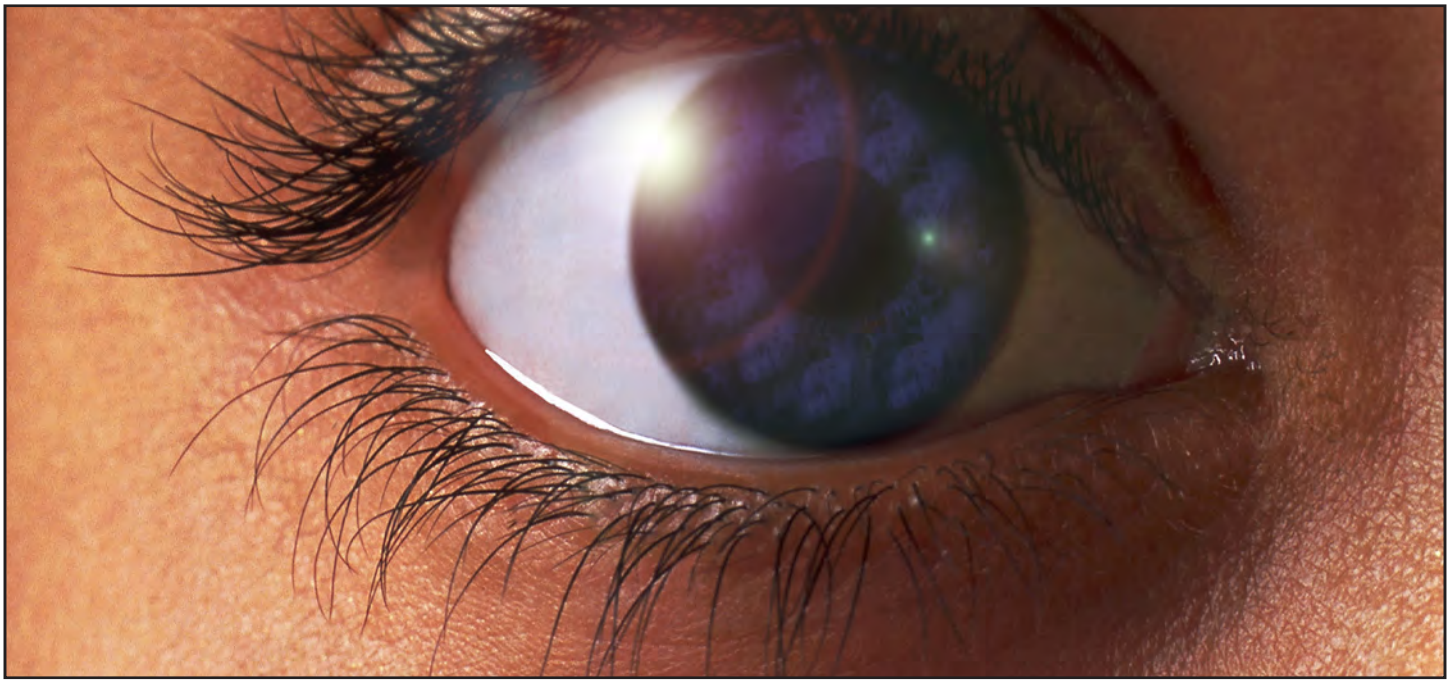
The picture of an eye (page 60) has a histogram (page 64) that shows a full dynamic tone range between the black point on the left (0) and the white point on the right (255).

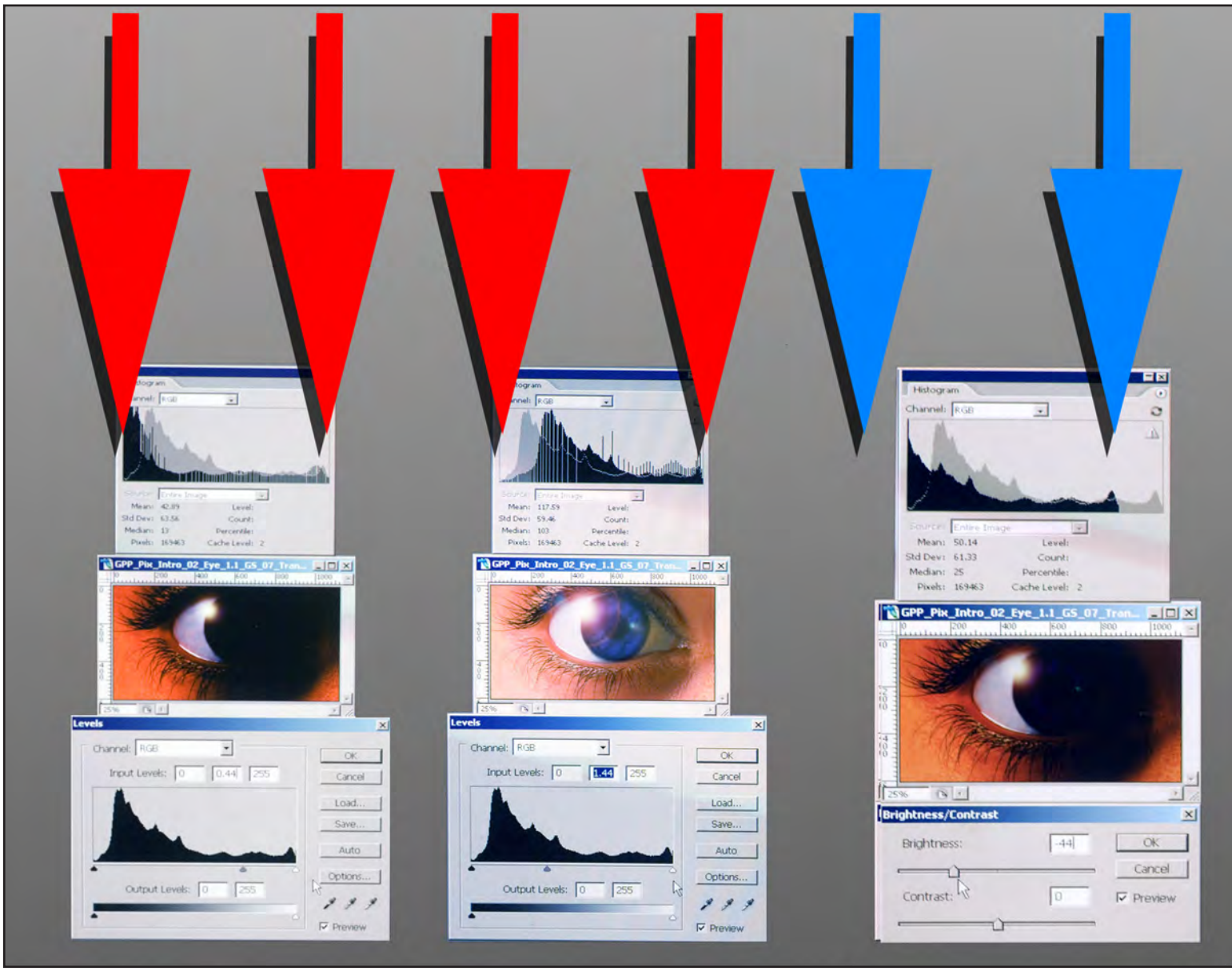
The rise of the curve on the left shows that there are more dark pixels than any other kind. Even though that seems obvious, what is less so but more important is the extreme left side which shows that there are almost no black pixels. That is good news. On the right side we can see that there are quite a few white pixels (which are the large highlight on the eye).

As alterations are made to the picture by manipulating image adjustments, the histograms will show how the dynamic tone range is influenced.

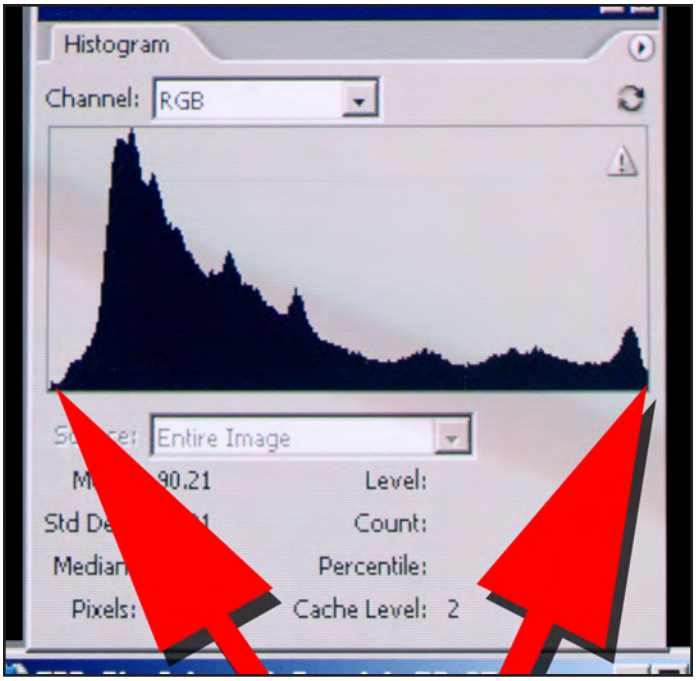
Some image adjustments push the curve off the chart, which means that data is lost. That is particularly true of the Brightness and Contrast control. On the histograms that follow you can see that Levels can be used to accomplish the same thing as Brightness without losing data.

Levels changes the brightness of some tones relative to one another and is a dynamic change. Brightness increases the energy of all tones equally and is incremental, not dynamic.



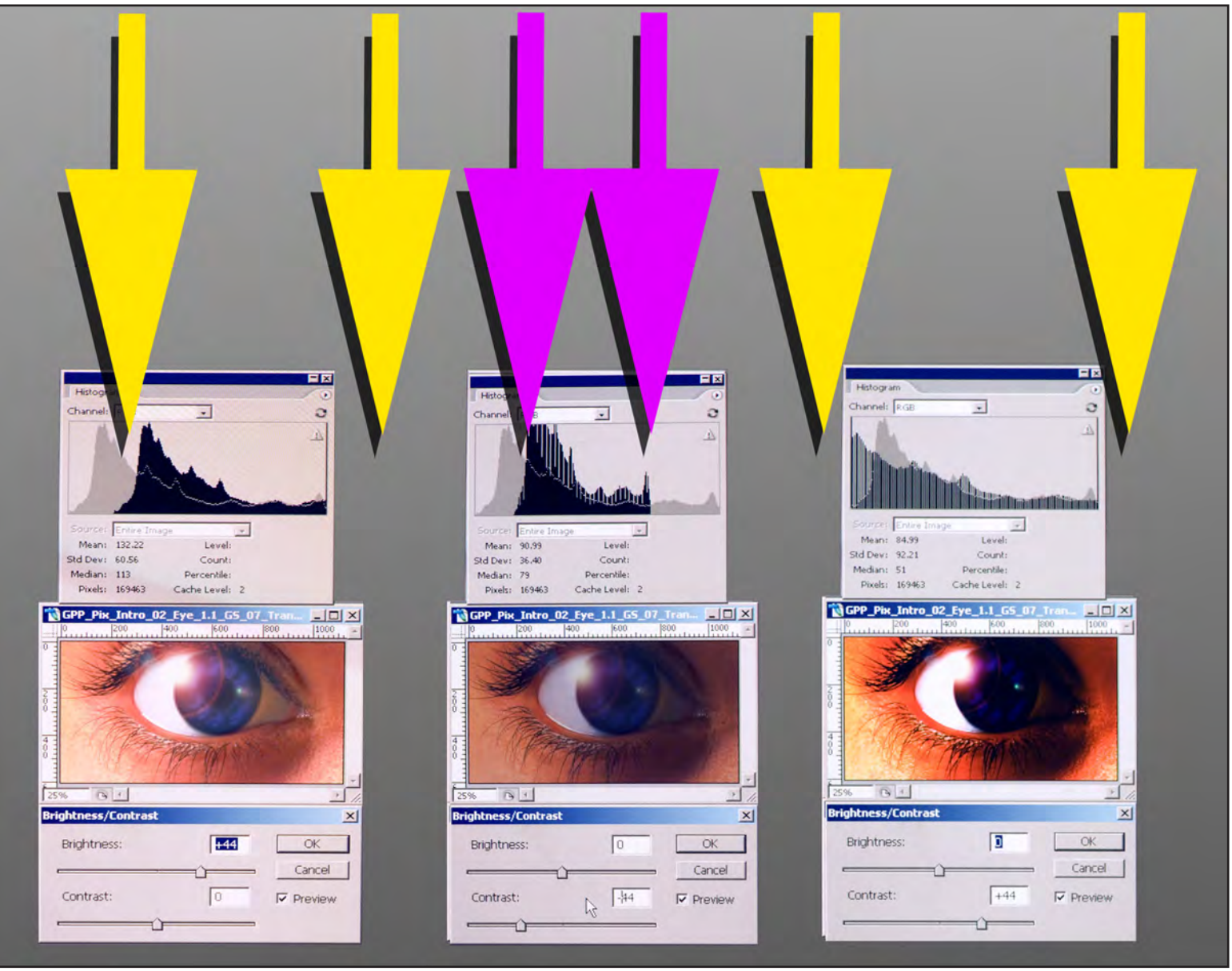

Histogram
Channel: RGB
Mean: 50.14
Std Dev: 61.33
Median: 25
Pixels: 169463
Level:
Count:
Percentile:
Cache Level: 2
GPP_Pix_Intro_02_Eye_1.1_GS_07_Tran...
Levels
Channel: RGB
Input Levels: 0 1.44 255
OK
Cancel
Load...
Save...
Auto
Options...
Output Levels: 0 255
Preview
Brightness/Contrast
Brightness: -44
Contrast: 0
Preview

Histograms Show Tone Range Changes



The histogram for the eye picture (right) shows a well balanced tone range fully contained within the Black and White Points. Peaks show a preponderance of dark mid tones. The curve extends beyond the scale on the right indicating that the *actual* white point is off the scale...lost. The visual result is more white in the eye highlight. The black point (left) is within the scale, where it should be.

Any adjustment you make to the image alters the tone range and you can see the resulting change in the histogram. Brightness adjustments stretch the curve off the scale (blue and yellow arrows) . Anything off the scale is lost. Contrast stretches the curve off the scale (green) or compresses inwardly, away from the original black and white points (purple). Only the Levels adjustments work within the original black and white points, so no information is lost (red arrows). Translation: Levels has the greatest effect on mid tones, less on highlights and shadows. Brightness & Contrast has more effect on highlights & shadows. 99% of all pictures require adjustment with all three tools.



Satin and Luster Surfaces

The surfaces of Satin and Luster papers resemble a glossy print that has been gently "sand-blasted". The mirror-like surface of glossy is softened just enough to make hard reflections disappear, yet strong contrast and saturation are retained. These papers have an extended dynamic tone range along with excellent details.

Prepress for luster and satin finishes can be approached as if you were working on glossy stock. Saturation can be pushed more than matte finishes. You can really add some "beef" to the dark tones.

Use Image > Adjust > Color Balance and select Shadows to adjust the coloration of the dark tones.

Begin by moving the color range further in the direction of the pictures dominant tones. For a sunset, try making the Shadows more red and/or yellow.

To reduce a color, increase it's complement (opposite). For example, to remove a magenta tint, increase the green.

After observing the changes made by adjusting the dark tones (Shadows), work on the Highlights (light tones). Try similar adjustments, but also try moving the light tones in the opposite direction to the Shadows. This will reduce the Shadow adjustment but in a way that is more dynamic. For example, if the shadows were made more yellow, try making the highlights more blue, observing the effect on the dark tones.

Get as close as you can using Shadow and Highlight adjustments and then make the final tweak using Mid-tones adjustments.

Rough Surfaces

Rough surfaces more or less obliterate fine details but provide a more artistic feel and touch that can ad value in the perception of customers. People just love the tactile feel of heavy art papers.

Watercolor artists use the rough surfaces in different ways. Some go heavy with the paint, which pools in the "valleys" of the surface creating a saturated look.

Other artists use a "dry-brush" technique that whisks light coats of watercolor across the peaks of the surface for a more pastel appearance. Prepress for one technique would be quite different than the other, especially in terms of Saturation and Levels.

The tooth of rough surfaces contributes to the total look of the print. It can have sheen or be quite matte having a profound effect on the visibility of texture.

The height or depth of the texture can create shadowing when cross-lit furt her emphasizing the media rather than the picture. The peaks pick-up highlights to the extent of their lustrous or matte qualities. The highlights act as a sort of scatter light.

Scatter light, like fog, reduces contrast especially in dark tones. Prepress therefore would attend to fine tuning the Levels or the Brightness & Contrast ratios so that the printed image works *with* the texture instead of against it..

Canvas media has a prominent weave that significantly degrades details but looks painterly. Canvas can even make some photographs look as if they were paintings.

The look of Epson Matte Canvas is completely different than the look of their Satin Canvas. Satin has a prominent weave and considerable reinforcement making it less flexible than matte. Matte Canvas has a low profile weave and stretches more than Satin.

The weave of the canvas can be emphasized or de-emphasizes by the coating used to finish it. Gloss brings out the weave and matte finishes hide it.

If you are making a giclée of an oil painting or acrylic original look closely at the surface to see if the canvas weave is detectable. Many artists use so much paint that there is no apparent weave, in which case emphasizing the weave in the giclée may not be doing anyone a favor.

How much to emphasize the canvas weave is a decision for your client. If gloss is preferred, then you can heighten the Saturation and work as if you were printing on Luster. If matte is the preference, adjust for scatter-light by easing back the depth of the dark tones. Even one or two points can make a difference.

Matte finishes have no black. "Black" is actually dark gray. Prepress for matte is then an exercise in gray-on-gray with no black. Combine that with the increased scatter light of rough surface textures and you have quite a balancing act on your hands. Scatter light dulls contrast and saturation. Instead of darkening tones, lighten them and then kick both the contrast and saturation.

The differences in the perceived dynamic tone ranges of matte and luster finishes can be seen by photographing them and then analyzing the histograms.

Inverted Negative Masks to Control Contrast

Contrast adjustment is easily handled by making an Inverted Negative Mask. To make one, duplicate the picture layer and call it Inverted Negative Mask or just "Mask". The objective is to control the relationship of dark tones and light tones to each other in a dynamic way.

Dynamic in this case means that the effect of the mask will depend on the density of the tone it is masking. The darker or lighter the tone, the more effect the mask will have, pulling the tones toward 50% gray, the ultimate mid tone.

Use Image > Adjust > Invert and then Image > Adjust > Desaturate. You'll see the Mask as a black-and-white negative… a reverse of the original. The procedure of reversing a Pos into a Neg is called "flipping".

Place the Mask layer on top of the picture layer and adjust the Mask-layer opacity to almost nothing… 2 or 3 % may be all you need.

You can completely erase away any mask parts that are objectionable, or reduce their effect by partially erasing them using an eraser brush with reduced opacity or flow.

Shadow-fill masks allow for extremely subtle manipulations of dark and light-tone inking. Duplicating the Mask layer and manipulating its color, hue, saturation (etc.) can make even more precise adjustments to control contrast.

The Final Surface Is What Matters

Giclée prints need to be protected to be archival. (See *Step Twelve* for more on coatings and finishing). Protection comes in any number of forms ranging from glass to coatings like varnish, sprays and laminates.

Whatever the protection layer happens to be, it will have surface characteristics that will change to total look of the giclée. Prepress work should take into consideration what the coating system will be.

Most coatings and laminates offer a range of glossy, satin or luster, and matte. Some have a wider range. All differ in how the descriptive words are interpreted in their products.

Not all satins and matte finishes are crated equal. They differ in the amount of scatter light they produce, which in turn affects the contrast of the finished picture. Scatter light fogs the image.

The absolute best protection is true lamination, in this writer's opinion. The protection layer is thick and even making a better seal than any liquid coating (unless you use many coats).

Giclées heading for the laminating press should not be printed on rough finish stocks or ones with excessive tooth or nap. Laminating works best on smooth surfaces,

For lamination, the more mirror-like the surface better, up to a point. Just as paint does not adhere well to glass, the giclée surface has to have sufficient tooth for the laminate binders (glue) to bite into and hold onto.

Airbrush artists use an ultra-fine pumice powder (called *Pounce*) to rough-up glossy surfaces and give the paint something to adhere to. Laminates have the same need and should be printed on stocks with a smooth finish that is not glossy for the best possible bond.

Using many coatings of high-gloss varnish or liquid laminate on canvas eventually fills in the weave texture. The result is like a flexible glossy photo. Epson's Matte Canvas has an especially low weave profile, so three are four coats are all you need. However, to get the same effect on Epson Satin Canvas you will need many more coats, up to twelve or more depending on your dilution, because of the high profile of the weave.

During the coating process, you can choose to emphasize or de-emphasize your brush strokes by altering the concentration of the coating and the drying time.

All liquid coatings "level" to some extent, just like water in a pond. Normally you want good levelling to get a smooth surface. Thin coating solutions level better than thick ones. If the coating liquid is too thick, or dries too fast at some mid-point in the leveling process, the pattern of the applicator will be visible. If you *want* brush strokes, use thick coating mixtures with a fan blowing warm air (like a hair dryer).

Weight and Fiber Texture Add "The Art Factor"

When people talk about art prints, they're usually talking about work printed on heavy stocks. The heavier the paper, the richer the feel, resulting in greater perceived value. That extra weight is like "more for the money" in the thinking of many customers.

Heavyweight stocks are good choices for giclées that are going out "as is" However, if the giclée is going to be mounted the weight of the stock doesn't matter.

With thin stocks a problem to consider is "*show through*" which produces a ghostly double image.

Show-through occurs when a stock is too thin allowing whatever is under it to show through to some extent or another. You can see this effect if you make a double sided copy on 20-lb paper or lighter stocks.

Thin stocks can cause other problems. There is a limit to a printing machine's mechanical ability to successfully handle stocks that are very thin (or thick). The grippers and rollers may not be able to grab it and transport it properly.

That said, ultra-thin and even transparent and semi-transparent media like acetate and vellum can be used with great affect. Giclée printing on clear film is a favorite way for photographers to make the over-sized negatives needed for making large sized "Platinum" prints.

Specialty and handmade media will probably require you to create custom ICC color profiles.

Paper Qualities Impact Giclée Printing

Rough paper is generally not regarded as a good paper for painting fine detail, but is excellent for a loose, expressive style of painting and printing styles.

Watercolor Paper

Watercolor paper is divided into three categories according to the surface of the paper: rough, hot-pressed (HP), and cold-pressed (NOT, as in "not hot-pressed").

- Rough watercolor paper has the most textured surface, or most prominent tooth. It's sometimes described as having a pebbly surface, a series of irregular rounded shapes like a pebble beach.
- Hot-pressed watercolor paper has smooth surface with almost no tooth. It's smooth surface is idea for fine detail.
- Cold-pressed watercolor paper is in between rough and hot-pressed paper, having a slightly textured surface. Cold-pressed is the most commonly used watercolor paper surface as it allows for a good amount of detail while also having some texture to it.

Soft-pressed watercolor paper is in between hot-pressed and cold-pressed, with a slight tooth. It tends to be very absorbent, sucking in paint or ink.

As simple as one-two-three, a highlight neg mask (above) is applied to control inking in the highlights of the original (right). The result (next page) is light tones with "enough" ink to avoid burn-out. Prepress adapts the dynamic tone range and "look" of an image to the tone range of the printer.

Andrea No. I
© Douglas Mesney 1970-2010

Boss Denbeigh / Car & Driver Magazine
© Douglas Mesney 1972-2010

Giclée Prepress Workflow

Step Four

SETTING UP THE JOB

Layout The Print and The Parameters

To begin, what is the name of the file? Like any digital file, names can aid or impair searches. Not being able to find a file renders it as useless as if it were corrupted. Search is all-important. So as you come to name the file, consider the following example, which is the system, I use.

CLIENT_Title_Size_Version_Date

There's more much on nomenclature, file-naming conventions and archiving in Section Three. For now, we have a file in the works. It has a certain size and must be positioned on the output media, allowing for how it will be stretched, mounted and/or framed.

Two inches is what I normally allow as a minimum border around canvas giclées that will get stretched. Virtually any commercially available stretcher bars can be accommodated with 2-inches of border canvas.

Gallery Wrap

The two-inch border can be used for "*Gallery Wrap*" a technique in which the picture wraps around the edges.

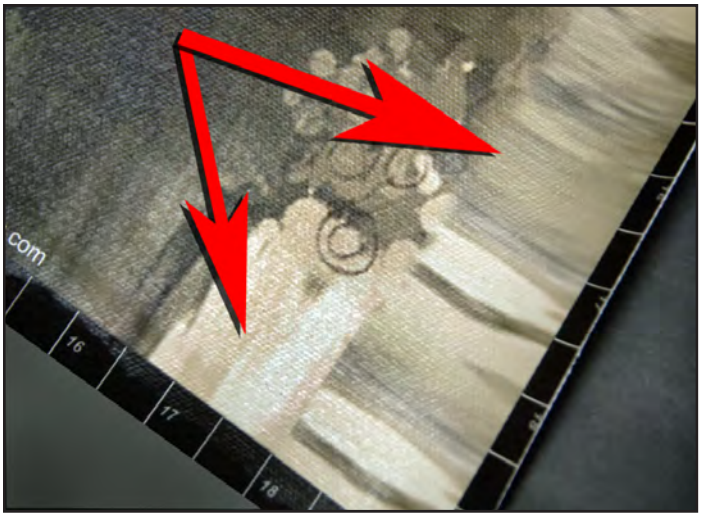
Gallery Wrap is very popular because it spares the cost of a frame and has a modern, border-less look. Some artists take the wrap into consideration when making their picture, but most do not.

To satisfy those who want Gallery Wrap but don't have sufficient picture, I have created a technique dubbed "Faux Wrap".

Faux Wrap involves taking slivers from the edges of the picture and stretching them across an inch-and-a-half of border, joining up with rulers that run around the outer one-half inch of each side.

To set-up a 16 X 20, start with a sheet that is two inches larger on all four sides, or 20 X 24. (For thicker heavy duty stretchers allow 3 or 4 inches all around.)

Around the outer edge place rulers. I use white-on-black, as it is less obtrusive. The purpose of the rulers is to make life easier when stretching or mounting or framing.



Two-inch border around giclée has half-inch-wide rulers at the outer edge and an inch-and-a-half wide Faux Wrap border.

Specifically, they make spacing the mounting staples precise, and that helps get a good even stretch. They are also handy as navigation guides to identify places in the picture when having discussions about it.

In the layers stack position the rulers on top of all other layers for now. In the next steps you'll be tucking the border elements under the rulers.

Making Faux Wrap

Position the original 16 X 20 image in the center of the sheet, then increase the size of the image so that it is 1/4-inch larger on all four sides, or to 16.5 X 20.5. You can do that using Edit / Transform / Scale.

Guides should define the centered 16 X 20 crop, as well as the inner edge of the rulers, one-half-inch in from the outer edge of the 20 X 24 sheet. These two sets of guides allow you to see the Faux-Wrap zone.

Select the outer quarter inch on the left side using the Rectangular Marquis tool. If you have placed Guides and have the Snap To Guides option turned on the selection procedure will go real fast.

Copy and the selected quarter inch of the picture on the left side and Paste the slice onto a new layer. Position the new layer on top of the picture layer.

Use Edit/Transform/Scale and stretch the slice to the left until it slides just under the rulers. Repeat this for each of the other three sides.

Merge the four Faux Wrap sides into a single layer and use Layer > Properties to title that layer "Faux Wrap Frame".

Add 4 new guides, each 1/8 inch *outside* of the 16 X 20 guides creating a square that is 16.25 X 16.25 inches.

Select the 16.25 X 20.25 area these new guides define using the Rectangular Marquis tool. Save the selection if you like, then feather the selection by six pixels or so. Finally, cut or delete the selection to give the border a soft-edge merge.

The last step is to fill in the corners of the frame. Start with the top left corner. Select the empty corner area as well as two inches or either the top or the left frame section using the Rectangular Marquis tool..

Within the selected corner area, use the Rubber Stamp cloning tool with a wide, soft brush and fill in the missing corner. Repeat that for the other three corners and the Frame is done. Or, simply paint them in if that works.

Make a duplicate picture layer and a duplicate frame layer then merge them to create a single layer, called "Picture_ Faux_Wrap".

You can call the picture whatever, however for these instructions the picture will be called... "Picture"). This layer is the one that further prepress work will be done on.

Save the file as Picture 1.1 on at least two hard drives. As prepress work progresses, new versions will be saved as Picture 1.2... Picture 1.3, etc.. Include the size & date.

Faux Wrap takes about five to ten minutes when you get the knack of it. Whether that is worthy of a charge is up to you. At my shop it's part of the good service… a way to give value instead of discounts.

Instead of Gallery or Faux Wraps, some clients prefer a simple black wrap. Whenever you can, save some ink (and money) by using no wrap at all if the sides will be hidden within a frame, or covered with black *gaffer tape*.

With the picture now set up on the media sheet, and the file named and saved, we are ready to begin prepress work Along the bottom side, just above the ruler, place another guide for caption information that identifies the giclée's Title/Size/Version/Date. info you'll need as work progresses.

Layer separations for control of inks. Cool blue tones have been separated from warm, red-yellow tones. The background (bottom) needs high contrast but the curtains (second layer) need low contrast and well as partial opacity with blending options set for lighten. Ganesha *(third layer) has specular highlights controlled by a highlight mask (top).*

Ganesha Rose
20 X 30 / D / AP-1 / 4 / 3 / V1.7 / 08.10.24
© Douglas Mesney 2008-2009 (www.mesney.com)

You Can't Stop A Dove

© Douglas Mesney 1976-2010

Giclée Prepress Workflow

Step Five

BASIC ADJUSTMENTS

Profiles & Soft Proofing

Before the actual prepress work begins, the media profile should be set-up in PhotoShop together with *soft proofing.*

Select View > Proof Colors. Use Proof Set-Up and select the profile for the media you are printing on. You may need to get that profile and install it. Profiles are tagged as *.icc files. In most Windows systems they are are installed to one of these three locations:

- Windows >System 32 > Spool > Drivers > Color
- Program Files > Common Files > Adobe > Color > Profiles
- Program Files > Common Files > Adobe > Color > Profiles > Recommended

Once installed and selected, Proof Colors mimick the look of the printed output as well as an RGB monitor can, which is still quite a leap to the real thing, but better than nothing.

If you haven't already decided whether to work in RGB or CMYK now is the time. That choice might hinge on how the picture will be seen. If it is going to be seen on Monitors or in Films or Videos, RGB would be your choice. However, if giclée or traditional means will print the output you might consider working in CMYK instead. Doing so will reduce the likelihood of working with colors that cannot be printed due to the limitations of the CMYK gamut.

In CMYK mode the monitor will display an approximation of the duller, less brilliant tones you see in the print. The closest approximation is the profile for the selected media.

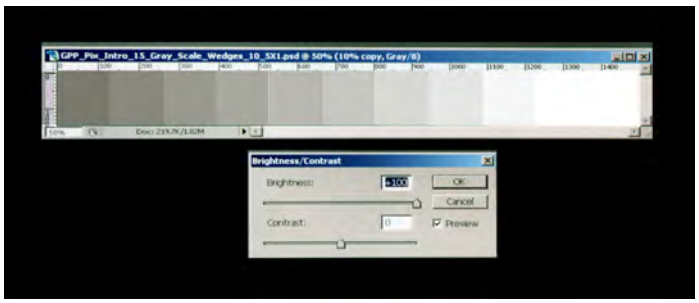
Next make a duplicate of the picture layer and title that layer Levels. Make your basic adjustments to Levels fthen go back and re-name the layer with the setting you used. The new name might be, "Levels +44" or "Levels -22". (The idea is that the label of every layer should tell you what you did.)

Levels may not do the job completely and you may also use Brightness and Contrast. To do that make a duplicate of the picture layer or the levels layer, make the adjustment and relabel the Layer Properties accordingly (for example, "Brightness -33").

Levels adjustments are preferable to Brightness and Contrast because no data is lost using Levels. Examine the following histograms and you will see how Levels adjustments *stay anchored* within the original Black and White Points (0 and 222), On the other hand, Brightness and Contrast push the curve off he scale. Whatever isn't on the scale is lost.

The next three pictures show a gray scale, the gray scale after having Brightness increased 100%, and the resulting histogram.

When a 10 step gray scale (above) is adjusted by increasing the Brightness 100 (center) all shades are diluted with 50% white. The resulting gray scale's "black" is now 50% gray. The original white and black points are pushed off the ends of the scale... *out of existence.*



Brightness and Contrast work differently than Levels. Brightness adds white (or black) to all tones in equal amounts.

Histogram shows the effect of increasing Brightness 100% to the historgam of the 10 step gray scale (above, center). The increased brightness adds 50% white to all tones.

Adding white (or black) to a tone affects the purity. Pure colors have no white or black. Adding white or black produced different shades of the same color.

Conversely, removing black or white from a tone makes it a more pure shade of a color. Removing all black or white returns it to total purity.

Pastels are colors that have been diluted with white or black, Saturated colors are more pure.

Brightness makes colors less pure.

Contrast makes colors more pure when increased and less pure then decreased, as a result of the tone-range curve being compressed (when contrast is increased) or stretched. Compression moves mid-tones into the dark and light tone regions and reduces the total number of tones. As the contrast is increased the compression saturates colors. If you want to increase the contrast without saturating the colors, use a *Contrast Mask* instead.

Contrast masks are high-contrast black-and-white versions of the picture. Duplicate the picture layer. Use Image / Adjust / Desaturate to make a black-and-white version. Place this contrast-mask layer on top of the picture layer. Change the mask-layer blending options to darken. Reduce the opacity of the layer to about 5%. Apply more and more contrast to the mask layer until you see what you like. Adjust the layer opacity again as a final tweak.

Levels makes pictures lighter and darker too, but in a completely different way, "*dynamically*". Dynamic changes are logarithmic. If you increase Levels, each tone gets lighter but not to the same degree. Each tone is effected differently and in proportion to its distance from the Black Point and White Point (0 and 255) at the extreme ends of the scales.

Basically, the curve of the histogram is *stretched* between the two anchor points of 0 and 255 (Black and White). Being stretched he curve changes its contours and shape. As this happens, the *number of pixels* in each column remain the same, but the column changes in position becoming either lighter or darker.

For example, column 222 (which represents approximately 20% gray) is half "full" so we'll say that means it contains 50 units (on a scale of 0 - 100). When the Levels setting is increased from 0.00 to 0.22, those 50 units move 22 columns to the right, becoming 22 points lighter.

The former occupants of column 244 did not move 22 points to the right. They cannot, because 255 is the end of the scale which they are *anchored* to. They may move only a few columns to the right. and that is what is meant by a dynamic adjustment... each tone is differently effected.

All that said, try to make most "exposure" changes using Levels, reserving Brightness and Contrast for further manipulation if required. Then, after perfecting the exposure, procede with color adjustments. If you work the other way around, all your color adjustments will be thrown off when you starting adjusting the expsoure in the ways just discussed.

Follow this sequence of adjustments:

- Levels
- Brightness & Contrast
- Saturation
- Color Balance
  - Shadows
  - Highlights
  - Midtones

Global Adjustments for Printing Machines

If your printer has any color issues that seem to happen all the time, now is the time to make adjustments for them to the extent you can using the machine's global adjustments.

For example, even though the system at Vashon Island Imaging is thoroughly color managed I still need to further adjust most image file by adding 10 point of Brightness, and a slight boost of Saturation to make the final giclée look more like what I see on the printer-server monitor.

To explain further, each printing machine at Vashon Island Imaging is connected to its own server computer. In this way, the anomalies of each printer can be addressed with a degree of specificity that is difficult when many printers are served by one computer.

Getting it right is the result of a close association between the giclee prepress artist and the machines he or she works with. After time and experience you get to know what each machine can do... and how to coax quality out of them.

Make a further Brightness and Saturation adjustment just before printing. That final tweak brings the color-managed master image into line with the dynamic tone range of the specific machine that will print it.

If I sent the same master image file to another printer, I would observe the image on *that* printer's server monitor and tweak the color as needed. There is never one setting for all printers because each produces a different look.

Include the final adjustment settings in the image file so that you can repeat the procedure in the future if need be. Do this by simply putting all layers into a new group and using the name of the group for the adjustments information. Such a name might look like this:

*CLIENT_Picture_1.3_16 X 20_Canvas_Satin_9880*_ Brightness+10_Saturation+10*

* 9880 is the name of the printing machine.

Embedding Profiles

You can Embed ICC Profiles into RGB, CMYK and Gray Scale files. Embedded Profiles remain with the picture files, so any ICC-aware application or device can read the file-creation- device's color-space information.

To embed a profile choose:

-
- *Windows*: File > Save As then select ICC Profile (profile name)
- *Macintosh*: Embed Color Profile (profile name)

OK, all the basics are out of the way and you are on your way. Now comes the part you will begin hating and end up learning to use as a moment of Zen in your life. What's it all about? Cleaning.

Selective sharpening adds to depth effect of Cosmic Rays. *Basic picture was duplicated and filtered with heavy Unsharp Mask. The sharpened layer was erased away gradually from the center. Blending options for the sharpened layer were set to lighten. The shadows (darktones) of the sharpened layer were burned and the highlights dodged.*

Red Race Car

© Douglas Mesney 1967-2010

Giclée Prepress Workflow

Step Six
SPOTTING AND CLEANING

"The Devil Is In The Details"

Every file has some blemishes and some have a lot. Cleaning up those blemishes is tedious and time consuming, but necessary. So learn to enjoy it, as my Father advised.

In the darkroom, dust is a problem. Impossible to be rid of, the little white or black spots that dust leaves on prints has to be hand-painted out using fine brushes and magnifying glasses. The work is called "*spotting*".

The hours spent at that tedious task can drive you crazy. But there is an up side to everything, if you can find it. That is what Zen is all about. So I learned to like it to the point where spotting prints has become part of the Zen of a good day, instead of a "spotting Hell".

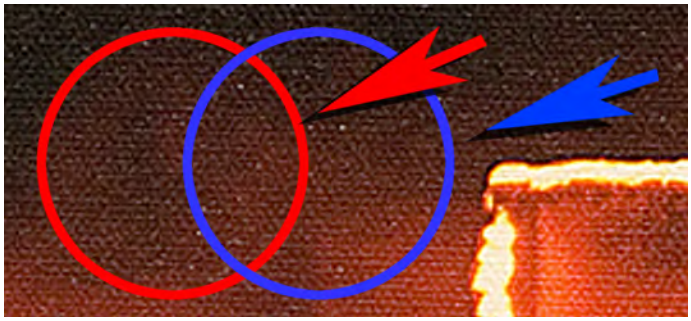
You would think that life would be different in the digital age, but you would be wrong. It takes just as long to spot a print, but in digital you do it before printing, not after; and once it is done it's *done*.

Examine your picture carefully including the borders and/or "wrap zone". Clean-up any dust and scratches or other spots and blemishes using the Rubber Stamp tool.

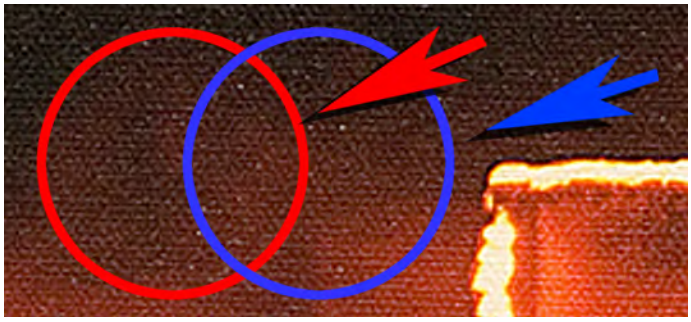
An alternative is the Healing Brush. The difference between the two is that when the Healing Brush drops its cloned sample the underlying *texture* is retained.

Canvas texture is commonly encountered by giclée prepress artists, as are the rough textured surfaces of many art papers and other media.

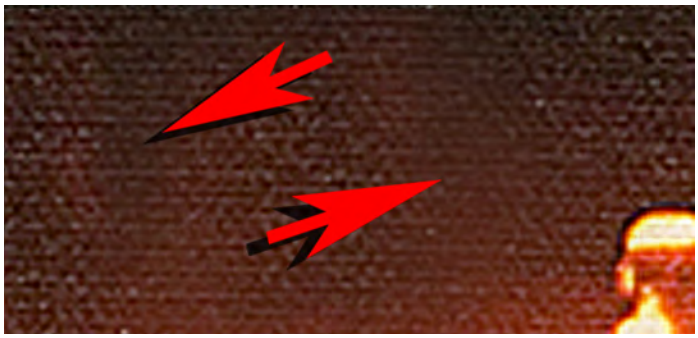
Frequently the image files you are given were shot by an amateur or semi-professional photographer, so the lighting may bring out the media texture in the original artwork.



Detail of Repent *shows texture of Epson Satin Canvas. The texture was enhanced by over-sharpening to make it more visible.*



The area circled in red was Cloned and dropped onto the area circle in blue with the result shown immediately below. The same area was sampled with the Healing Brush and dropped into the same area with a result as shown at the bottom of the page..



The fuzzy edges of the soft-edged Clone brush are actually gradient edges with transparency. Where the gradient is thin, the layer below shows through. That "double vision" makes the gradient region look blurry and noticeable.

Cloning with the Healing Brush is far less noticeable because the texture of the background layer is retained. It doesn't always work, particularly with very fine textures like sand and powder.

The result is that your prepress corrective work will need to retain the look of the texture in order to blend in and be invisible. A deft handed prepress artist leaves no trail.

You might be asking yourself, "why would anyone want to use the Rubber-Stamp tool when the Healing Brush works so much better?" That depends on what is better.

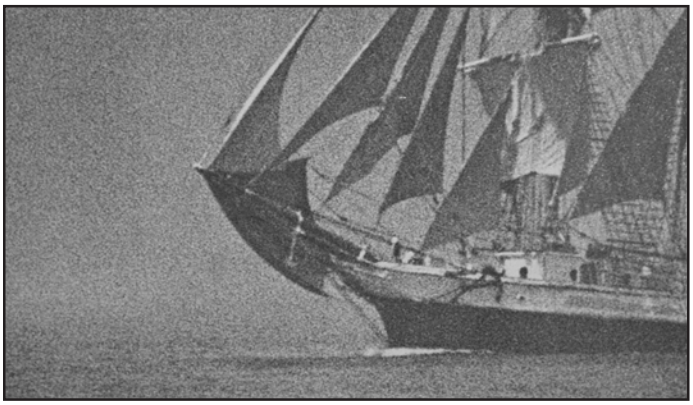
Sometimes the healing brush just doesn't work. Even when it does, it is much more processor intensive and "fussy" to work with... which can s-l-o-w you down.

The rubber stamp tool is much faster and easier to work with. Maybe I feel that way because I have been doing PhotoShop since version 3.0 back in the last century, when healing brushes hadn't even been thought of yet.

Many of the newer PhotoShop tools are extensions of older ones, developed to solve specific problems. The Healing Brush just discussed is one such new tool.

Not every picture you encounter will have texture as pronounced as canvas. Usually the textures you encounter can be fixed with the rubber-stamp clone tool with some *faux* texture made with tools like *Grain, Noise and Mezzotint.*

Film grain is another commonly encountered texture. Depending on the nature of the grain, the rubber-stamp clone tool will serve you better for spotting and cleaning.

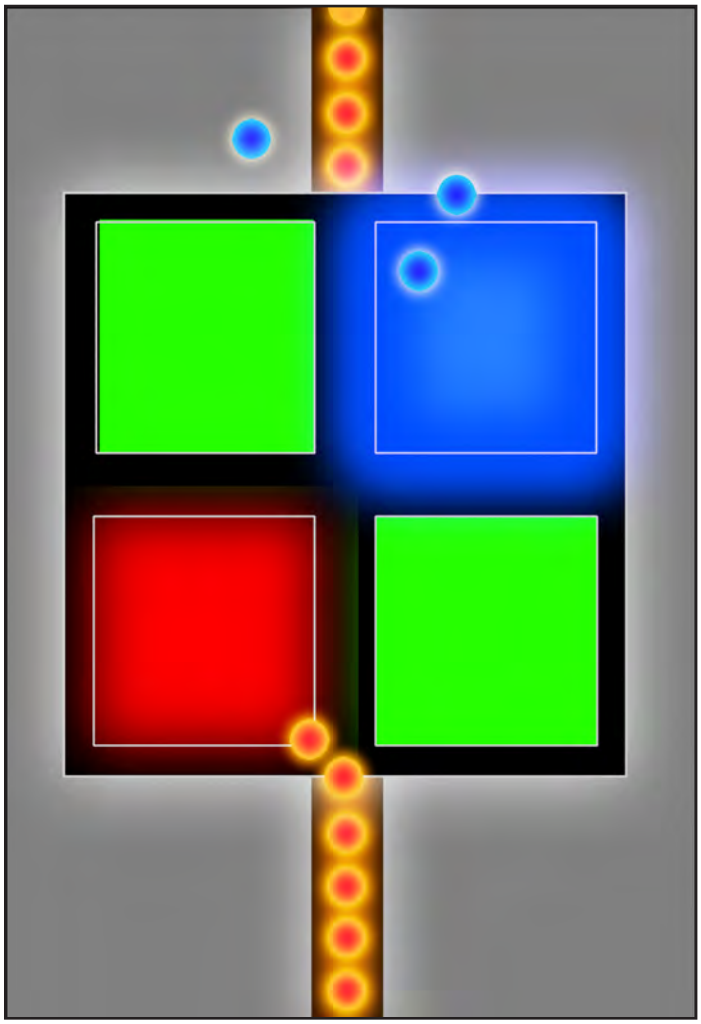


Detail of picture taken with Tri-X film rated at ASA 3200 (3-stop push processing) to generate maximum grain size. Pictures shot on film all show grain. Fast film has larger grain. Slow films are called "fine grain".

Using the rubber-stamp instead of the healing brush will save you a lot of time in the long run but you must also master the use of other texture-generating tools.

Repairs made with the rubber-stamp tool (or airbrush) that need texturizing should be isolated on a separate layer. Once isolated, noise, grain or mezzotint effects can be added as needed to recreate the grain texture (or noise) in the original picture. Like any other layer, the blending options of the texturized layers can be used to enhance and *nuance* the faux-texture effect.

Digital cameras show image noise instead of grain. It looks like random speckles throughout the picture, often colored. Things such as exposure time, temperature and different camera modes affect how much noise is produced. Some noise will always be present.



Rogue electrons and photons stray off their course and can activate the CCD or CMOS light sensors creating digital noise.

All electronic devices that send or receive a signal generate noise as random electrons "escape" from the stream, exciting one or more of the RGB sensors of any pixel they come into contact with. .

Light that enters the lens and misaligns with the sensors will also cause image noise. Even if you cannot see the noise when you look at your picture, there is some form of image noise in any image you take.

Audio and video productions also have their versions of noise. Audio noise sounds like "white noise" and video noise looks like "snow".

Whether film or sensors every light sensitive material has a *threshold level* of photon energy that is necessary to activate a chemical reaction in film or the transformation of photons into electrons by a CCD or CMOS sensor.

When there is not enough light to capture an image the sensitivity limits of the recording material can be altered so that they are more sensitive. The more the sensitivity is increased, the greater the amount of noise. The greater the "push" the greater its artifacting. For example, who can forget the night-vision scenes of recent wars... those glowing eyes, like a cat's caught in the headlights.

Photographers using film solve the problem by "pushing" the film development (increasing the development time). Digital photographers push the signal processing. Both methods manage to capture images under low light conditions, but at a price. Film gets grainy and digital captures get noisy.

Digital cameras with manual settings make it possible to decide on the amount of signal boosting (pushing).

Automatic cameras may just go into that mode all by themselves when the light gets low, the same way they can automatically turn on their flashes.

Using higher ISO settings results in more grain or noise. Higher settings start at around ISO 500. Below that setting noise levels are virtually unnoticeable. When you get to ISO settings in the thousands, the noise is unmistakable. Algorithms are used to reduce noise, but don't completely clean it up.

Three Types of Noise

- Random
- Fixed Pattern
- Banding

Exposure length and ISO speed have the greatest affect on the generation of random noise. You cannot predict where it will occur. Algorithms on newer digital camera eliminate a lot of the noise, but you will encounter images where the noise remaining in the capture is objectionable.

Fixed pattern noise surrounds "hot" pixels. This is the noise made by runaway electrons. Hot pixels look more intense than the ones surrounding them and are much brighter than random noise. The fixed pattern also makes the noise more noticeable. Long exposures and high temperatures cause fixed pattern noise to appear. The pattern may derive from the grid of the pixel array.

Banding noise really depends on the camera as not every digital camera will create it. It is produced as a "by product" of digital image processing steps, where the algorithm isn't quite right. Banding also is a common problem for ink jet printers. Banding is quite visible and utterly annoying. High ISO speeds, shadows and photo brightening will be more likely to create banding noise.

If you are a photographer using digital cameras, you know that the most noise is generated by long time exposures using high ISO settings.

Dealing With Noise: "To Be or Not To Be"

Increasing the ISO is like turning up the stereo's volume. Electronically the same thing is happening. The signal is amplified. *Everything* in the signal is amplified, noise included.

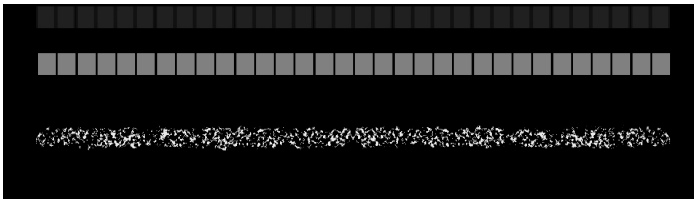
Long exposures leave plenty of time for electrons to escape and excite random pixel sensors. The noise is most visible in the darkest tones. If the ISO is high, those little electrons get *really* excited.

Is the noise objectionable?

Photographers have always dreamt of grain-less pictures. Big grain can really add to some pictures, however. Early in my days of darkroom experimentation I would use a trick called "matriculation" to beef-up the grain. The developed film was alternately dipped into hot water and ice water, which would crinkle-up the grain and make it more pronounced. It's a look I love now made easy in PhotoShop with no fuss and no muss.

The pixels that make up a digital image's bitmap can also be considered to be a kind of grain. Certainly they qualify as a texture, especially when pixel resolution is so low that you can actually see them.

The main difference with the look of film grain compared to pixels in digital pictures has to do with the random pattern of grain versus the grid pattern of pixels. Even if it were possible to make digital light sensors as small as film grains, the pictures would still look different because the pixels are lined up on a grid whereas grain is totally random.



Pixels line up with grid precision and have clear sharp edges. Film grain produces indistinct edges, being composed of odd-sized and randomly placed bits of silver and/or dyes. Try drawing a thin line with sand.

Notice how a thin line of grain has no distinct edges. It looks just like a thin line drawn with sand.

The "Vibe" of Film Is Grain

Your eye easily sees the difference between a real movie and a video film. The edges of objects in grainy motion pictures "vibrate" from the rapid succession of film frames, each with a different grain pattern.

Video images appear totally stable because the pixels are "locked" in their grid and stationary. That's the difference between the look of electronic and digital media compared to film. Film "jitters" while video movies are stable.

Videographers and digital-film makers go to great lengths to lose the electronic look and recreate the look of film. They do that by introducing grain (noise) and processing it.

There are digital solutions for those who want to emulate the look of film, as there are ways to eliminate noise.

Getting Rid of Noise

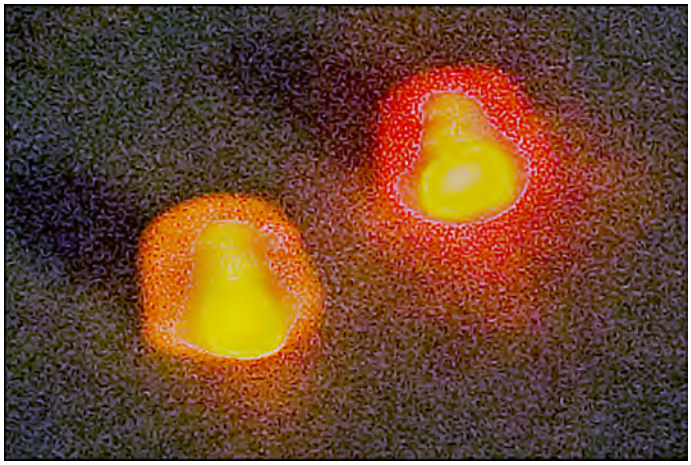
Noise can be substantially reduced if not totally eliminated. A lot depends on the picture.

The picture for our example will the one below of yours truly at *Burning Man* in 2004. The picture shows my Ford-Van "control room" for projected images.

The projections were a 4 hour chill-lounge show that was originally made for the *Peppermill Casino* in Reno, Nevada.

The show uses three projectors and in my mobile control room I would monitor the signals sent to the projectors on small "confidence monitors".

The author in the back of an old Ford *van converted into a control room. Yellow LED lighting throughout the van used little power with great night vision. My studios are all lit with strings of Xmas lights, too.*



Random noise in the dark tones almost always results from using long exposures and/or very high ISO sensitivity ratings. This noise was generated at ISO 3200, with a relatively short exposure of 1/8 second.

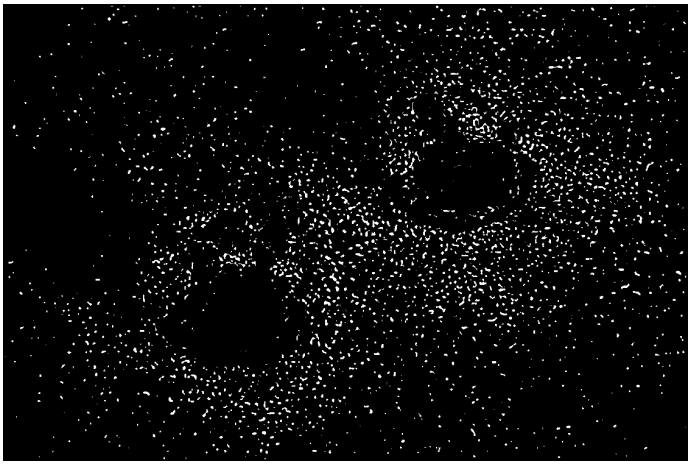
Masking Noise With High-Contrast Negatives

High-con positives can mask the noise in your pictures and are a quick fix. Begin by making a duplicate of the picture layer and placing the dupe above the picture layer. Call this layer Hi-Con Pos.

(Originals are always called "positives", even if they look like a negative. "Negatives" are reversed (inverted) positives.)

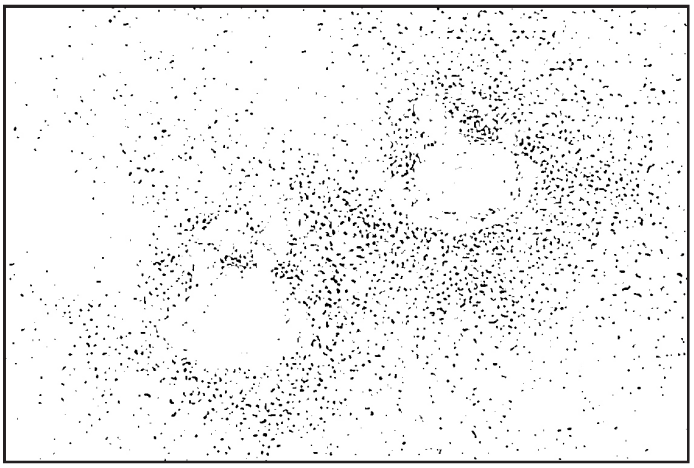
Select the dark areas with noise. Copy and paste those dark areas onto the new layer. Different problem areas can be placed on additional layers if you wish.

Use levels or brightness & contrast to strip away all mid-tones. Desaturate the layer to make it black-and-white. The result should look like this picture, below. You may need to paint out any spots that are legitimate and not noise. The procedure amplified the entire image, not just noise.



The picture's noisy areas have been isolated and made into a black-and-white high-contrast version.

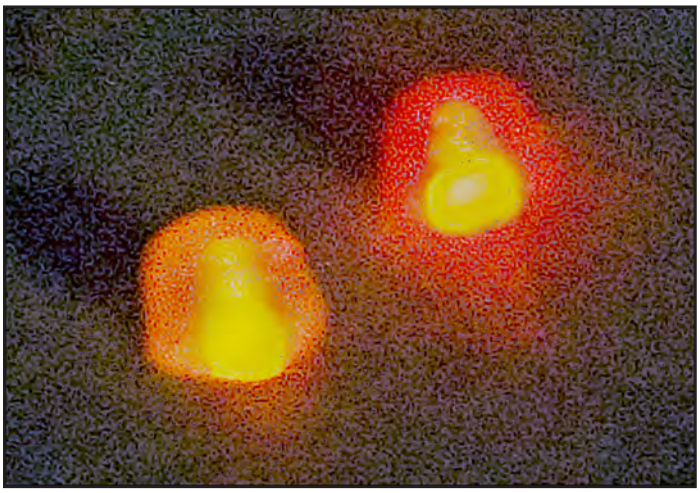
Use Image > Adjust > Invert to reverse the high-con picture into a high-con negative. Now, all the noise looks like black (or dark gray) bits against a clear background.



The high-contrast negative is flipped to a high-con negative (above) which will mask the noise in the picture.

Use Filter > Blur and Filter > Blur More to soften the edges of the black noise pixels promoting a better fit.

Set the blending options for mask layer to darken, and finally adjust the layer opacity until the noise is gone. If any individual dark pixels are offensive, erase them.



The result is subtle especially in a small picture like this but if you look closely you'll see that the untreated picture has more little white spots.

Another way of attacking noise is to copy the picture layer, apply the Median Filter, put that layer on top of the picture, set the blending options for darken, then lighten the layer until you see the noise and speckles disappear.

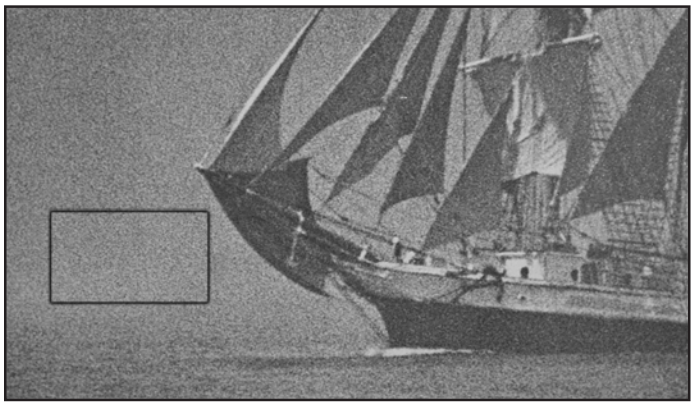
Filter > De-Speckle is a third alternative however this tool is whimpy and you'll probably end up taking the negative noise mask or median filter approach.

Simulate Textures With Noise, Grain & Mezzotints

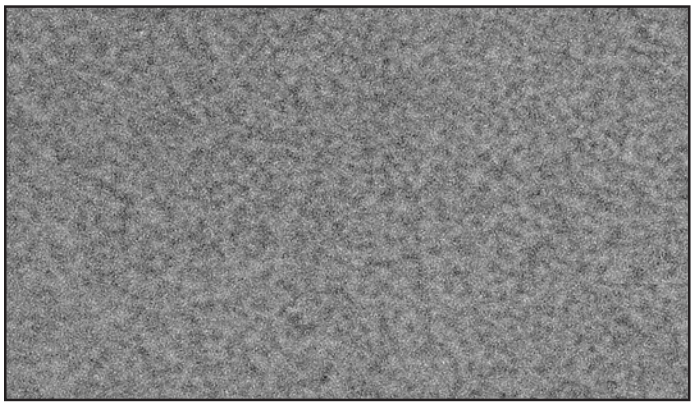
Noise, grain and mezzotint filters can be used to restore the original texture of a picture when it has been disturbed by cleaning or retouching. Almost anything you do except spotting will either reduce the texture or make it more obvious, revealing your work.

Airbrush work in particular disturbs the native texture of a picture, but these filters can help restore it with amazingly accurate *faux* grain.

It will take a little practice to get the knack of it. The methods outlined below aren't the only ones, but these are fast and easy and will take care of 90% of your challenges. No filter is "better" than another as each picture is unique.



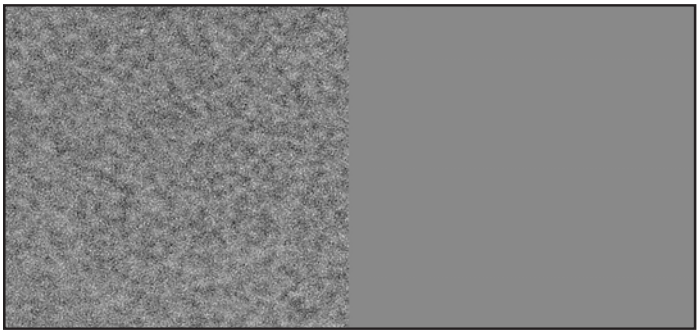
A small section of this picture (above) has been enlarged to show the grain texture in the close-up, below.



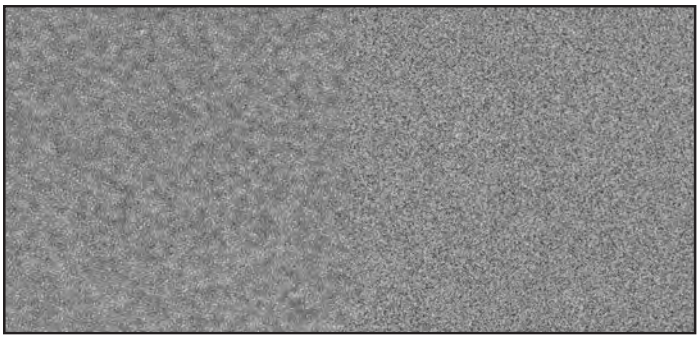
Extreme close-up of grain pattern in ship picture. Notice the "mottle" pattern which is the result of grain clumping. When film processing is pushed by extending the development time, grain clumps grow larger.

The next few pictures show how noise and mezzotint filters can be used to recreate almost any film-grain texture.

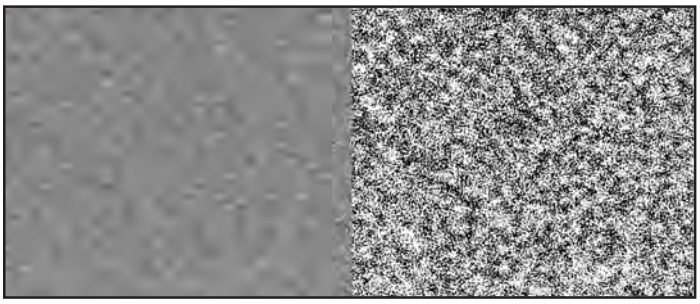
To make the demonstration more dramatic, a sample of solid 50% gray with no texture at all will be converted into a texture that is virtually identical to the picture's grain.



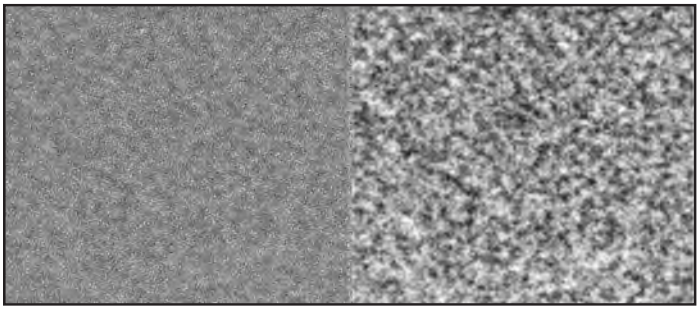
Panel of 50% gray (right) represents soft-edged cloning or airbrush work that has eliminated the texture of the original picture (left).



First, the Noise filter is applied to the gray panel (right). Already you can see that the matchup is good. The difference is that the noise is sharper and needs to be blurred. Note that the next two examples are exaggerated by extreme enlargement to show the effects of the blur procedures.



Copy the noise onto a new layer and use contrast to isolate the "mottle" pattern of grain clumps (above, right). Blur the clumps (below, right). The dark blurred clumps are now right but not the light ones.



Set the blending options for the blurred high-con clump layer to darken and then adjust layer opacity to closely match the look of the original.

You can use the same procedures to produce texture in clone and airbrush work that has reduced or eliminated the original texture in a picture.

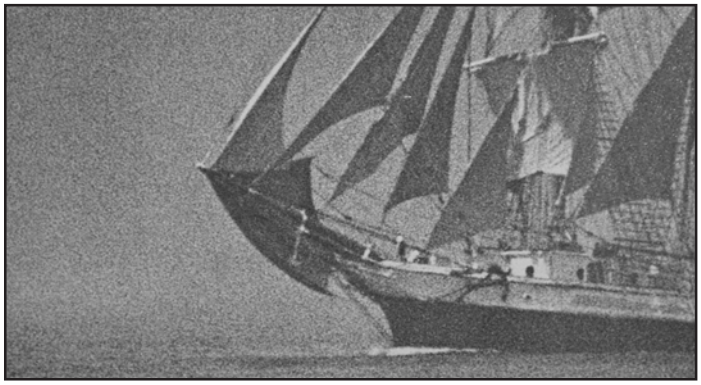
The procedure begins by isolating the parts to be texturized on a separate layer (or layers). In this exercise the solid-gray panel represents the cloning or airbrush work that needs texturizing.

Gausian noise looks the most like film grain. Uniform noise usually works better when the "grain" is digital.

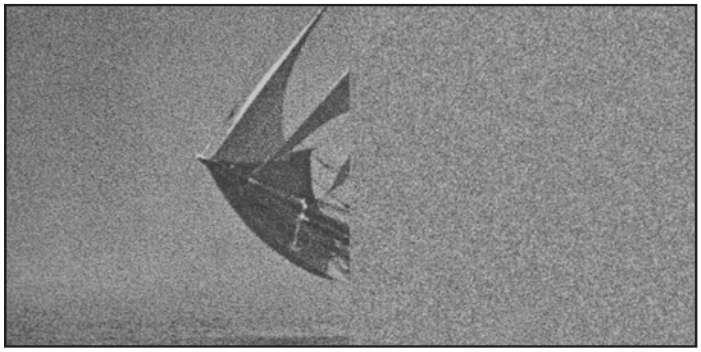
Grain Filter Alternatives

Filter > Artistic > Film Grain is virtually the same as a mezzotint but takes longer to execute because it is more processor intensive.

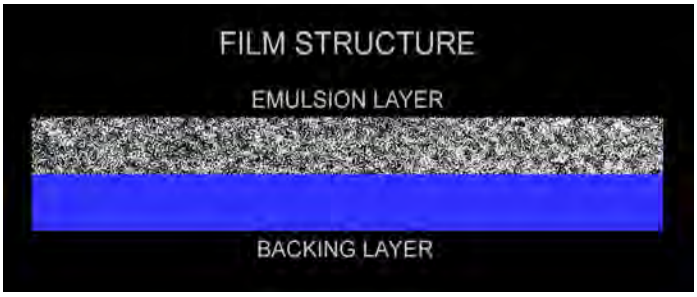
Film grain is an example of a newer PhotoShop filter replacing an earlier, simpler and equally effective one, in this case mezzotints. Because they look the same, my choice is the one that works faster... mezzotints.



Using the same original sailboat picture (above), the film grain filter was applied to an adjacent panel of solid 50% gray (below). As you can see, the match is astoundingly good.



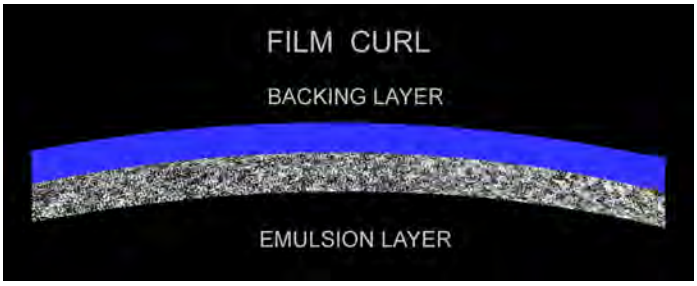
To show the close match, the ship has been covered with a panel of faux grain made by using a film grain filter on a solid swatch of 50% gray. If you are doing a very large picture it could take a long time. The film grain filter is very processor intensive. Be sure to save before using processor intensive procedures in case you inadvertently use up all the



Pictures shot on film have a grain pattern that looks like sand, or salt & pepper up close. The speckles are grains of silver or dye that form the image and that layer of the film is called its emulsion.

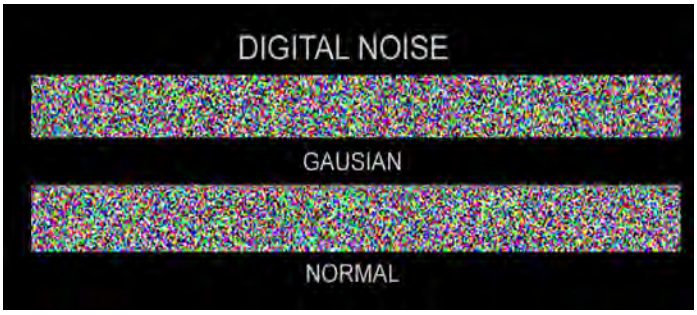
The emulsion is a hardened suspension of light sensitive silver salts and/or dye-coupler particles within gelatin… like tapioca pudding. A thin layer of the emulsion gel coats a transparent backing made of clear poyester or acetate.

Film negatives and positives have an emulsion side and a backing side. The emulsion side can be differentiated because the surface will show a relief image of the picture where the thickness varies according to the amount of silver or dye present as a result of exposure to light.



An easy way to tell the difference is that the film will have a slight curl to it, with the backing side normally facing upwards.

When you handle film negatives or positives (aka slides & transparencies) take care not to touch the emulsion side as the oils and perspiration on your fingertips can permanently mark the film. White cotton gloves are recommended for handling film.



Digital Noise resembles film grain but is much sharper. If blurred the look is a dead ringer for film. Use Filter > Blur and follow with Filter > Blur Again until the look matches.

Empire of the Sun © Douglas Mesney 1960-2010

Steel Mill
© Douglas Mesney 1967-2010

RAM leaving the system unable to save your work.
Giclée Prepress Workflow

Step Seven
HIGHLIGHT CONTROL

Making Something from Nothing

Highlights are the most frequent prepress adjustments. The challenge is to keep the brilliance but maintain sufficient inking to avoid media show-through. But wait, isn't that a contradiction? The white in a giclée is the media, after all. There is no white ink.

When viewed from an oblique angle, the surfaces of media reflect the light. Surfaces with a lot of reflection are called "glossy" and those with little or no reflectivity are called "matte". There are many names for reflectivity, like "nap", "sheen", "luster", "pearl", "metallic", "glassy", "dull", "brushed", "sandblasted", "frosty".

Whatever you call it, the surface of a media has a look that *changes* when ink is applied to it. The more ink, the greater the change. The ink will have it's own reflectivity and some inks are more glossy than others.

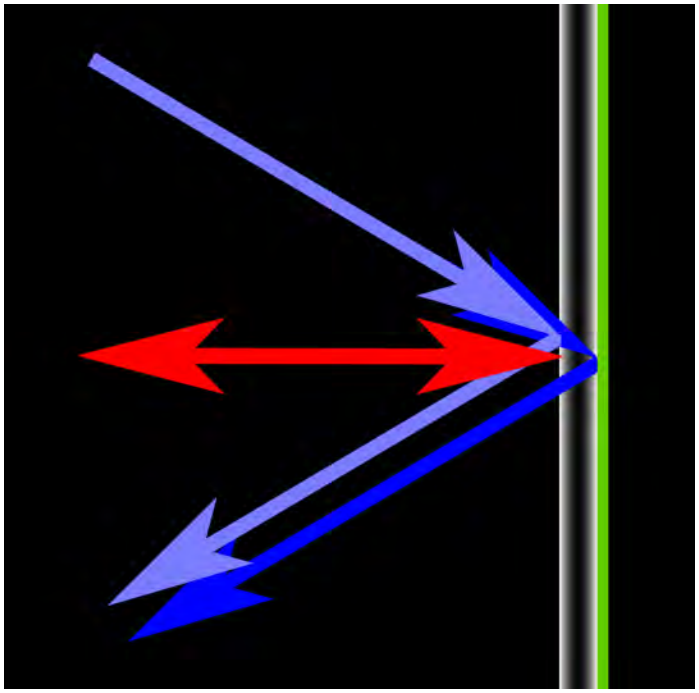
No matter the ink, the final reflectivity of the giclée depends on the coating applied to protect it, whether glass, varnish, urethane, laminates or sprays.

Reflecting pool in a Turkish cistern provides an existential background for this multi-colored figure study entitled "Cistern Dancers".

Reflectivity

Reflection of light is either *specular* (mirror-like) or *diffuse* (retaining the energy, but losing the image).

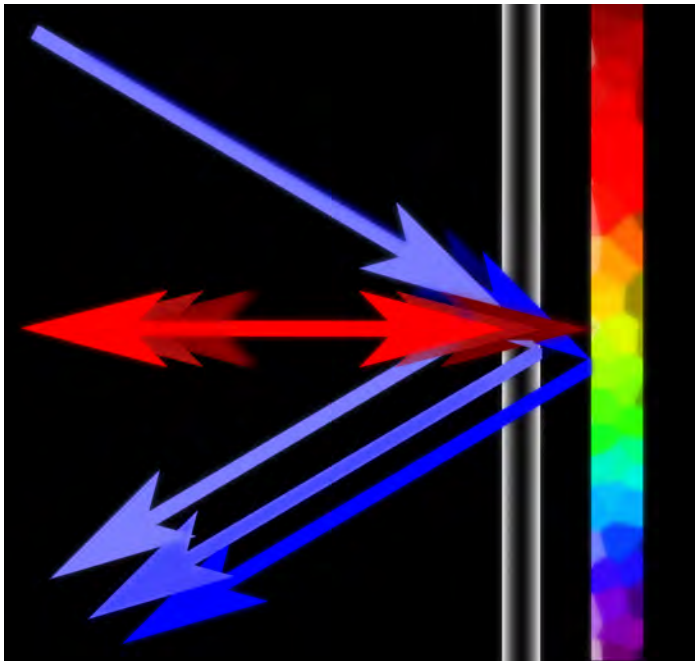
A mirror is a common example for specular light reflection. Reflections also occur on the surfaces of water and transparent media, such as glass or giclée coatings.



Common mirrors are glass with a metallic coating on the back side. Light reflects off both the surface of the glass and the metallic coating, creating a double reflection, or double image. Front surface mirrors are reversed, with the metallic coating on the front surface. This avoids double reflections but the exposed surface is easily damaged.

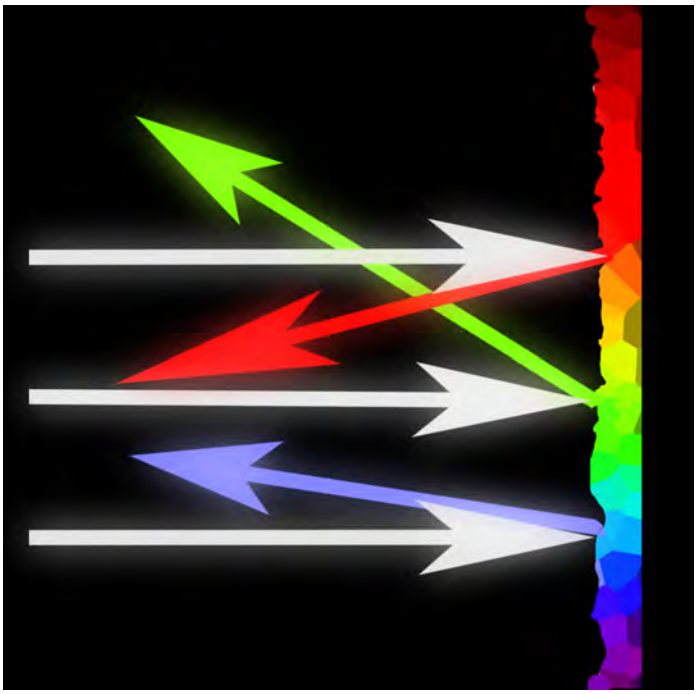
Reflection of light is either *specular* (mirror-like) or *diffuse* (retaining the light energy, but diffusing the reflected image).

A mirror is a common example for specular light reflection. Reflections also occur on the surfaces of transparent media, such as glass or other giclée finishing materials.

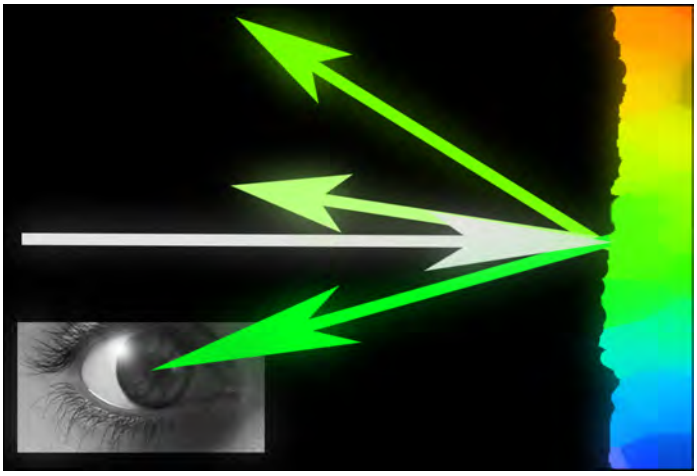


It's not your eyes, glass over glossy art causes a triple reflection.

When light reflects off a dense material (with a high refractive index) it changes *polarity.* That is why polarizing sunglasses will reduce surface reflections. (*Section Three* has more on this.)

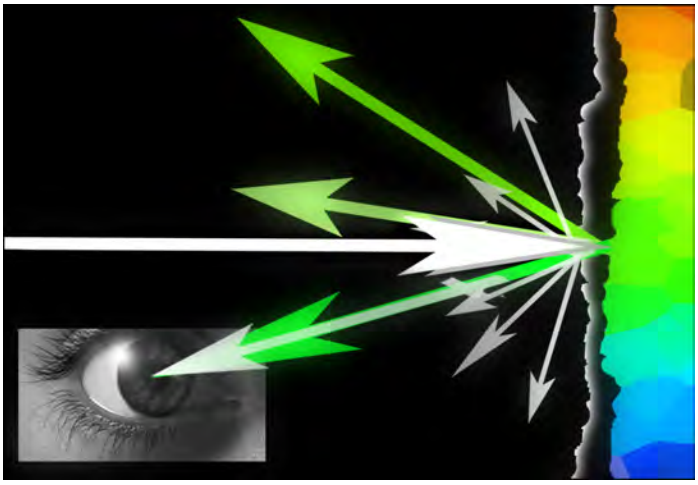


Textured and matte surfaces are not smooth and reflect light at different angles.



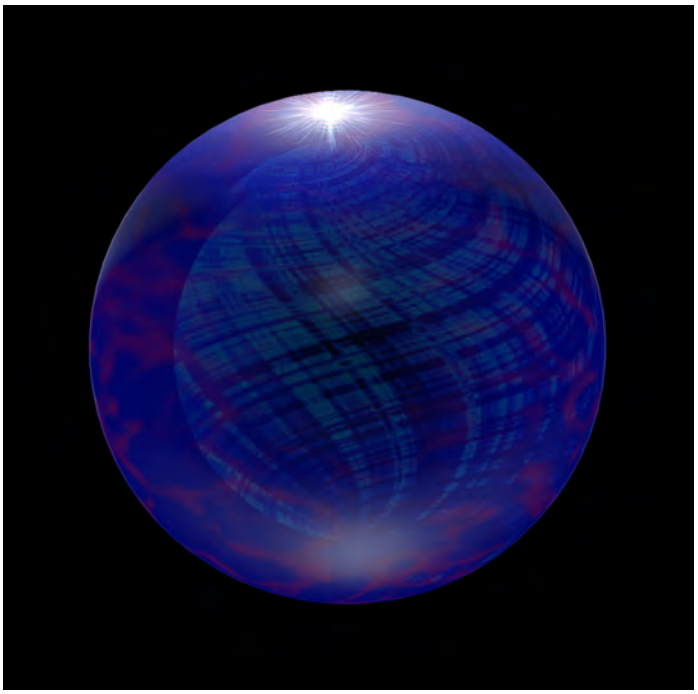
Matte and textured surfaces reduce the brilliance of colors because only part of the color reaches your eye.

Differences in the reflectivity of the media and ink reveal the picture in faux relief when it is viewed from an oblique angle. These effects are magnified to the degree that the media shows through the ink. In the light-tone and highlight areas of the print there is very little or no ink. The effect is considered objectionable and minimized by insuring that there is at least *some* ink in the highlights. (Of course, if the print will be coated there will be no such problem to deal with although highlights still benefit from some tone.)



Matte finish coatings produce "scatter light" which is diffused source light. Scatter light dilutes the purity (saturation) of colors and fogs over dark tones moving the dynamic tone rage away from the black point.

The only places where there should be no ink on the media are the *spectral* highlights.



Spectral highlights are clear and brilliant reflections of source light... the little gleams on the chrome or glass. Only high-gloss materials produce spectral highlights and many pictures have no spectral highlights at all.

If the picture has no spectral highlights, there should be no places where there is no ink on the media. The inking may be very light indeed, but there should be at least at least 2% ink in the very lightest tones.

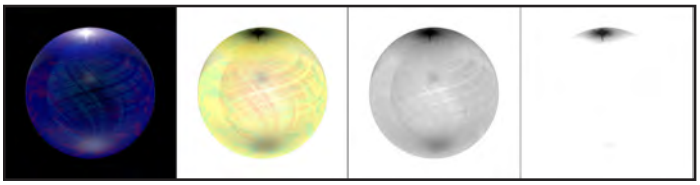
At least half the images that come to Vashon Island Imaging have blown out highlights... in the Info panel they register 255 RGB and zero CMYK when sampled with the eye dropper tool, which means no data.

No data doesn't just mean "white", it also means there is nothing there and you are seeing the media background color instead of image pixels.

No data also means that you cannot use any image adjustment tools on those pixels because there is nothing to adjust.

The prepress artist must put pixels where none are in order to have something to work with. There are several ways to do that.

Highlight Control Mask



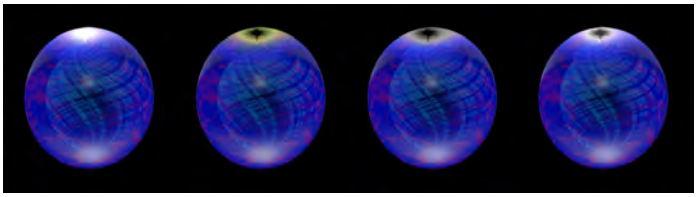
Original (left) is inverted (center left) desaturated (center right), and adjusted for brightness and contrast (far right).

Duplicate the picture layer, call that layer "Highlight Control Mask" and place it as the uppermost layer in the stack.

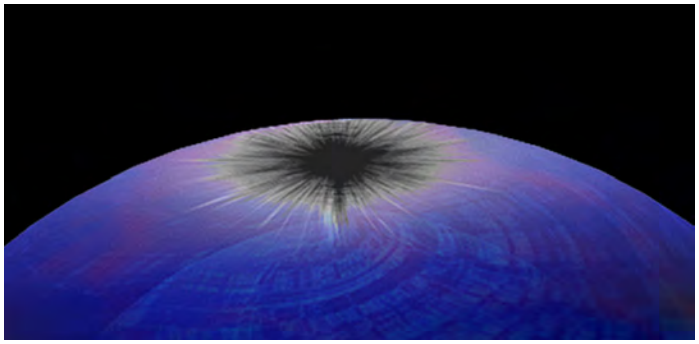
Use Image > Adjust > Invert to make the picture into a color negative. Everything is reversed, all colors appear as their complementary shades. Joining together the picture layer and this inverted one would result in gray because every color when blended with its complement produces gray. But that is not what we are after.

Use Image > Adjust > Desaturate to take out all the color and make the layer into a black-and-white negative.

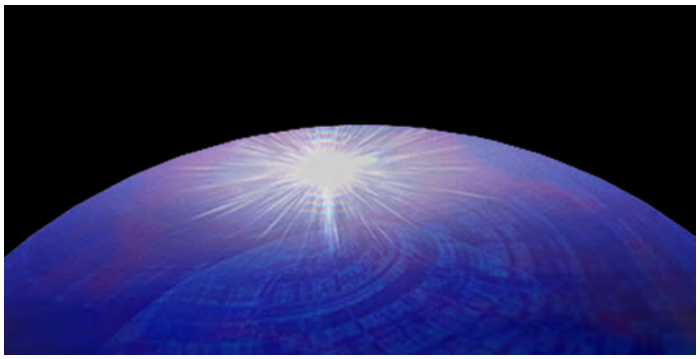
This negative is the *Highlight Control Mask*. Place it above the picture layer. Set the blending options for the mask layer to darken. The color negative will show through for some tones (maybe you will like the effect) and the desaturated inversion makes everything look flat (maybe you like that, too). However, brightness and contrast has a huge effect on the negative and can be used to blow away all but the very darkest tones. The resulting mask should look almost like line art.



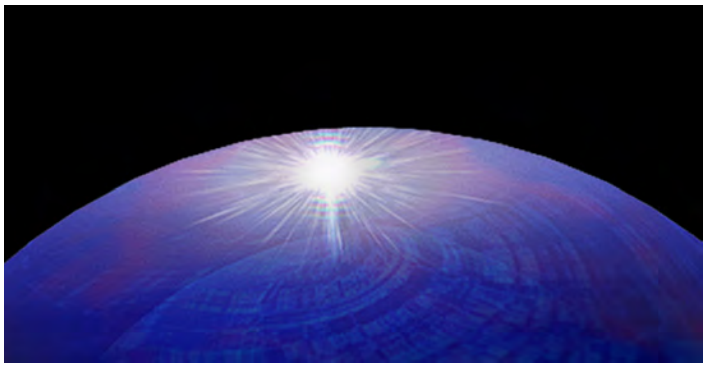
The masks have been placed over the original(s) with blending options set for darken. The mask on the right works best for highlight control.



Finished contrast mask should have all tones stripped away except the darkest blacks, appearing almost like art.



Adjust the opacity of the mask to somewhere between 2% to 10%. This mask is 22% in order to make the effect visible in this book.



The spectral highlight is erased away from the mask. This will be the only area on the giclée with no ink.

Get the percentage of mask ink as high as possible without totally killing the brilliance of the highlights. Try adding 5% to 15% and then *partially* erasing away the mask making special highlights brighter, but always at least 2%.

You may find that by filling up the brightest highlights with a percentage of ink they become like adjacent tones and disappear into them. In these cases, the adjacent tones must also be managed. This can be done by creating two or three versions of the highlight control mask using different amounts of brightness and contrast control while separating the tones from one another. One tone per layer.

Snow scenes and other high-key pictures benefit greatly from highlight control using high-contrast negative masks.

Water sparkles are spectral highlights but look bleached out or white unless filled in with pastel shades of the dominant tones around them.

There are times when even spectral highlights should not be white. Water sparkles are a good example. When there are a lot of sparkles, the result looks washed out because there is too much white from so many sparkles.

The sky created the sparkles and must be given the same treatment they get if the scene is to look natural. In pictures like these the sky and water reflections are commonly blown out because cameras can't handle extremes of any kind. Put color back using highlight-fill masks that are tinted with the appropriate shades of color. To get the mask to accept color, reduce the contrast first (which adds some mid-tones). Try filling the mask selection with a pure color and then reducing opacity.

What makes the situation objectionable is that there are so many of these white highlights that from a distance they visually dilute the surrounding yellows and oranges with a result looks washed out and lackluster. The objective is to put color back in yet maintain the brilliance of the highlights.

Typically, the source light that is making the reflections and sparkles needs the same treatment as the sparkles themselves if they appear in the scene. The source lights may even be more blown out than the water highlights.

Before and after highlight fill. The brightest portions of the sky are overexposed and blown out in the original. Several different shades of highlight fill restore color and life to the sky. The effect is exaggerated in this example so that you can more easily see it (below).

Highlight Color Fill Masks

To put color in highlights first make a high-con negative mask as described earlier. Then use Image > Adjust > Color Balance to add color to bring the blown out parts back to life. Several layers of these highlight fill masks with different levels of tone provide even more realism and "depth".

Making Water Sparkle Highlights

Use Select > Color Range and sample the white spectral highlight in a water sparkle. All such white spectral highlights will be selected, along with anything else that's white. Deselect all but the water sparkles using other tools like the Lasso(s) and Marquis(s).

Use Select > Modify > Expand to make the water sparkles selection one pixel larger, then Select > Modify > Feather the water sparkles highlight selection by one pixel. The selection should now be slightly larger and have soft edges, to blend more smoothly.

The amount of feathering can be modified depending on the sizes involves and a few tries should nail the amount needed to blend perfectly.

Saving the selection is always a good idea because it is likely you will be reusing it more than once as you hone in on the effect you want.

Make a new layer and call it Sparkles.

Sample the color immediately surrounding the spectral highlights and fill the sparkles selection with that color.

Adjust the opacity to lighten the new yellow highlights until they look just right. Finally, use the Eraser with a medium-hard-edged brush to erase through a few of the yellow highlights, making them white again by revealing the white ones in original picture, underneath.

Finish the effect by darkening the yellows surrounding the new highlights. Burn them with the tool set for *shadows*, even though they are highlights. Select those slightly darker shades of color using the Magic Wand with Contiguous unchecked. Again, expand the selection by one pixel and feather it one pixel. Make a new layer called "More Highlights" and fill the selection with a darker shade.

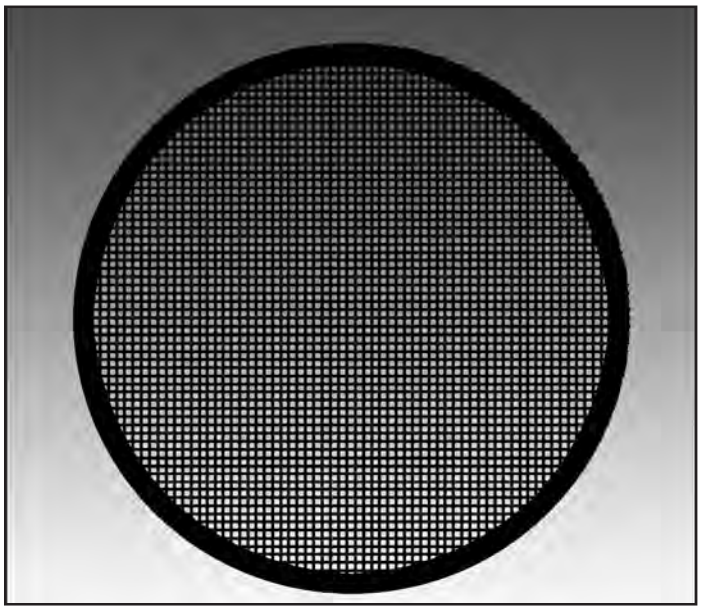
By dividing up the different highlight tones onto different layers, they can be individually adjusted using Brightness & Contrast or Levels to make the effect bright or subtle.

The technique just explained works well with snow or beach scenes and anywhere highlight detail has been lost due to overexposure. The picture on page 65 shows an example, controlling the highlights in the model's hair.

Build Highlight Tone By Duping and Merging

If there is even a little data in the highlights those faint details can be put onto a separate layer and that layer duplicated many times. Then merge the highlight dupes all together. There have been occasions when I have made 10 duplicate layers, merged them, and repeat the procedure 3 and 4 times -- the equivalent of thirty or forty layers -- to slowly build-up tone depth where none seemed to exist.

Black Net Masks



Photographers use net filters of different colors to control contrast and provide a degree of diffusion, or softening, sometimes referred to as a "Doris Day filter".

Net filters diffuse light, slightly blending together the edges of tones and shifting the white point by lowering the contrast. This alteration of the tone range brings it closer to what film cameras can record, avoiding highlight burnout.

The same effect can be created with a Black Net Mask. It's an easy mask to make and like all easy things has limited value and use.

To make a Black Net Mask simply make a new layer, fill it with black (or a color) and reduce the opacity to whatever extent you feel does the job… probably somewhere between 2% and 10%.

The effect of Black Net Masks is linear, not dynamic, which means it has an equal effect on all colors, reducing their brightness. Light tones are affected most. The result is like looking through a black net, hence the name.

Black Nets Masks can also be used to de-emphasize certain parts of a picture so that other parts stand out more prominently. Dulling down the background with a Black Mask will emphasize the foreground. So will a Highlight Mask, but the effect is not the same, not as dull.

Andrea No. 2
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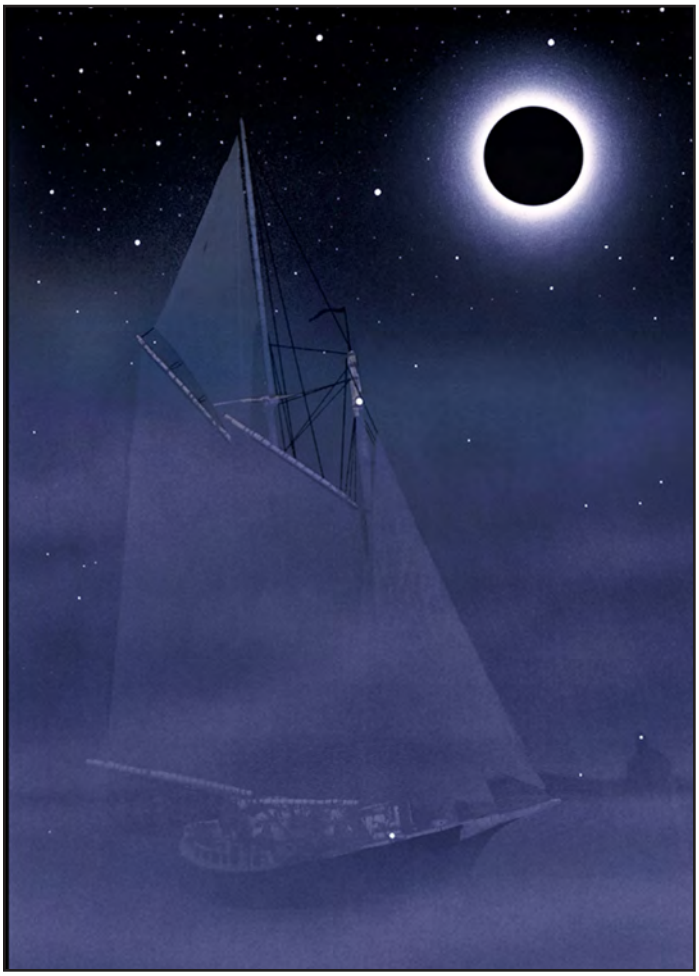
Giclée Prepress Workflow

Step Eight
DARK TONE ADJUSTMENTS

"Black is Black"... or Is It?



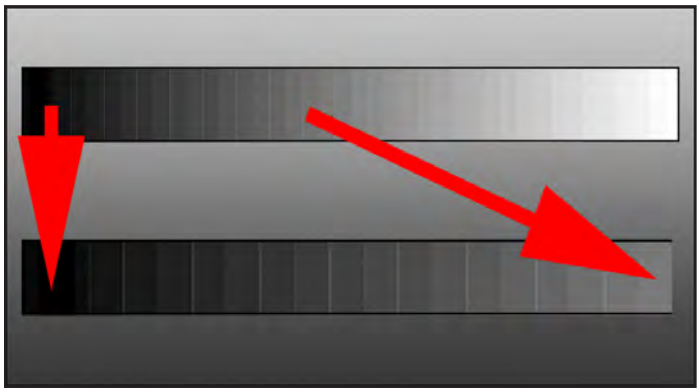
Dark pictures test the giclée prepress artist's skills. The objective is to avoid over inking and the resulting loss of dark-tone details.

Over-inking dark tones is the most common problem with giclée prints. The challenge with dark tones is to get sufficient ink on the media to produce rich color without losing details in the shadows and dark tones.

Once again it is a matter of degree, often incremental. When you go out at night life is a study of dark-on-dark tones. Within a very limited range of tones we manage to differentiate a "full" spectrum of grays and muted colors.

When darkness falls, our eyes adjust by switching over to special night-vision cells instead of the normal RGB sensing ones. Those cells don't see color but can discern contrasts of shading.

Technically, the tone range on a moonless night lacks anything lighter than 60%-70% gray. Yet we see more than that, or so it seems. Our mind takes the 30 step gray-scale and stretches it to a new scale, moving the white point.



At night half the tone range disappears with the sun. Our eyes adjust by stretching what's left into a new spectrum.

When you look out over the sea on a foggy night it is with difficulty that you see details, yet they are there. In the real world details don't pop out of shadows, you have to look into the dark tones to find them. For a giclée of such a scene to look "right" it should also have details in the dark tones when you look for them there. Achieving that involves the development of "*rare tones*" in the dark regions.

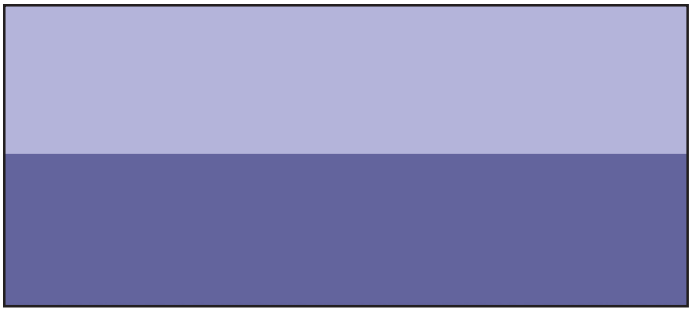
Rare tones are what I call the ones that are "hiding" and waiting for you to discover them and bring them to the eyes of the beholders. Finding them involves extending the dynamic tone range.

In any picture, everything hangs between the "white point" and the "black point", which define the limits to the dynamic tone range of the picture. A full dynamic tone range extends (in the digital world) from 0 to 255. However, at night or in dark places the tone range is more limited. The darker the situation, the more limited the tone range. The more limited the tone range, the harder it is to see details. How do we see *detail*, actually?

Details are defined by visual edges where one tone becomes another. Some edges are hard are crisp, others so soft that its hard to call them edges at all even though they border two different tones. Think about fog and smoke.

Expanding the *differential* between the two tones is how you can improve detail. The differential can be augmented by manipulating brightness, contrast, hue, and/or saturation.

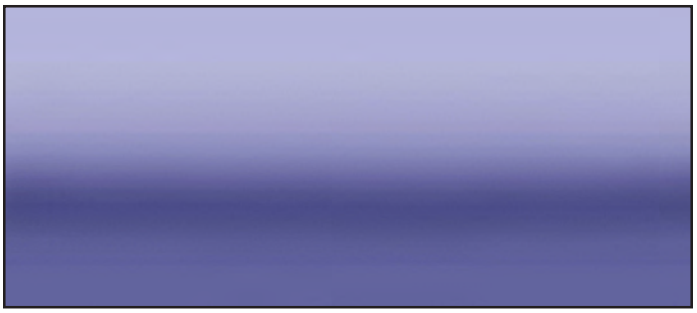
Introducing a third color along the center of the edge bordering the two shades, appropriately softened or sharpened can enhance differentials.



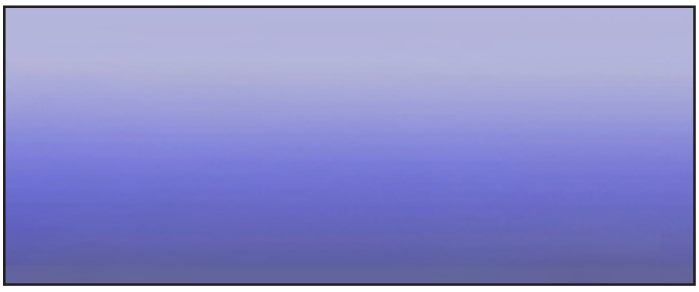
Hard edge separates two tones. These tones have substantial differences of lightness to begin with but are being used for these illustrations to make the adjustments visible, albeit exaggerated.

Simply increasing the gradient brightness along the light edge and its darkness along the other will go a long way to help define the borders. This is what the Unsharp Mask filter does, in effect,

Soft gradient separation of tones looks borderless.



Lightening the top half and darkening the bottom increases the contrast and starts to creat a border.



Above, the center of the gradient has increased saturation.

Hue *has been altered along the center of this border. Differences like these may seen obvious at this scale but when reduced are subtle, as can be observed in the next two pictures below.*

At smaller scale the gradients look more like edges.

The center of this gradient has been changed to a complementary hue.

Adding a *third color* along the center of the gradient establishes strong separation enhanced by "color conflict". Putting it on a separate layer allows you to control that element without it affecting anything else.

Jig Saw Puzzles

Cutting pictures into pieces and putting them back together again is what is what giclée prepress is all about. Your expertise will depend on your ability to separate out the necessary parts.

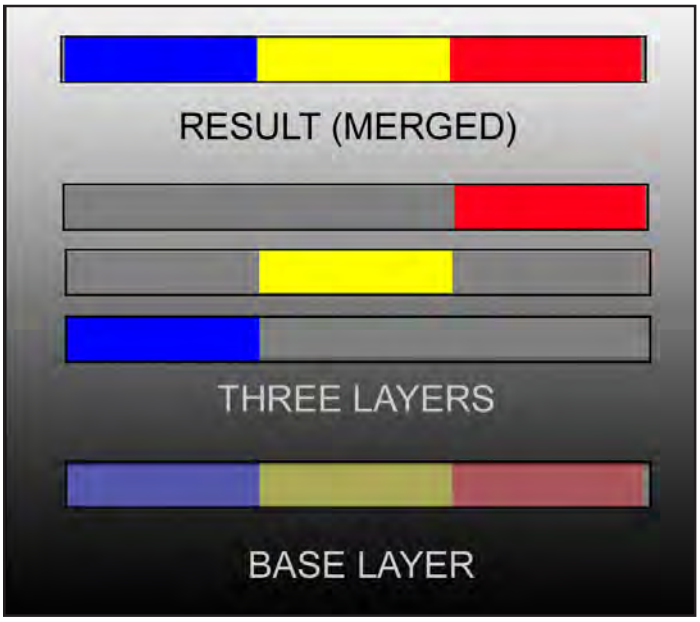
Selection tools to cut pictures apart include:

- Lasso(s)
- Marquis(s)
- Magic Wand(s)
- Pen(s)

Pen tools are the ones I use most. Pens are used to make *Paths*, and those are converted into *Selections*. The other tools make selections directly.

Whichever tools I use, the objective is the same: to take apart the picture into as many pieces as are necessary to adjust, each on its own layer. After adjustment, the pieces are put back together again. In that way, each problem area can be individually perfected to fit within the dynamic tone range of the giclée printing machine (or display device). There's no such thing as too many layers.

To keep things under control layers are grouped and merged periodically, but before that saved with a name identifying its version number. It is not unusual for there to be a dozen or more versions saved as work progresses. This ties up a lot of disk space but allows you to go back all the way to the beginning if necessary.



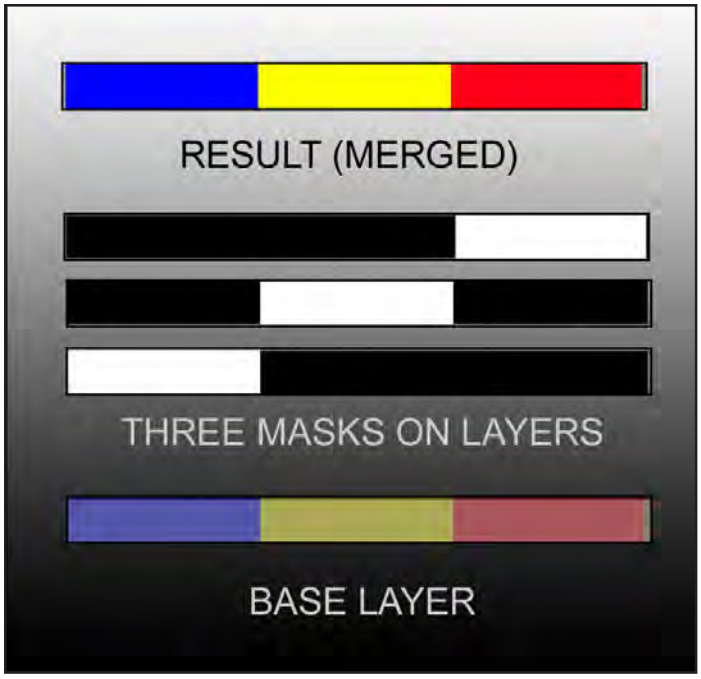
My method is to separate pictures into different layers, adjust them, and then merge them together again.

Cutting out elements and pasting them onto separate layers comes from earlier versions of PhotoShop which did not have "virtual layers" ("*adjustment layers*" and "*masks*"). Although most people get sold on the virtual layers concept and procedures, I find them arcane.

To me, simple cutting and pasting is easier, clearer and faster than using "virtual layers". However, file size rapidly builds as layers are added.

Virtual Layers for Smaller File Size

The concept behind virtual layers is simple to understand (but complicated to use).



Masks function as windows either blocking material (black) or allowing it to be seen (white). Gray masks allow partial visibility facilitating gradient masks. Mask information is contained in alpha channels.

Layers contain pixels and when you copy a layer doubles the number of pixels.

Masks aren't really there. They have no pixels. They contain *alpha-channel* information

Alpha channels are "windows" that block or allow visibility of what lies below. They have no substance because they function electronically. Having no substance they take up virtually no file space.

Black masks totally block visibility. White allows visibility. Shades of gray allow partial visibility.

To make masks you can use brushes, selections with fill, opacity and any number of other procedures applied to normal layers when making selections and adjustments.

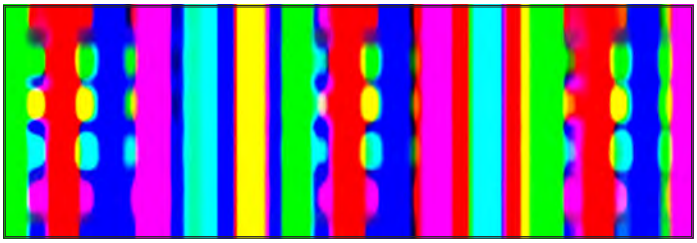
As I am able to get the results I like using cut & paste, I have not bothered to learn much about virtual layers but that doesn't matter.

What matters most is what needs to be done. If you know that, you can choose the right tools. The selection of tools is part of a larger *strategy*.

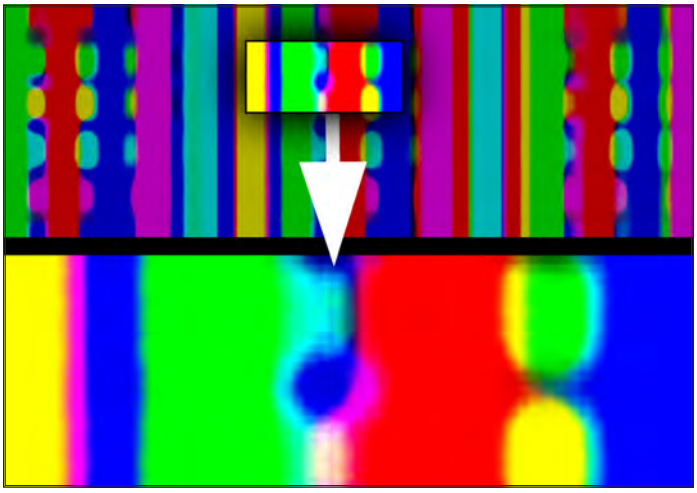
Strategy is what this book is all about. Identifying problems and figuring out how to solve them. Remarkably few tools and techniques are needed for pixel perfect giclée printing.

Unsharp Mask Sharpens Pixels, Not Pictures

Unsharp mask accentuates borders between pixels by building contrast along the gradient borders between pixels of different tones.



The image on top was sharpened quite a bit to illustrate how the filter handles the gradient edges between tone areas.



Contrasting colors have been generated by the unsharp mask filter to more clearly define the edges between major tone areas. The contrasting colors are complementary hues.

The unsharp mask filter accentuates the border between two regions of tone by building contrast along the edges that define the borders. There is contrast of brightness and complimentary colors are also used by the Unsharp Mask filter to create border "lines".

Using the filter's sliders you can control the thickness of the borderlines and the amount of contrast. As sharpening is pushed to the limits the picture can take on a "posterized" look.

Seattle Skyline has hundreds of distinct edges but only a few regions.

When the unsharp mask filter can't find an edge it will make one anyway and you can do the same thing. You can recreate the intensified border effect without the unsharp mask filter by creating your own border lines.

Working on separate layers, you will be able to individually control the bright and dark sides of the "ridge" line of the border for a more subtle and (possibly) less posterized appearance. More importantly, you will control *which* borders are accentuated.

The unsharp mask filter is indiscriminate, and sharpens everything equally. Often *selective sharpening* is called for whereby different portions of a picture receive different amounts of sharpening. For example, the eyes of a portrait can be sharpened to bring them out.

The apparent sharpness of one part of a picture depends on the sharpness of adjacent areas. Likewise, how one tone appears depends on the neighboring ones.

Viewers' eyes scan pictures and if they see one or more sharp points or objects, they call the picture sharp even if the rest is soft. Photo retouchers frequently sharpen a models eyes, nose, mouth and parts of the hair while softening the skin. Choose the top three focal points in the picture as well as a secondary pair. Concentrate your efforts on those key points of interest.

Separate Tone Regions With Intensified Borders

Pictures are made of tone regions separated by either edges or borders. When an edge softens to the point that is isn't really an edge anymore, I call it a border. Edges and borders define tone *regions*.

Regions are areas with predominantly one range of tones. The range could be defined by brightness, color or both.

Begin by separating the dark and light zones or major color areas. In the Seattle panorama (above) the sky is one region and the foreground water another.

Separate the regions onto different layers and adjust their levels (mid-tones), brightness & contrast and saturation and observe the effects on the overall "balance" of the picture.

Regional separations like a sky can involve a lot of detail work.. For example, the edges between a skyline and the sky. Or, a mountain range edged with trees. It can be quite time consuming and you may wish to charge for this service.

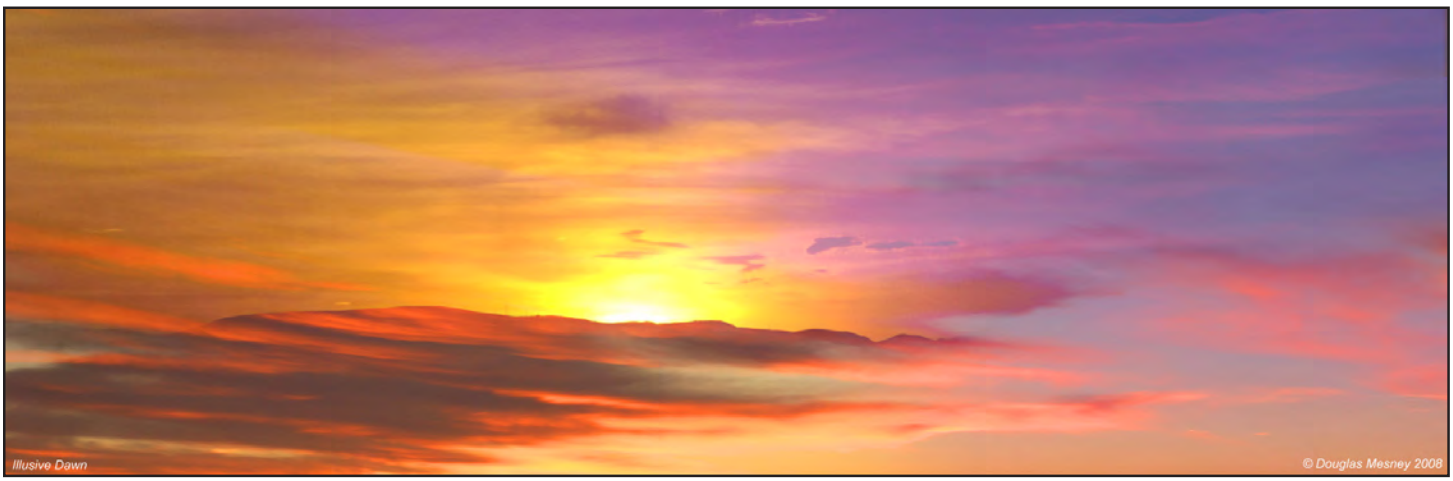
Guide layers can help you find the clipping paths. Duplicate the picture onto a separate layer and increase the brightness substantially. You will see a world of possibilities.

Separated regions can be individually worked on to develop rare tones after the pictures overall balance of regional tones has been worked out. For example, the Seattle sky had a gradient applied to separate it from darker foreground water and give the scene more "depth".

The sunset sky had color adjustments made in each of three regions. Red was added to the Shadows (dark tones) of the orange region. Blue as added to the dark tones in the purple region. Yellow was added to the shadows of the pink region.

Brighten the guide layer to see into the dark tones. Clipping paths and selections can be made on this layer and then applied to others.

The guide layer is your road map not only for making clipping paths for masks and separations, but also for "ingredients" that can be processed to build up rare tones. Illuminated windows in the Seattle pan are an example.



Inuktuk Orators *relies on shadow detail to bring extra depth between the foreground and background. Without detail in the shadows, the picture would look more two dimensional.*

Dark tone region has been separated onto its own layer.

Hopefully there will be stuff in the dark tones that can be developed into rare tones. If not, maybe there's a way to "sculpt" any large areas of solid tone into more interesting sub-components that involve rare tones. Even simple gradients are better than solid masses.

Detail in dark tones of shadows is not visible making the objects look flat and two dimensional.

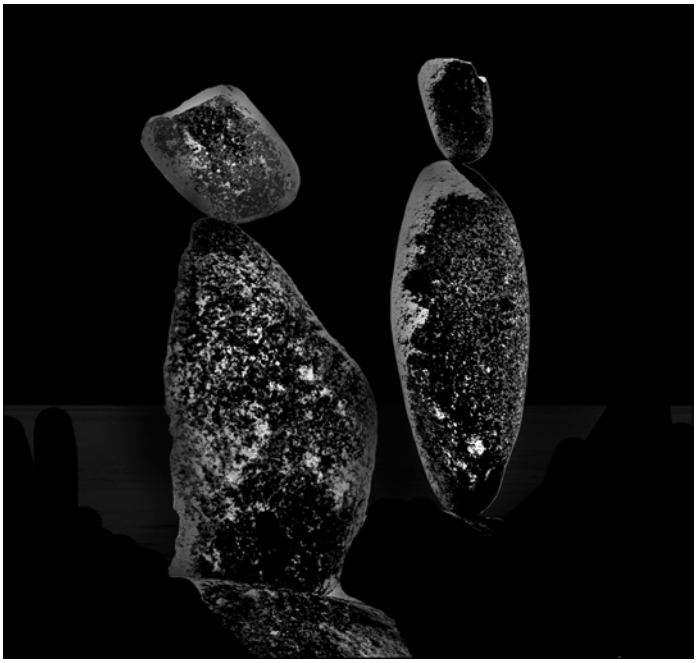
Using the guide layer as your, well… guide, zoom into the picture until you are at a magnification of 800+% to enlarge the borders and edges to a size that can be worked on.

Guide layer is made by lightening the image enough to see what is in the dark tones. The background has been changed to black in order to make it easier to see differentiation among dark tones.

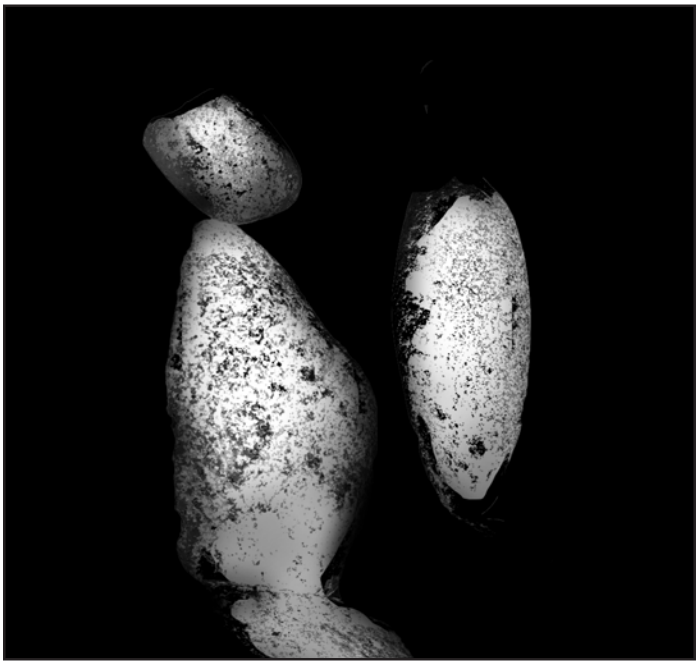
Make two copies of the guide layer, one for highlight brightening and one for dark-tone deepening. Desaturate these layers and mask out the parts you don't want. You may be able to do everything on one layer.

On one layer work up the light tones using the dodging tool set for *highlights*. On the other (or same) layer, go over the area with the burning tool set for *shadows (*dark tones). Work with a low opacity brush so that it takes a lot of passes to slowly build up the separation. Back and forth, alternately burning and dodging. You can appreciate that this is a lot of work and takes some time (billable time?).

If you worked on two layers, you can individually change their blending options, the first to lighten and the second to darken. Combine that with opacity control for the two layers and you have simple but complete control. When you are satisfied, the two can be merged back together or grouped to save space on the layer stack.



High-contrast pos mask contains dark tone details. These can be added with subtlety using a lighten blending option.



High-con negative (called a "shadow-control mask") is used to fill the darkest tones "just enough" to lift them from 100% ink to 98% in the darkest regions. The mask has been airbrushed using black with a 50% opacity brush to pull back the dark-tone ink dynamically, 'sculpting' the shadow tones to add a third dimension to the rock figures.

The picture used in this example is a night scene and is all about what's happening in the shadows cast by the moon. Sure, it's a seascape of sorts, but as you get closer you can see into the shadows and there are textures and rare tones to enrich the viewing experience. It is one's perception of details in shadows and highlights that brings realism to a picture. When too bright the details are *"surreal"*.

Finished blend has picture layer on the bottom of the stack. The pos mask is on the top set for lighten blending with a layer opacity of 22%. The neg mask is in the middle set for darken blending and a layer opacity of 44%.

Notice that the shadows remain dark and about the same brightness, as shadows normally look at night, when "… red is gray, and yellow white, and we decide which right and which is an illusion", to quote the *Moody Blues.*

If it's a really big area or edge you can copy and paste the whole piece onto another layer and use levels or brightness and contrast to get them worked up, then use blending options and the eraser to keep and show only the parts you want. You may end up with only a little bit of stuff on that layer but every little bit helps, as the saying goes.

As you divvy up the dark tone region into more and more separation layers, very precise control becomes possible. In addition to the emphasizing edges and borders between the areas within regions, the areas themselves can be adjusted to increase the visual differences between them and their neighboring tones.

Shadow Control Mask

Shadows (dark tones) can be made lighter *dynamically* using a shadow control mask. This is a highlight control mask that has been inverted with blending options set to lighten. To make one from scratch, start by duplicating the picture layer and calling that layer "shadow control mask".

Use Image > Adjust > Invert to make the picture into a color negative. All the colors in the picture are reversed into their complementary hues and shades. Combining the

picture and its inversion would result in gray because every color becomes gray when blended with its complement. (To dull or "dirty" a color, blend in its complementary shade with varying degrees of opacity.)

Use Image > Adjust > Desaturate to take out all the color. The result is a *black-and-white negative*. This negative is the shadow control mask and it should be stacked above of the picture layer.

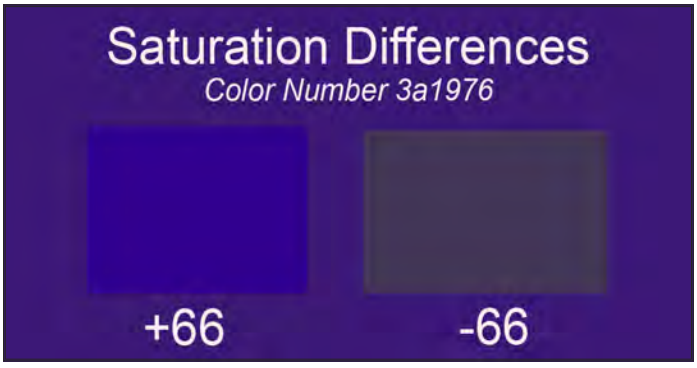
Set the blending options of the shadow-control-mask layer to lighten, and finally adjust the opacity of the mask to somewhere between 2% to 5%. Try to lighten the dark tones as much as possible without killing them. Try opacities of 5% to 15% and then *partially* erasing away the mask in selected areas to "sculpt" the effect. You'll need at least 2% opacity to see a visible difference in the giclée.

Although lightness and darkness are the first adjustments that come to mind when tone separation is necessary, there are other ways. Recall that there are seven types of contrast. We have only explored a few of them so far.

Contrasts of color and saturation provide a veritable rainbow of opportunity to differentiate among dark tones to develop rare tones and to add details, textures and gradients of tone that may not be in the original.

Saturation Differences Between Areas

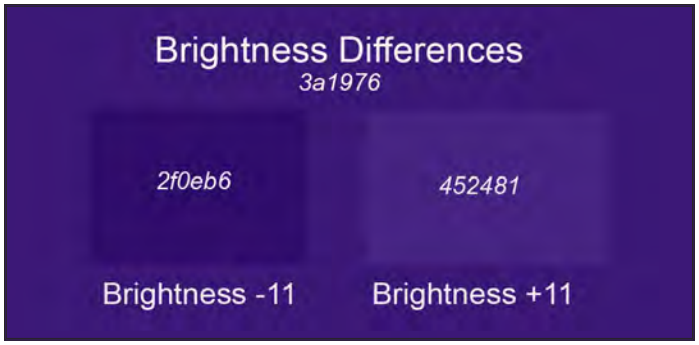
A simple experiment demonstrates how strong differentiation can be achieved among dark tones with simple adjustments of saturation.



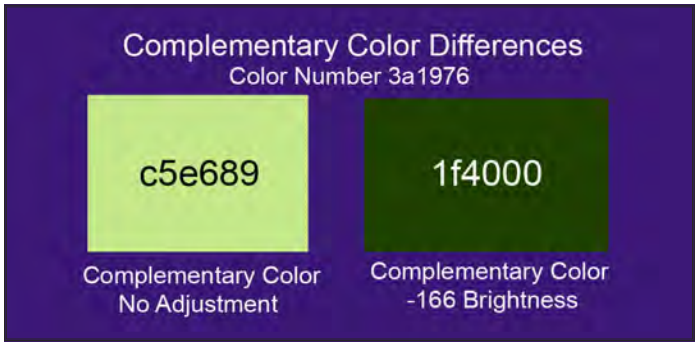
The background is filled with color number 3a1976. The inner left patch had its Saturation increased 66 points and the patch on the right was deceased 66 points.

The differences between the color patches are clear. This technique provides opportunities to develop many rare tones in areas that might otherwise be blah. It can also be used to more clearly differentiate among areas and regions.

The same background color (3a1976) has 33 points of yellow added to the color balance shadows. *On the right 33 points of blue has been added (blue is the opposite of yellow).*



When darkened by reducing the brightness -11 points the original color (3a1976) becomes 2f0eb6. With +11 the new color is 452481.

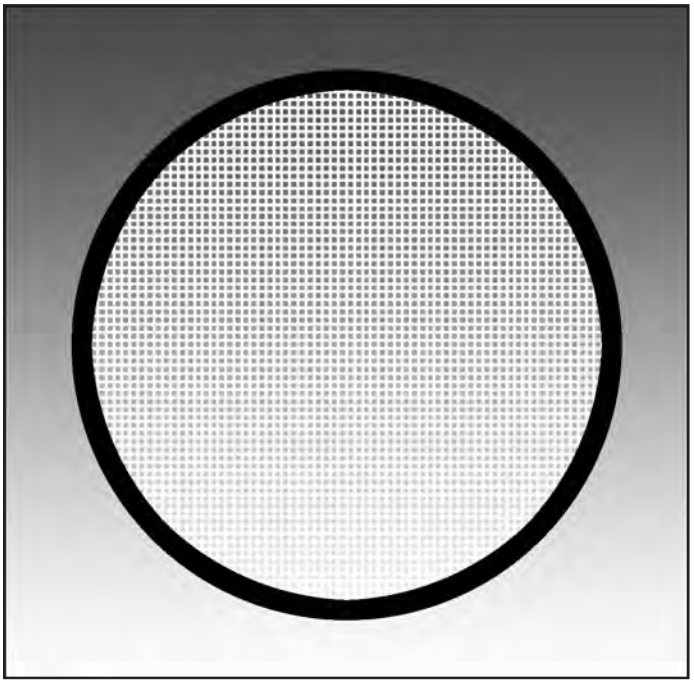


The complementary color for 3a1976 is c5e689 which, when darkened to the level of brightness of the 3a1976 becomes 1f4000. Although the same brightness, 1f4000 is strikingly visible against 3a1976.

White, Gray & Color "Net" Masks

Photographers use sheer "nets" to control shadows and dark tones as well as for diffusion. Hollywood movies of the 1920's and 1930's in particular feature a diffused, soft look made with nets sometimes called "Doris Day filters".

Different color nets produce different effects depending on the scene and it's lighting. A black net will diffuse without lightening. A white net will both diffuse and lighten (especially the dark tones). Color nets diffuse and introduce tints of their hues.



White net masks diffuse and lighten the tones in a scene. The lightening is most visible in the dark tones. Net filters resembles curtain material (which can be used if you don't have a filter).

Net filters diffuse ever so slightly, blending together the edges of tones, reducing the dynamic tone range and lowering the contrast. This reduction of the contrast can help bring the tone range of the scene into the latitude of film and digital cameras.

A black-net *mask* will also do that but the effect is not the same, not as dulling. However, for a snow scene you can imagine how well a combination of black- and white-net masks could bring out the foreground and/or other regions or details.

White nets and white-net filters lift all tones equally, but the lightening effect is more pronounced in the dark tones and darker mid-tones. A black net's effect is seen in light tones.

White Net Mask

Making a "white net mask" can create an effect similar to a white net filter, without the diffusion. It's an easy mask to make and like all easy things has limited value and use.

To make a white-net mask simply make a new layer, fill it with white and reduce the opacity to whatever extent you feel does the job… probably somewhere between 2% and 10%. Erase it away in parts you don't like or to call attention to certain areas. If you want diffusion, use blur filters. Then, if you want the diffusion apply some gausian blur to the picture or a copy of it that has been merged with the mask.

The effect of white (or color) net masks is linear, not dynamic, which means it has an equal effect on all tones, increasing their brightness (and color) by the percentage of the layer's opacity. The result appears similar to looking through a sheer net curtain, hence the name.

White-net masks can also be used to de-emphasize certain parts of a picture so that other parts stand out more prominently. Dulling down the background with a white-net mask will emphasize the foreground. Good for "fog".

You're not restricted to white. Try the same effect using different colors for different parts. Areas and regions can be lightened and tinted at the same time. The lightening provided by a White Net Mask is more even than using a brush, unless that brush has hard edges.

Shifting the blending options to lighten or darken makes this otherwise linear effect quasi dynamic. If it is a color mask other blending options can render interesting effects.

Priority One: Avoid Over-Inking

As a general rule, CMYK Info readings for the darkest tones should not exceed 95% for any single color and the inking should never reach 100%.

That said, dark tones benefit from "enough" ink to make them rich and deep. For example, good solid black is achieved on a traditional for-color printing press by having 80% cyan, 60% magenta, and 30% yellow *under* the topmost layer of black ink. Without those undertones the black wouldn't be as deep and might, in fact, be dark gray if the pressman turns down the taps on black to avoid over-inking, as many do.

Giclée printing doesn't have underlay or overlay inks because they are all sprayed on at the same time. But you can get the same effect by getting into any tone and burning color the shadows.

Burning the shadows enriches the color in a way that is similar to saturation. If the color gets too strong in one area, reduce the contrast of that area or desaturate it partially using the sponge tool.

In printing, less can be more. Ride the inks and pull them back as far as you can without losing dark tone depth. You don't always need a total black. If most other tones are light even dark gray will appear to be black. A little black bear in on a snowy white mountain could be dark gray but still look black. Keep the ink as light as you can while maintaining the look sought after. Pumping up the ink will not usually help. Instead, lighten the surrounding tones.

Washington Wheat
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Giclée Prepress Workflow

Step Nine
SHARPEN & BLUR

Fuzzy Wuzzy Wasn't Fuzzy... Was He?

Not all pixels are created equal, because no two algorithms are the same. Some are noticeably better than others. Better? Pixels?

Like anything in life, "better" is a matter of personal preference. Preferences can also come from needs, such as technical requirements. For example, a technical rendering requires extreme sharpness but a baby's portrait does not... or does it?

Sharpness begins with image capture by a scanner or digital camera. Both of those kinds of devices provide sharpening to some extent or another. People are tempted to turn on sharpening because everybody likes sharp pictures. It's counter-intuitive though, and turning on sharpening turns off quality. But what is quality?

Quality is the ability to control edges and borders. Control means being able to emphasize or de-emphasize them. What is an *edge*?

Edges come in two forms, for our purposes.

- *Objects* (that appear in the picture) have edges.
- *Pixels* also have edges.

What is counter-intuitive about most sharpening algorithms is that they sharpen the edges of pixels, not pictures.

Pixel-edge sharpening is not in itself a bad thing. In fact it is something most giclée prepress artists do as a l*ast step* before output. That is what I term "*technical* sharpening". There is also "creative" sharpening and we'll discuss that later.

Technical sharpening facilitates the mapping of pixels by the giclée printing machine. Like any other output device, giclée-printing machines have to process your image input and "map" it.

Pixel by pixel the printer assigns a color to each pixel. Each is a specific. single color. There is no dithering at this point. Dithering may be desirable during image production, but bad for image output.

In computer graphics, a bitmap or pixmap is a way of organizing memory, the image file protocol used to store digital images in temporary memory while the machine prints the image.

Bitmapping & Artifacting

Bitmap means a "map of bits" or "map of pixels". It does not mean one bit per pixel or one pixel per bit. (Some people use the term "bitmap" to mean one bit per pixel and the term "pixmap" for images with multiple bits per pixel.)

Bitmaps exist so that image information can be stored as digital data and communicated to other digital devices.

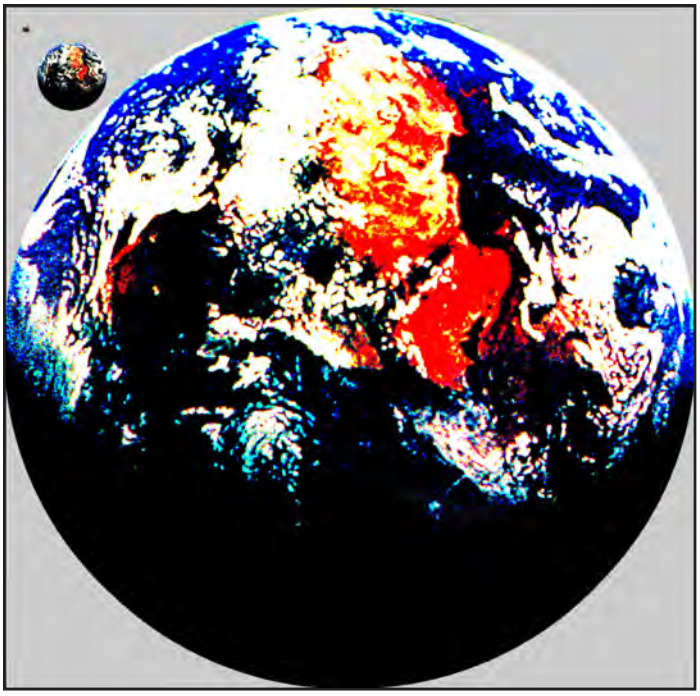
A bitmap is a spatially mapped array of pixels. Rasters are bitmaps. The maps plot pixel locations on a grid using two axes, X (left to right) and Y (top to bottom). The position of a pixel on a bitmap grid is measured by its *coordinates* on the X and Y axes.

All image systems are based on coordinates. They are the "navigation tools". 3-D imaging systems add height as a third coordinate called "Z".

Mapping allows each pixel to be individually *addressable*. Every pixel has a different address on the bitmap. That means you can individually manipulate them... and so can your devices.

Every bitmap has a "native" resolution. For example, your computer monitor shows a bitmap of its native resolution.

When you send a file to a device that is not the same as its native resolution, something's gotta give. How can you squeeze 1000 pixels into a space that can only contain 100? There is no problem going the other way as 100 fits nicely into a space of 1000. Going the other way, *truncation tosses away* 900 pixels leaving 100. Before that, the content of the 1000 pixels is *compressed* to fit within 100 new pixels.



Earth appears as three sizes in the picture above. The largest is 1,000 X 1,000 pixels, the second largest is 100 X 100 pixels and the smallest 10 X 10... can you see it?

Compression *averages* 1000 pixel colors into 100. They are not the same as the old colors but so close that you would hardly notice that anything changed. This process is technically referred to as *re-sampling*. Re-sampling is something that purists don't like.

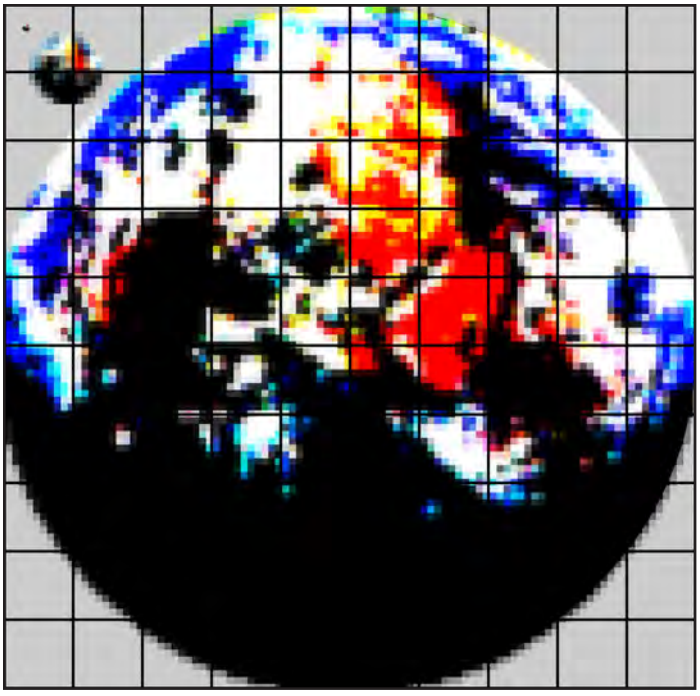
Let's now look at some exaggerated reductions of an image reduced from 1,000,000 pixels to only one.

Our examples start with an illustration of the Earth (above) that is 1,000 pixels wide and 1,000 pixels high... one million pixels in total.

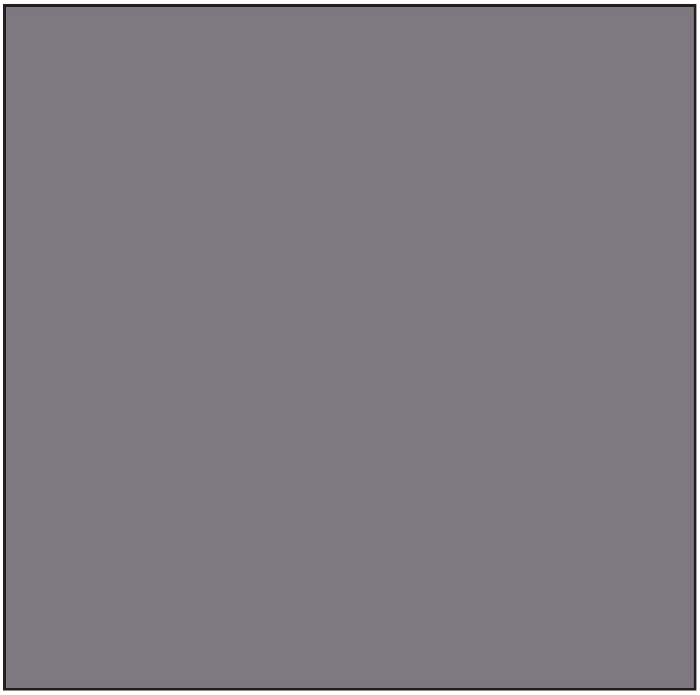
As the resolution of the Earth pictures decreases, the colors of the pixels are blended together and rounded up to the closest color available in the device or display's color gamut.

By the time resolution is 10 X 10 pixels, this effect is clearly visible. Eventually, all the colors are blended together in a single gray pixel. (When all colors are equally blended the result is neutral gray.)

As the colors are rounded up more and more rare tones are eliminated and the result is a much smaller gamut. Pictures with smaller gamuts appear to have more contrast and saturation. The build-up of contrast and saturation during the reduction process can be adjusted back using the appropriate controls if the gamut of the reduction is objectionable.

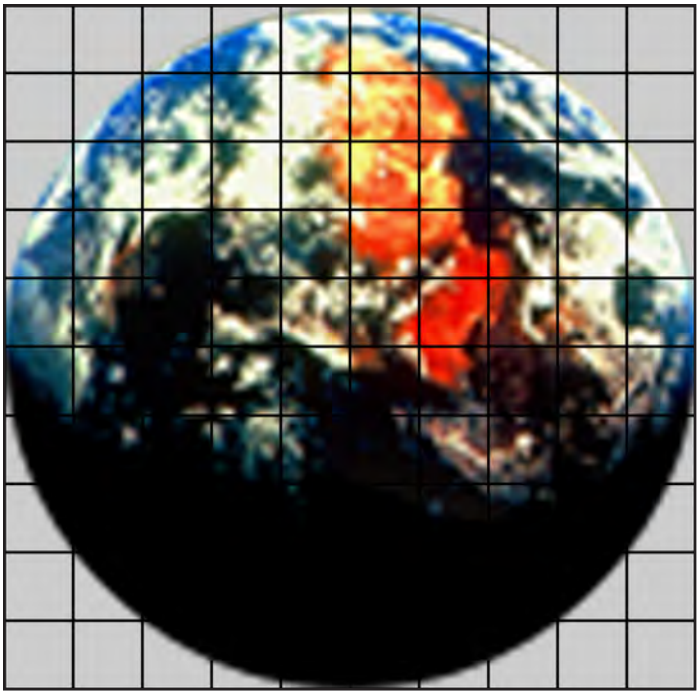


The scale for the grid lines is 10 X 10 pixels. The large Earth is now 100 X 100 pixels; medium size is 10 X 10; small is only a single pixel.

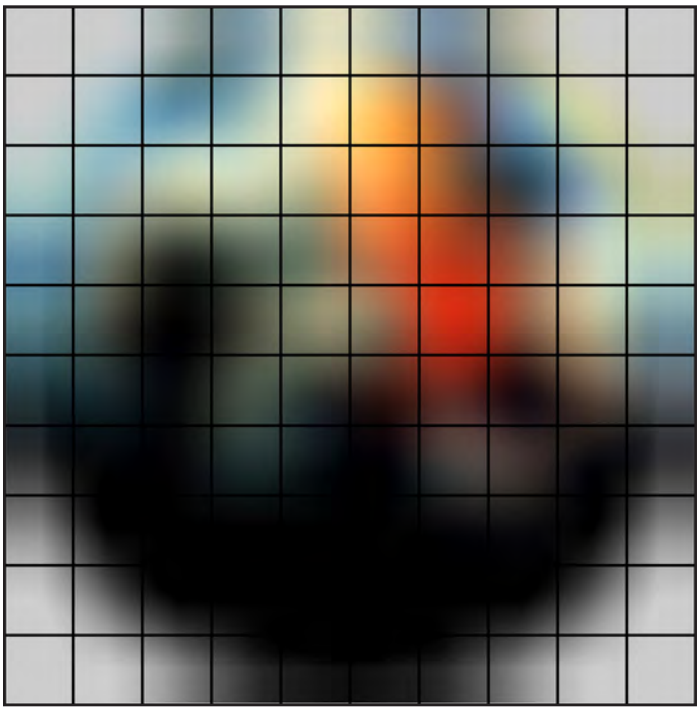


Eventually the whole picture is reduced to a single pixel. All the colors have been rounded up together and the result is a shade of gray.

Bitmap images have a fixed size determined by their pixel dimensions. They can be reduced in size without any difficulty, however enlarging bitmapped images is problematic because there aren't enough pixels.
If there aren't enough pixels, devices create them making pixels where none existed before. Sharpness suffers as a and colors change too in the re-sampled enlargement.



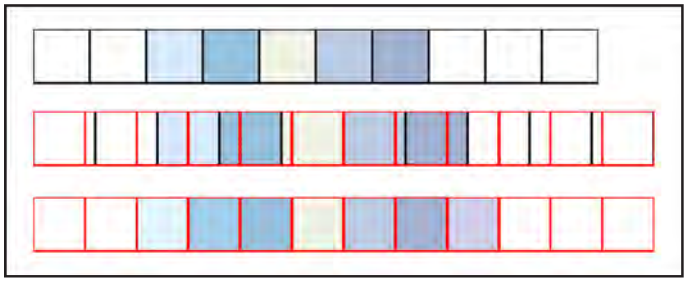
Here a 100 X 100 pixel Earth has been scaled up *to 1,000 X 1,000 pixels. Compared to the reduced version (left) this one looks fuzzy.*



Here a 10 X 10 pixel Earth has been scaled up 100 times to a new size of 1,000 X 1,000 pixels. 99% of the new pixel information has been "invented" by the software algorithms.

Dithering is responsible for most of the softness of enlarged bitmap pictures. But what is a poor computer to do? Can you imagine how horrible the result would look with jaggies magnified 10 times? There are algorithms that specialize in extreme enlargements of digital images using fractal technology, like *Genuine Fractals,* which can work better.

Here is an illustration of 20 pixels. The address of each is indicated together with its color number. This row will be reduced to 10 pixels, and the result enlarged to12 to illustrate what happens during averaging. (See a larger version on page 103).



The 20 pixel row has been reduced to fit into a 10-pixel space (top row). The center row shows the borders of the enlarged 12 pixel space. The extent of overlap (shown in the center row) determines the averaged new color (bottom row).

How is the averaging done? Many algorithms are involved. Not only are the component parts mixed by percentage, but the result is also dithered and all that made to fit into the target bitmap gamut. Calculations are made easier and faster when enlargements and reductions use computer-friendly sizes.

Computer math is based on eight.

8 X 8 = 8
8 X 2 = 16
8 X 4 = 32
8 X 8 = 64
8 X 16 = 128
8 X 32 = 256
8 X 64 = 512
8 X 96 = 768
8 X 128 =1024
and so on…

Sizes and calculations that are divisible by eight run smoother in any application. Image sizes divisible by eight will load faster, process faster, and print faster with the fewest *artifacts.*

Artifacts in a digital image are any undesired alterations introduced by the algorithms processing the image data. Commonly seen artifacts are the kind of squiggly "halos" that appear in over-compressed JPEG pictures and excessive pixilation in MPEG videos. As all algorithms are not created equal, some devices produce more artifacts. Compression artifacts are a particular class of data error and are usually the consequence of quantization in *lossy data compression.*

The 100 X 100 pixel Earth (page 80) was reduced to 10 X 10 and saved as a high-compression jpg (level 2). The compressed file was enlarged back to the original size. The result shows extreme artifacting.

"Lossy data" is a term used to describe algorithms that toss away pixel information after creating their own compressed versions.

Lossy compression method is one where compressing data and then decompressing it retrieves data that is different from the original, but is close enough to be useful.

Lossy compression formats suffer from generation loss: repeatedly compressing and decompressing the file will cause it to progressively lose quality.

Compression artifacts occur commonly in file formats such as JPEG or MPEG. Files are compressed to save disk space and to make file transfers faster.

As you well know, the larger a file the longer the up-and-download times over the Internet. There the objective is to get the smallest possible picture data file while retaining "enough" image quality.

What people call image quality is related to resolution primarily, but artifacts can have severe impact on picture quality, especially for small size images of the kind you see on the Web and in videos.

Compression artifacts come about when the original image data is rounded up or truncated.

Above, the illustration shows a row of 20 pixels. The address of each is indicated as its X and Y coordinates (the lower number). Above that is the color number of each pixel. If this information were written in tabular form it would like the table immediately below.

How Image Data Is Written

Uncompressed image files are written, saved and processed by other digital displays and output devices bit-by-bit, literally.

Uncompressed instructions for the twenty pixels illustrated above require twenty lines of code to write the address and color instructions for each pixel, as in the table, below.

Pixel Address		Color
Column	Row	Number
1	1	ffffff
1	2	ffffff
1	3	ccffff
1	4	99cccc
1	5	ffffff
1	6	cccccc
1	7	9999cc
1	8	ffffff
1	9	ffffff
1	10	ffffff
1	11	ffffff
1	12	ffffff
1	13	ffffff
1	14	99cccc
1	15	cccccc
1	16	ffffff
1	17	99cccc
1	18	ccffff
1	19	ffffff
1	20	ffffff

The same data when compressed writes the same instructions in five lines of code, as below.

Pixel Address		Color
Col	Rows	Number
1	1-2/5/8-13/16/19-20	ffffff
1	3/18	ccffff
1	4/14/17	99cccc
1	6/15	cccccc
1	7	9999cc

Compression schemes can also limit the total number of colors, rounding up rare tones into more primary ones. Five pixels with individual rare tones end up all the same color when rounded up into one pixel.

cc	ffffff	ffffff	ffffff	ffffff	ffffff	ffffff	9999cc	cccccc	ffffff	99cccc	ccffff	ffffff	ffffff
	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20

Once artifacts have ravaged an image, they are impossible to repair effectively. For that reason it is important to save master images as uncompressed files. Compressed files and any others) should carry the master file's version numbers to facilitate finding the master if needed.

Original Pixel Colors				
ff9999	f1b0b0	ee9b9b	faaaa4	faa5aa
1/1	1/2	1/3	1/4	1/5
Rounded Pixel Colors				
f9b9b9	f9b9b9	f9b9b9	f9b9b9	f9b9b9
1/1	1/2	1/3	1/4	1/5

Pixel colors change as a 10-pixel image is scaled up to 12 pixels. The new colors are the result of averaging.

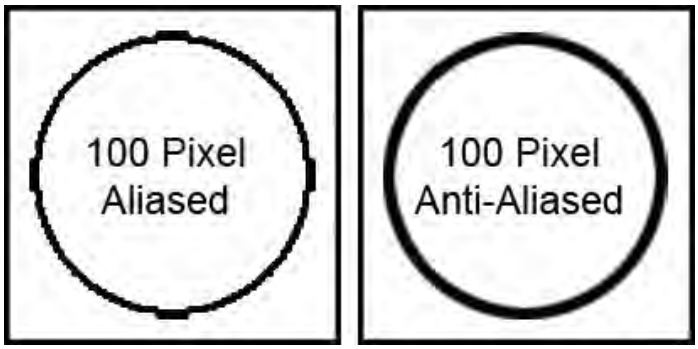
"Tiling" is another compression artifact. To understand tiling, recall that computer math is based on integers of eight. To process large images efficiently, algorithms divide large bitmaps into "bite sized pieces" which are squares"tiles" of some number divisible by eight.

Aliasing By Any Other Name is Still Aliasing

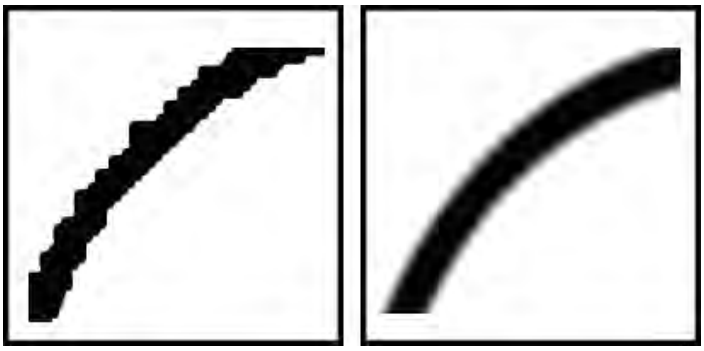
Aliasing is another kind of artifact commonly called "jaggies". It is the direct result of rounding up. Curves and diagonals have a stair-step appearance because it is impossible to render curved or diagonal lines using squares.

The lower the resolution, the worse the jaggies will appear. Anti-aliasing algorithms fill in the gaps in the "stair-steps" that form the edges of curves and diagonals. They do so by making pixels where none existed. Thus, they are not part of the original image and thus can be considered an artifact.

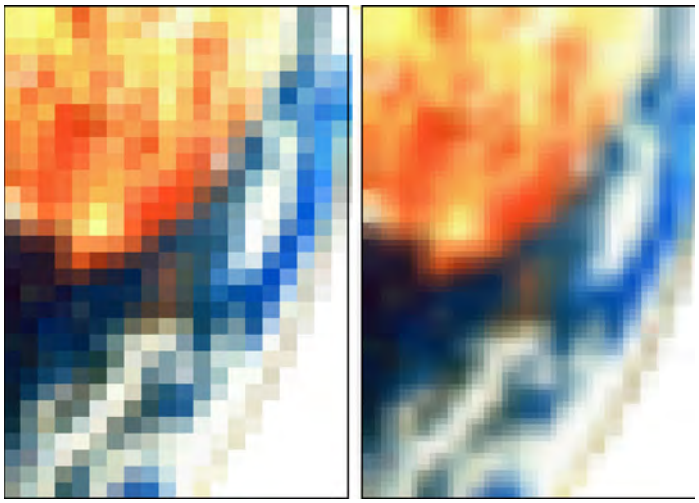
Dither is similar to anti-aliasing. In this case, the colors of two pixels are used to determine the color of a third pixel lying between them. This new pixel thus 300 has a value that is the average of the two pixels on either side of it. Dithering reduces or eliminates unwanted jaggies.



A 100-pixel diameter circle aliased (left) and anti-aliased (right).



Close-ups of aliased circle edge (left) and anti-aliased (right).



Dither and anti-aliasing around edges and borders increases the number of rare tones. Giclée prints benefit from these tonal nuances.

Very few images are the kinds of simple ones used here for illustrative purposes. In the real world most pictures contain an endless variety of curves and diagonal edges in every conceivable color and shade.

When all of these are anti-aliased and dithered the result is a soft look that can be close to that of film. The anti-aliased images captured by high-quality cameras and scanners can look better than sharpened versions, in the eyes of some.

Sharpening algorithms clean up the edges of pixels and reduce the effect of dither and anti-aliasing.

Almost every camera and scanner defaults to a certain amount of sharpening. As a result, the files your client gives you for giclée printing may well have already been sharpened, reducing the dither and anti-aliasing.

When you zoom deeply into the image and examine the *pixels*, are they sharp and distinct or is there a softness to them? If they are very sharp you may wish to blur them. If they are too soft, you may wish to sharpen them. There are no rules.

The total look should lead your decision-making. Technical drawings and graphics look better with sharp pixels. Fine art generally prints better if you use softer, blurred pixels. Soft-edges produce more rare tones than sharp ones and these extra colors enrich the total look.

It is worth repeating that I am talking of pixel-edge blur, not about making the picture look blurry. To make a picture look blurry use Filter > Blur > Surface Blur.

The kind of blur we're after here is the kind that generates "gradient pixel edges", which is an oxymoron.

Sharpening enhances the snow in this winter scene. The picture was divided into three depth zones with extreme sharpening on the closest elements and slight blurr on the background mountains. The sharpest element is the eagle in the tree.

Creative Sharpen and Blur

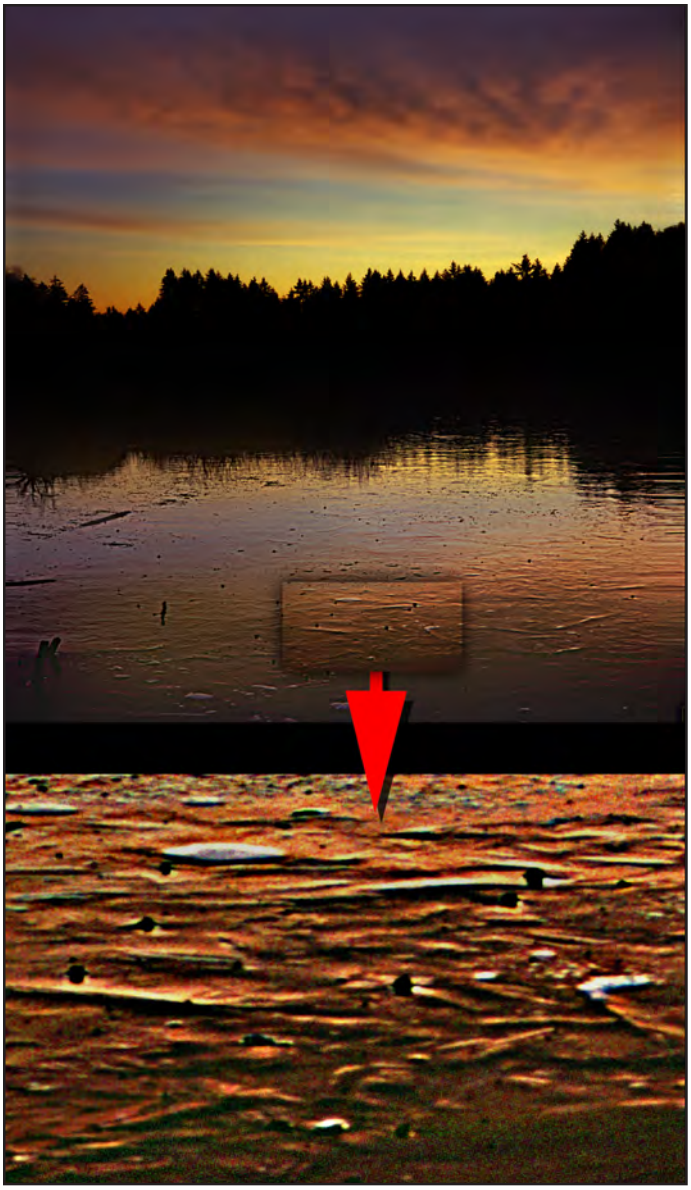
Sharpen and blur can be used creatively to enhance images.

The scanning eyes of viewers look for sharpness and generally the sharper things are the easier they are to "read". The sharpest parts of pictures are the ones that the eye comes to rest on while scanning. This by making some parts of a picture sharper than others, the artist can direct the attention of the viewer to objects or parts of the picture that are considered more important. Likewise, objects or portions of pictures can be made less important by making them less sharp.

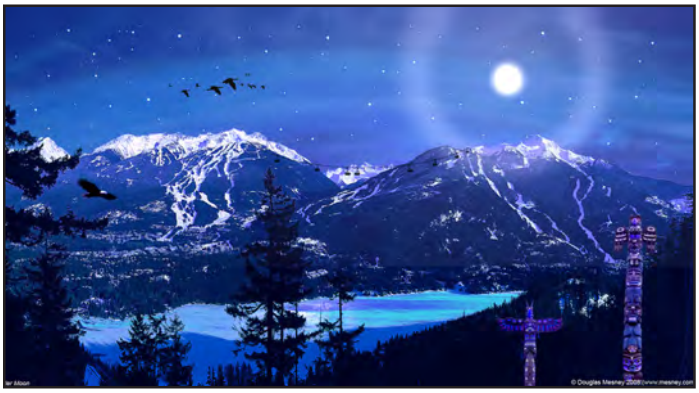
How sharp an object appears depends on the relative sharpness of the objects around it, and the background. Selective focus is a favorite technique used by photographers to bring the viewers' attention to the subject. Gausian blur can be used to achieve a similar effect.

Creative sharpening creates interplay between focus and blur within the scene to improve visual navigation.

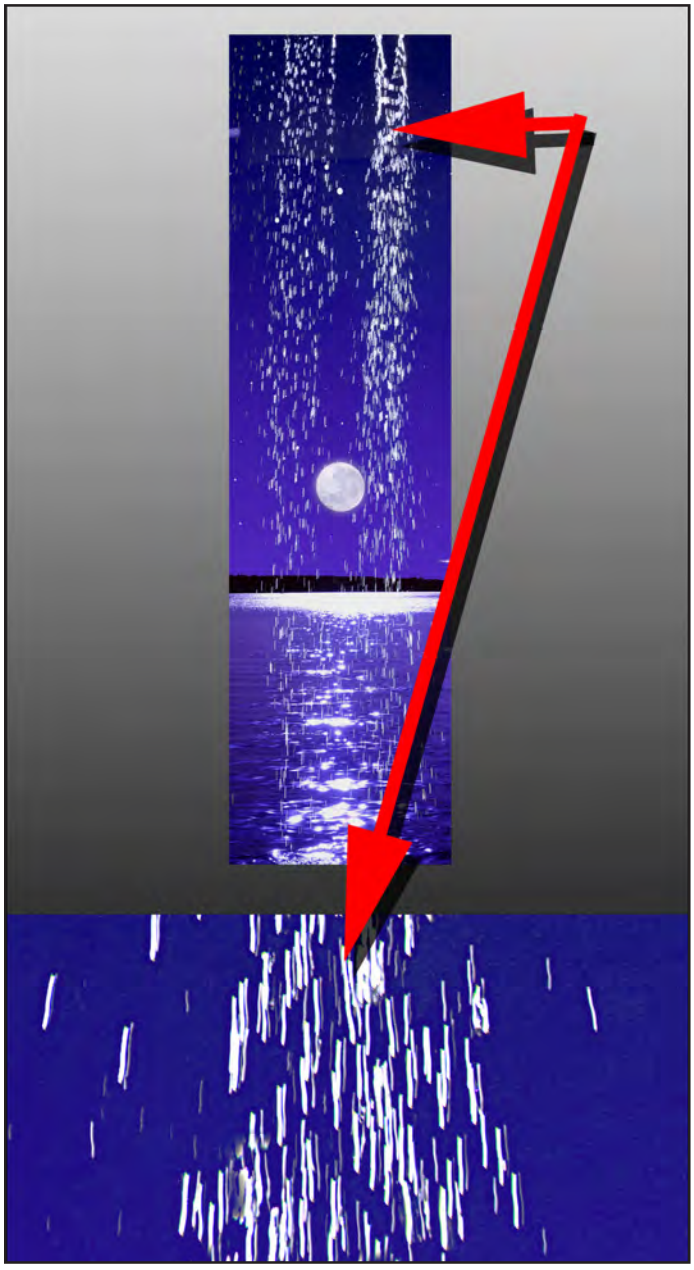
The hyper-intense edges created by extreme Unsharp Mask settings can add "snow" to the branches of trees or create highlights on ice and crystal pictures, glassware, chrome and other shiny things. The aurora in this scene was also sharpened to make it a veil of "crystals".



In this picture by Kirk Beeler the sky reflecting on the pond surface was originally a soft-edged grouping of gradient colors like the sky above. Applying extreme sharpening built contrasty edges light on one side and dark on the other... perfect for the look of ice.



Gausian blur creates a soft misty halo around the moon. I started by stoking a circular selection with a light gray. Then the Gausian filter was applied and the result tinted with a shade of light blue. To finish the effect the contrast was heightened and layer opacity reduced.



Extreme sharpening enhances anything that sparkles by adding a high-contrast edge around tone regions. If the effect is overwhelming try varying the opacity of the sharpened layer, or change the blending options to lighten or darken.

Blurring the background calls attention to the foreground. Sharpening the butterfly makes if more dominant and attention grabbing. The soft- focus tool that is so popular is easily mimicked this way. Separate the picture into foreground and background. Use gausian blur on the background and light on the foreground. Find a third level of depth for an even better effect. Sharpen the key subject area(s) or item(s).

Softening a woman's portrait is flattering for the skin, but the eyes, nose, lips and some of the hair should be sharpened. A little sharpening can look like more when the adjacent areas are slightly softened with an overlay layer that has gausian blur applied with selective erasure.

Pixel Mapping to Displays and Printers

Rule of Thumb: Avoid Scaling.

When the image file is sent to the giclée printing machine it should map to the output device with pixel-to-pixel accuracy if you want to avoid further dithering and anti-aliasing by the printer's algorithms. Personally, I don't like the printer making the decisions, no matter how good it is.

When a smaller pixel map is enlarged or reduced to fit into another the original pixels are changed into new ones. That may be with more dithering and anti-aliasing by the algorithms used by the output device.

Professional giclée printing machines have settings that map input files pixel-to-pixel. However, many devices re-map, making all new pixels. If your file is even a few pixels different in X or Y coordinates then all new pixels will be re-sampled and remapped to fit the printing machine's bitmap. (In any event, the image will be re-sampled into the printing machine's gamut.)

DVI Output to Displays and Projectors

Audiovisual displays and projectors interpret image files the same way as printing machines when it comes to pixel mapping.

Take for example a typical 1024 X 768 pixel monitor screen. If you send it a 1024 X 768 pixel image, it will "fit" with pixel-to-pixel accuracy. But what if you send a larger or smaller one?

VGA, RGB and other analogue displays scale incoming images up or down to their own native resolution. The original pixels are changed into new ones and the quality of the new ones depends on the algorithms of the specific display or projector. Some are better than others.

The main differences are in the total number of tones the device can produce, its dynamic tone range.

DVI (Digital Video Input) facilitates pixel-mapped display and projection. There is no scaling. Pixels are mapped by address. Pictures with pixel dimensions that are larger than the display's dimensions will "overshoot" the display and not be seen. Smaller sized images won't fill the screen. Pixel-to-pixel DVI mapping provides the sharpest, clearest and most steady kind of video image.

Vector Edges Are Always Sharp

Vectors define areas but have no "substance". They establish virtual borders, like "invisible fences". Vectors are like rubber bands because they can stretch and shrink and as they do whatever is contained in the vector borders expands or contracts too.

As long as the graphic element is in vector form its pixels can flow into whatever space is defined by the vector. (Rasterized images are locked into their bitmapped dimensions.)

Vector graphics are made of geometrical "primitives" (native shapes and forms) such as points, lines, curves, and shapes or polygons. These are all based on mathematical equations, not pixels.

Vector graphics formats are complementary to raster (pixel) graphics but because they are "virtual" they can't

be printed. Before they can be printed they must become rasterized (bitmapped). Rasterized images are grid-arrays (maps) of pixels, not mathematically formulated shapes.

Vector graphics files store the lines, shapes and colors that make up an image as mathematical formulae, then construct the screen image for the native resolution of the output device.

Mathematical formulae can scale to any size and then determine where the dots that make up the image should be placed for the best results. The quality of the image is only determined by the resolution of the display or printer. The file size of vector data of the image stays the same.

Business graphics are often vector based, as are illustrations made in Adobe Illustrator and animation software like Flash. Whether shown on screens or as printed output, vector graphics provide the sharpest, crispest edges and *least painterly* look.

Type fonts in particular benefit from vectors. Bitmapped type can't be enlarged much as the edges become soft. Vector type is infinitely scaleable with no change in quality, other than the resolution limitations of the printer or display.

Video Pixel Mapping

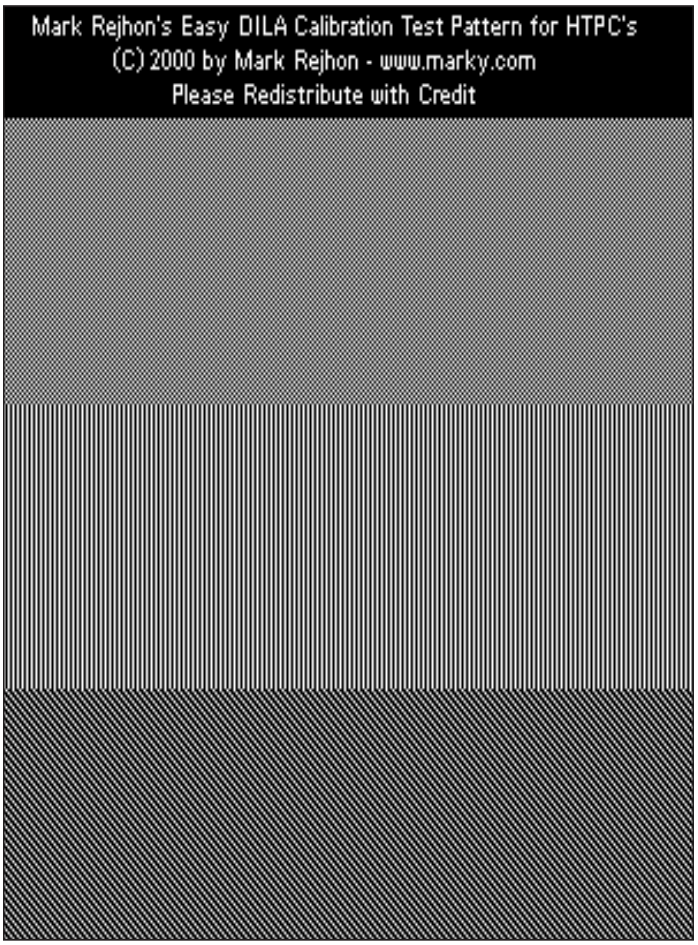
If the image dimensions are smaller than the native bitmap size of the display, the result is a black border around the picture. The effect is (called "window boxing" (below) or "letter boxing". This technique prevents pictures being stretched or shrunk distorted by the monitor.

In order to understand the concept of video pixel mapping it is necessary to understand the path taken by the video from the source to the display.

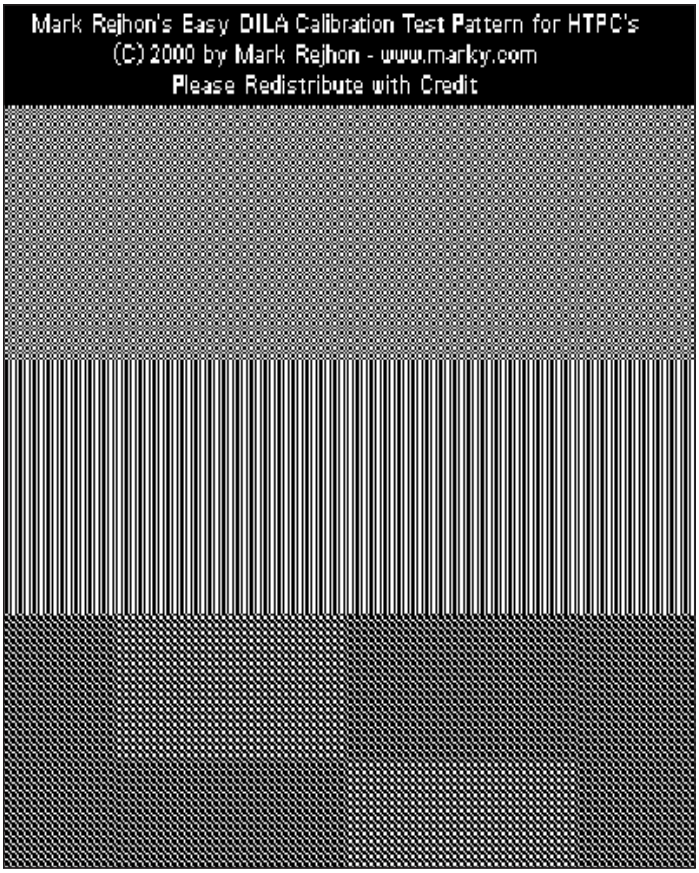
Typical signal sources are analogue TV, digital satellite, cable or terrestrial TV. Up until recently video sources typically had a video signal where each individual image was made up of a 720 pixels times 576 pixels. "720 X 576" is the name for the resolution of the image. Any other size picture signal must be scaled and each scaling step causes artifacts, decreasing overall image quality.

1:1 pixel mapping is a video display technique used in some devices, such as LCD monitors and high-end video projectors. A monitor that has been set to 1:1 pixel mapping will try to display an input source without scaling it. Each pixel received is mapped to a single native pixel on the monitor.

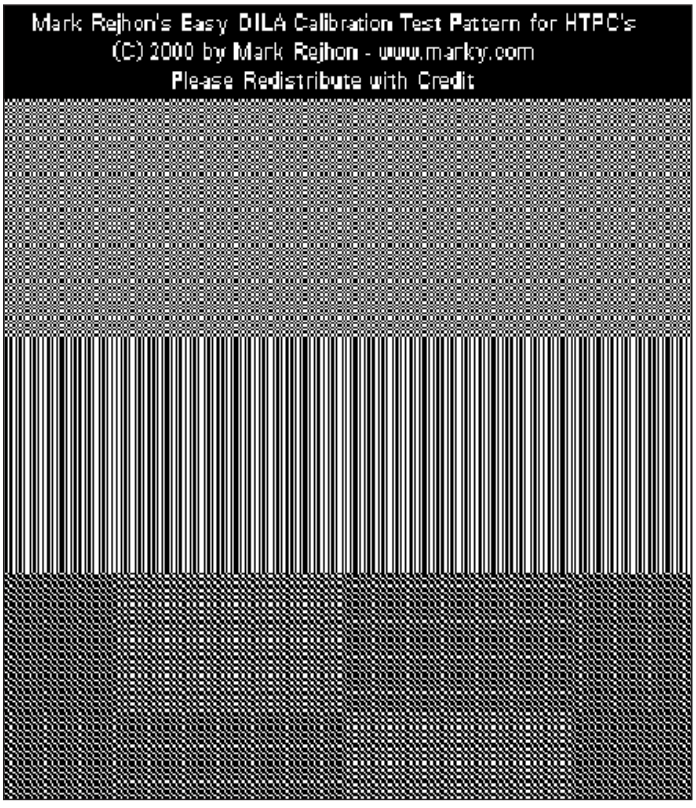
Below is a popular test pattern used for testing pixel mapping. The first image is the original, the second has been scaled up by a factor of 1.33 (same factor TV scales horizontally on a 16:9 ratio desktop, whereas a traditional 3:4 ratio os 1024 X 768).



Test patterns Scaled to 1:1.33



Any scaling will begin to generate moiré effects of one kind or another because the pixels no long line up one-to-one.



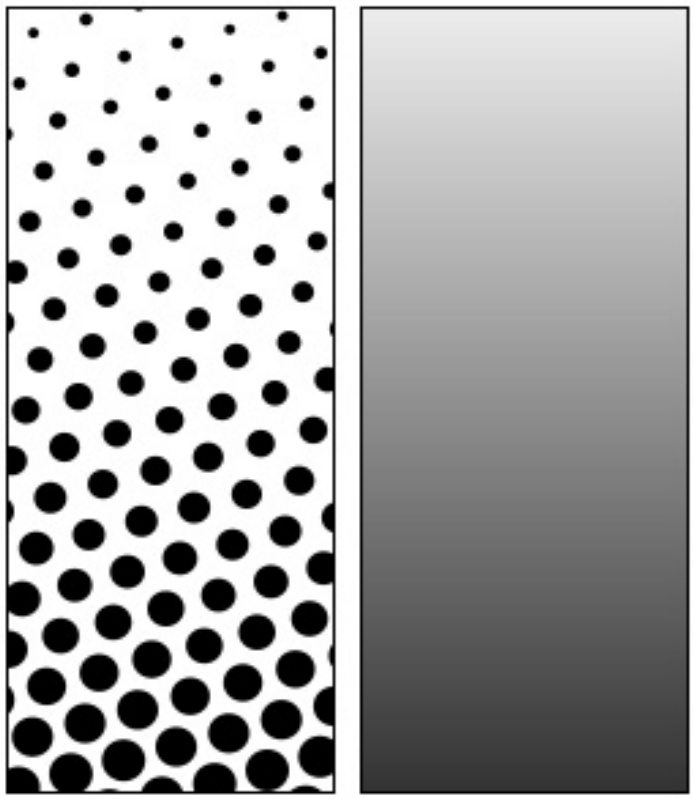
Moiré patterns of interference show clearly on this enlarged test pattern. Scaling artifacts have compounding the previous scaling.

More on Moiré

To reproduce photographs and other multi-colored art the originals are screened (photographed through a screen) to separate them into dots.

The dots make it possible to get thousands of shades with only one color of ink, by changing the size of the dots. The dots have to be small enough to create an optical illusion wherein the human eye blends them together to see a continuous tone once again.

Whenever more than one pattern is involved, there is a risk of interference between them if they are not matched, resulting in moiré patterns.

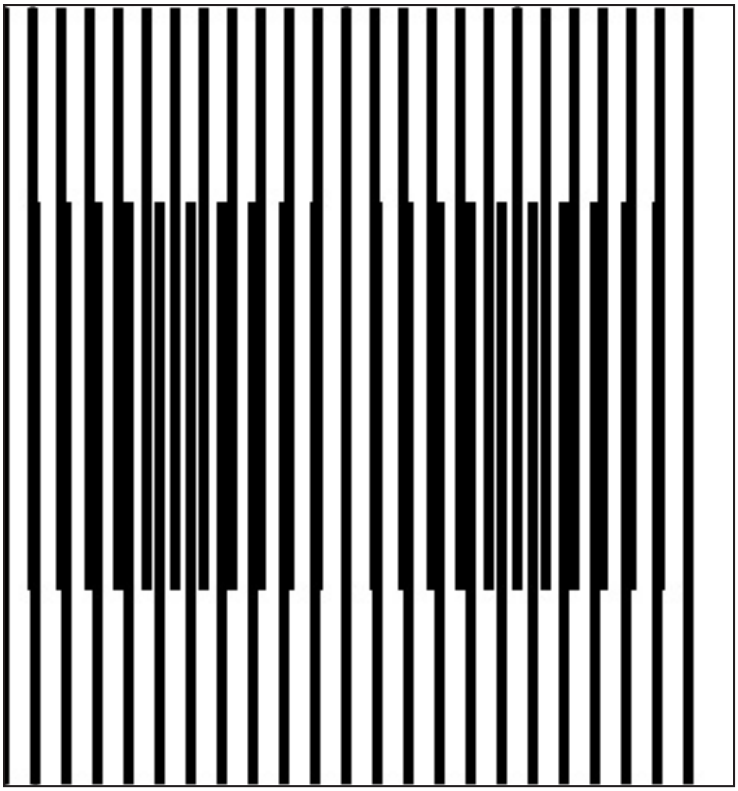


Continuous tone artwork (right) is screened into dots for printing. The dots in this illustration are very exaggerated.

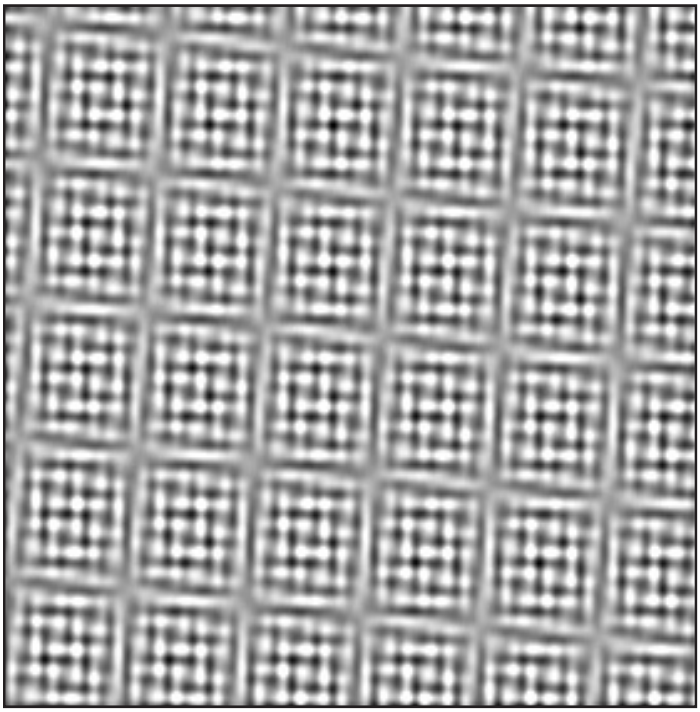
Gray colors are obtained from black ink by printing tiny dots. The smaller the dots, the lighter the gray color appears, and vice versa.

The dots are arranged on a grid, like pixels. The more dots per inch the finer the resolution. However, physical limitations on how small dots can be printed limit the range of tones that can be printed using dots.

When one screened image is printed on top of another, the angles of the grids must be offset so that the dots do not print on top of one another.

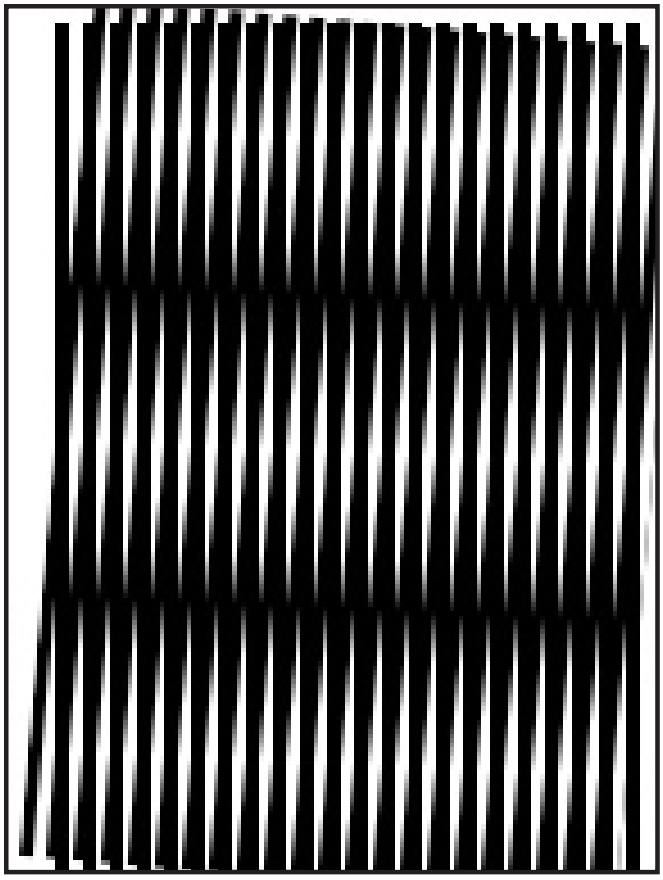


This picture shows how moiré interference occurs between two overlaid line patterns when their frequencies are different.



Moiré patterns also happen when screen angles conflict.

Although moiré patterns are the basis of some "Optical Art" and can be fun to play with for video and photo effects, they can be a pain as well. Who hasn't tried scanning printed pictures only to have ugly moiré patterns appear in their copies?



Interference pattern created with two identical sets of lines at angle to one another..

Dealing With Moiré Interference Patterns

To reduce the moiré effect when copying pre-screened originals, using a Descreen filter is a good way to begin. The Median filter is useful as well.

The origins of the moiré pattern are the interference between the dots in the originals printing screen and the pixel map of the device capturing the image, a scanner or camera. Which ever is used, try any built-in algorithms, like De-Screen if available.

Although I once used scanners, I rarely do any longer because have found that copy work is better done with a good-quality digital camera. The reasons for that are primarily that unless you purchase a very expensive scanner, the sensor in the digital camera is (probably) better than the scanner's.

Cameras use different algorithms than scanners. Scanners inherently sharpen more than cameras, probably because the anti-aliasing and dither algorithms are designed to offer a "film" look. The film look is soft and that is desirable in this case, to minimize the interference of the dots by making them fuzzier.

Using a camera, de-focus the screened original very slightly and shoot one frame. Shoot an additional frame with sharp focus (which you will end up using only for reference if your soft-focus frame was done just right).

Bring the picture into PhotoShop and make it four times larger than the reproduction size will be (400%). Duplicate the picture layer and call it Blur.

Use Filter > Blur and then Filter > Blur More. You can also try the Gausian Blur, Median and Despeckle filters, each on their own layers for precision control. Surface Blur gives a gross effect.

Then, by controlling the order of the layers in the stack, and adjusting their blending options, you'll find the combination that does the best job for the picture you are working on.

Every picture requires a slightly different combination of blending and layer opacity. Layer stacking is also influential.

After completing the blurring procedures re-size the picture to its repro size and use the unsharp mask filter to *restore* as much sharpness as possible without making the moiré discernible.

For hard-to-fix cases, do the processing in two stages. After blurring the 400% size, reduce it to half it's size and blur it again at that magnification. Then reduce it down to repro size. Finally, use Unsharp Mask and restore as much clarity as you can.

Lab Color Method

This procedure will help reduce moiré patterns as well as noise. First convert your image to LAB Color. This is a scientific method of defining color in which there are three channels. The L channel holds contrast and detail information while the A and B channels hold color information.

Use blur techniques (as above) on the A & B channels. Be sure you use the *same adjustment* on both, as they are dealing with complementary colors and differences in settings will affect the color balance.

The details in a LAB image are mostly held in the L channel, so your blurring of the other two (A & B) can be quite intensive.

On the L channel use the Despeckle or Median filters. Remove as much noise or moiré pattern as possible, keeping sufficient edge detail. (Dust & Scratches is another filter choice.)

After that, sharpen it with the unsharp mask filter, with an easy hand. Finally, re-convert the picture back to your original working space CMYK or RGB.

Working large and then reducing back down to the repro size is desirable for the LAB method as well. Every time that an image is resized up or down, new pixels are created with anti-aliasing and dithering, which soften edges.

Color Printing with "Controlled Moiré"

The printing industry relies on controlled moiré patterns to reproduce thousands of color tones from four ink colors.

In the creation of printing plates for the four-color printing process, original artwork is photographed four times. First through Red (#29), Blue (#47) and Green (#61) filters and once without any filter.

The resulting four negatives are called "separation negatives". (These are the same filters used for "tri-color" photography.)

The three filtered separations are *black-and-white* negatives that contains the information for one of the three primary RGB colors. The forth, un-filtered one has "color" information for the black plate.

The result are separation negatives for:

- Red (R)
- Green (G)
- Blue (B)
- Black (K)

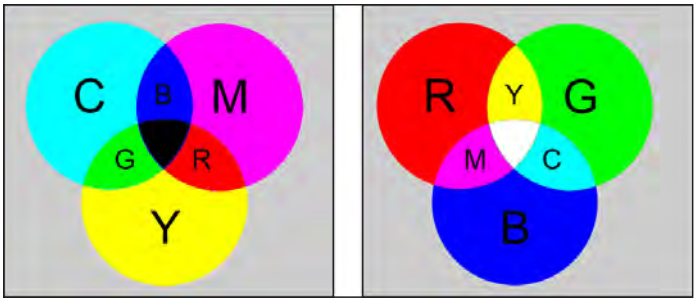
These separation negatives (except K) equate to PhotoShop *channels* when you are working in RGB.

Each *negative* reverses back into a *positive* when it is contact printed onto a photo-sensitized printing plate.

Being *inverted* from the negatives, each "pos" printing plate has data for the *other two* primary colors. These two blend together into the complement (opposite) of the original color, called "secondary colors":

- Cyan (C)
- Magenta (M)
- Yellow (Y)
- Black (K)

The red negative makes the cyan plate; the green neg makes a plate for magenta ink; and the blue one is used for the yellow plate.



Cyan, magenta and yellow overlap to create red, green and blue (left), and vice versa (right). What are primaries for printing (left) are secondary colors in RGB color spaces (right).

The three printing plates for Cyan, Magenta and Yellow can be used to recreate the original three RGB primaries. Thus, the secondary colors of light are the primary colors of printing, and vice versa.

In a perfect world, when cyan, magenta and yellow are combined they should produce black. Instead they make an ugly dark-brown gray. A forth negative is therefore made with no filter and used to make the black-ink printing plate.

Black and white are necessary to create contrast. The eye uses the Black Point and White Point of a scene or picture as a bases for interpreting all other tones and light levels.

Printing Plates Are "Halftones"

When a picture or other continuous tone art is printed, each of the four printing plates is a "*halftone*".

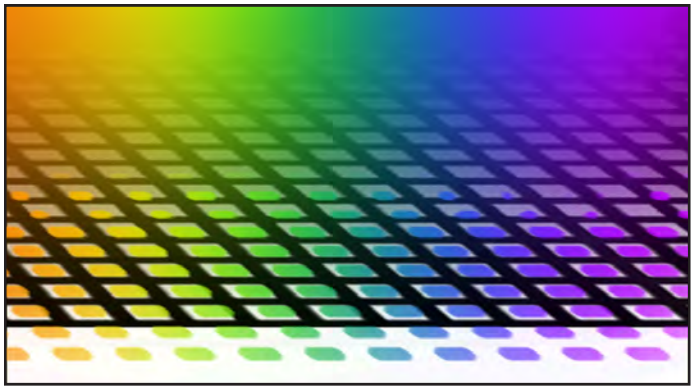
Halftone is the name given to "*screened*" artwork. The name derives from how the process works.

Screens are sandwiched between a transparency of the artwork and a sheet of photosensitive black-and-white film. By leaving a small space between the screen and the film, the light is diffused slightly and falls on the film as round dots instead of squares. In that way the image is "screened" into a grid of round dots.

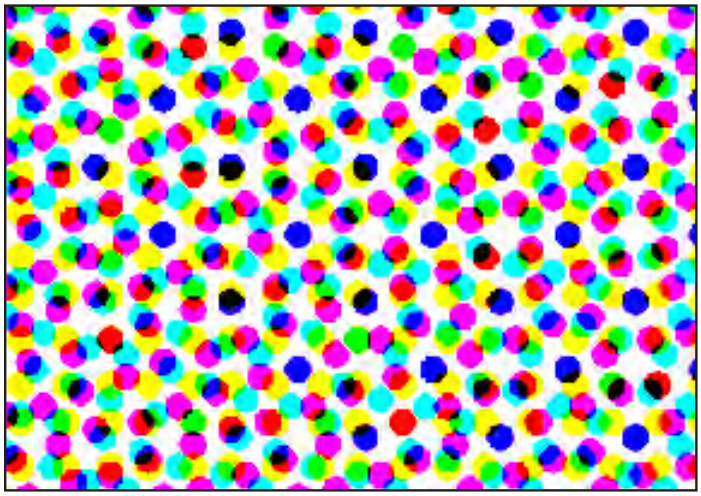
The size of the dots is determined by the strength of the light exposure. Lots of light produces big dots and little exposure makes small dots. (No light makes no dot.)

Screening each separation negative provides a continuous tone of each color. In that way, the rainbow can be reproduced using only four printing inks (CMYK).

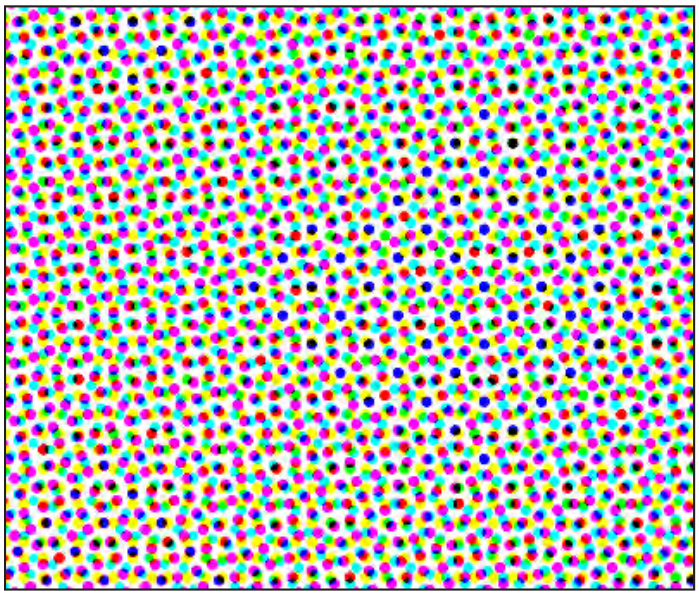
The whole process works because from the right distance the eyes don't resolve the tiny dots and instead blend them all together into continuous tones.



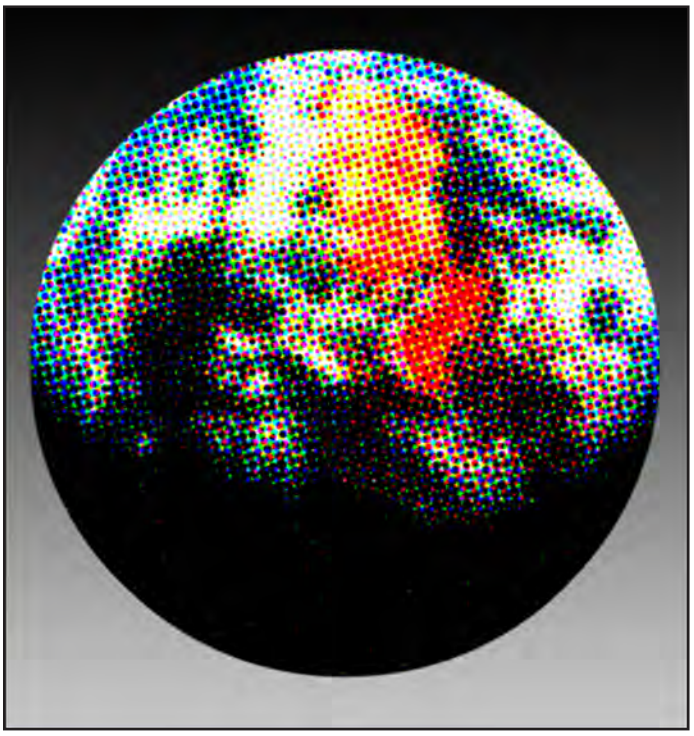
Light passing through a screen (above) diffuses slightly and falls on photosensitive film as round dots instead of squares (below).



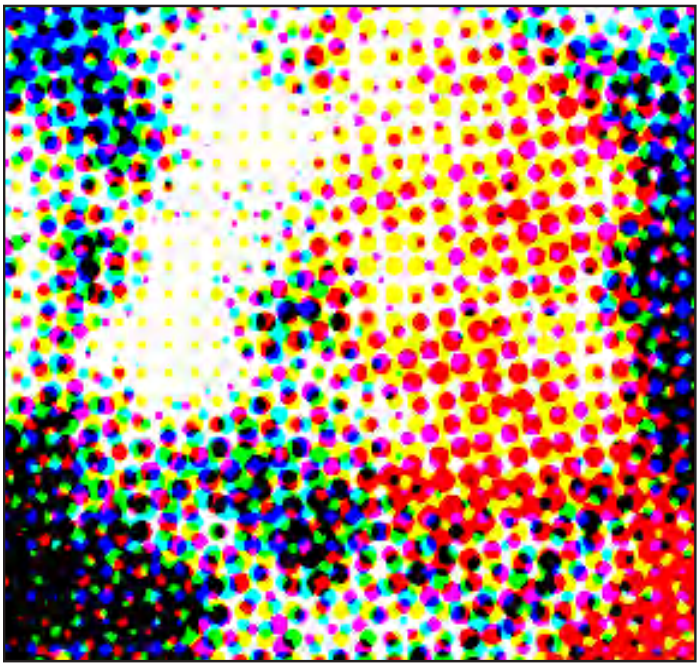
The screens for each color are offset on different angles so that the colors do not print on top of each other.



*This is a halftone above of neutral light gray and has equal amounts of the four primary printing colors, CMYK. The "*controlled moiré*" pattern is easy to see at this magnification.*



Earth as a screened four-color halftone.



Close-up of Earth picture at top of page. The angles of the four screens are offset to avoid dots printing on top of one another. The specific angles depend on how many colors are used and the preference of the press operator.

Typical CMYK process screen angles:

C	100°	15°	105°
M	15°	45°	75°
Y	0°	0°	90°
K	45°	75°	15°

Part of prepress for traditional printing methods consists of selecting screen angles and halftone frequencies, which minimize moiré. The visibility of moiré is not entirely predictable. The same set of screens may produce good results with some images, but visible moiré with others.

In PhotoShop color halftones can be created using Filter > Pixilate > Color Halftone. The dot (pixel) diameters are adjustable, as are the angles for the four separation screens.

Audio Visual Moiré Patterns

Moiré patterns are commonly seen on television screens or in projected videos directly when a person is wearing a shirt or jacket of a particular weave or pattern, such as a checked jacket, a dotted tie or a striped shirt.

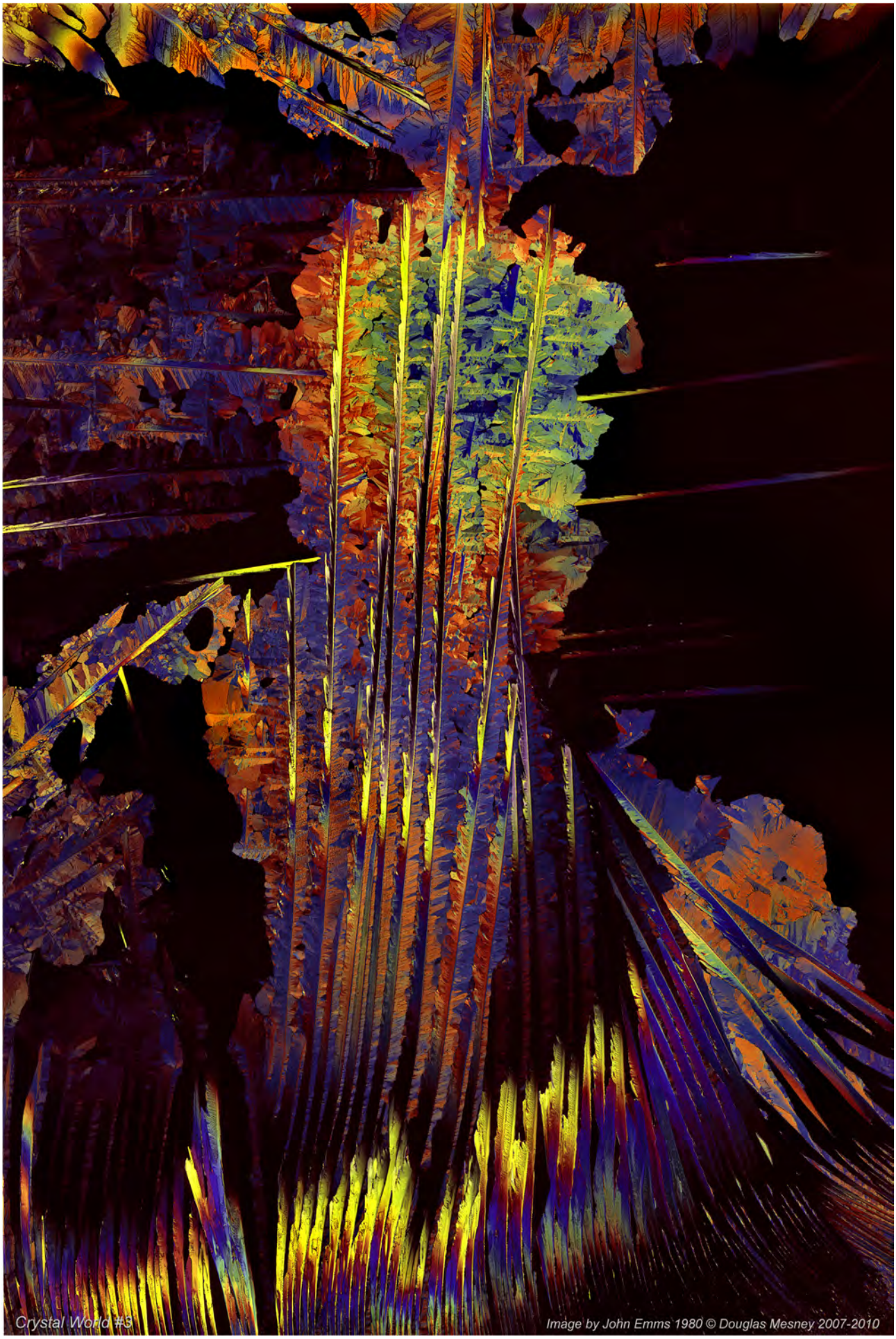
As the person moves about, the moiré pattern is quite noticeable and called "strobing". Newscasters and other professionals who appear on TV regularly are instructed to avoid wearing clothing, which could cause the effect.

Taking a picture of a TV screen with a digital camera often produces severe moiré patterns. These can sometimes be reduced by angling the camera. As with the angling of process-color-screens to avoid dot collisions, the same can be done to avert the same conflict between the bitmaps of your camera sensor and the monitor you are shooting. Likewise, zooming in or getting closer (or farther away) might help.

Another tip for TV-screen photography: use a slow shutter speed. The screen is refreshing about 30 times per second. If you catch it between cycles with a fast shutter speed, you'll either get overlapping cycles or a diagonal "tear" in the picture. Use a shutter speed below a 30th of a second. An eighth of a second or 1/15th is better,

Once the noise is there it must be dealt with using the procedures outlines above. Dealing with these problems is no different than the other sorts of noise and interference-patterns.

Extreme sharpening enhances the hard edges of the crystals in the microscopic photograph by John Emms (right).


Crystal World #3
Image by John Emms 1980 © Douglas Mesney 2007-2010

Turkish Lamps

© Douglas Mesney 2001-2010

Giclée Prepress Workflow

Step Ten

COLOR MATCHING

"The Impossible Dream"

Color matching is the most expensive form of prepress, for a reason.... color matching is impossible. You can get really close, but it will never be perfect. There are reasons, of course. But what is color matching?

Color matching is correcting for variations in the following:

- Perception of viewer
- Device limitations
- Light quality
- Pigments
- Media
- Algorithms

Is that enough?

Perception is the quirkiest of problems. Despite scientific measurements do we really ever know if anyone is seeing things the same way we are? Sometimes it doesn't seem that way.

Besides physical deficiencies such as degrees of color blindness, any one color has more or less appeal to one's senses and even their emotions.

Colors have emotional appeal just as the some pictures are more likeable than others. It's a matter of personal taste. That is why it is important to learn the clients feelings on the subject.

Part of your obligations as a giclée prepress professional is to advise the client about what is possible and what is not, (and at what cost).

Device limitations are at the heart of the color-matching challenge. The differences between the many kinds of input devices (cameras, scanners) and output devices (printers, monitors and projectors) are easy to see but harder to manage (to say nothing of fix). .

The colors of an original piece of art cannot be faithfully captured by *any* input device, for a variety of reasons.

Every device has "sweet" colors and "sour" ones. Unless you have the original to compare to, you're lost.

If you are originating the capture and file you want to get the best possible capture that requires the least color adjustment in PhotoShop.

Light color comes into play when making the capture of the original and later, when the color of the light illuminating the giclée will forebear on how ink colors are perceived. In both cases, "ideal" light is neutral in color and even across the field of view.

Neutral means "Daylight" (*Section One: The Study of Light* has more on this subject).

"Daylight" means light that is 5500 degrees Kelvin. Depending on where you live, a cloudy overcast day will deliver light that is very close to that color.

My trusty 18% photo-gray card has traveled far and wide, even to the top of Mount Kilimanjaro. Its original price tag from Alkit Camera in New York says $7.95... those were the days.

If the light is *exactly* 5500 degrees and your capture device has a *perfect* sensors and algorithms, then a picture of an *18% photo gray card* would result in an image file producing an equally neutral gray of the same tone value and depth (shade).

But the light is never *exactly* 5500 degrees. That's OK, being close is all you need.

Daylight Method for Accurate Capture Color

Overcast sky also provides very even light. The cloud cover acts like a giant diffuser. Unless you have a giant sized studio, you'll never get more even light than what the sky has to offer. That is why I shoot copy work outdoors on cloudy days.

Daylight studio at Vashon Island Imaging. Polycarbonate roofing and siding provides strong light with mild diffusion. Plastic sheeting provides further diffusion when necessary, stapled to the 2 X 4 framing.

Skylight and sunlight can be used when copying slides, film negatives and transparencies. It provides the same benefits, *even* light close to 5500 degrees.

When sunlight is available it is the supreme source light because its intensity is so great that your exposures will be at high f-stops providing good *depth of field*.

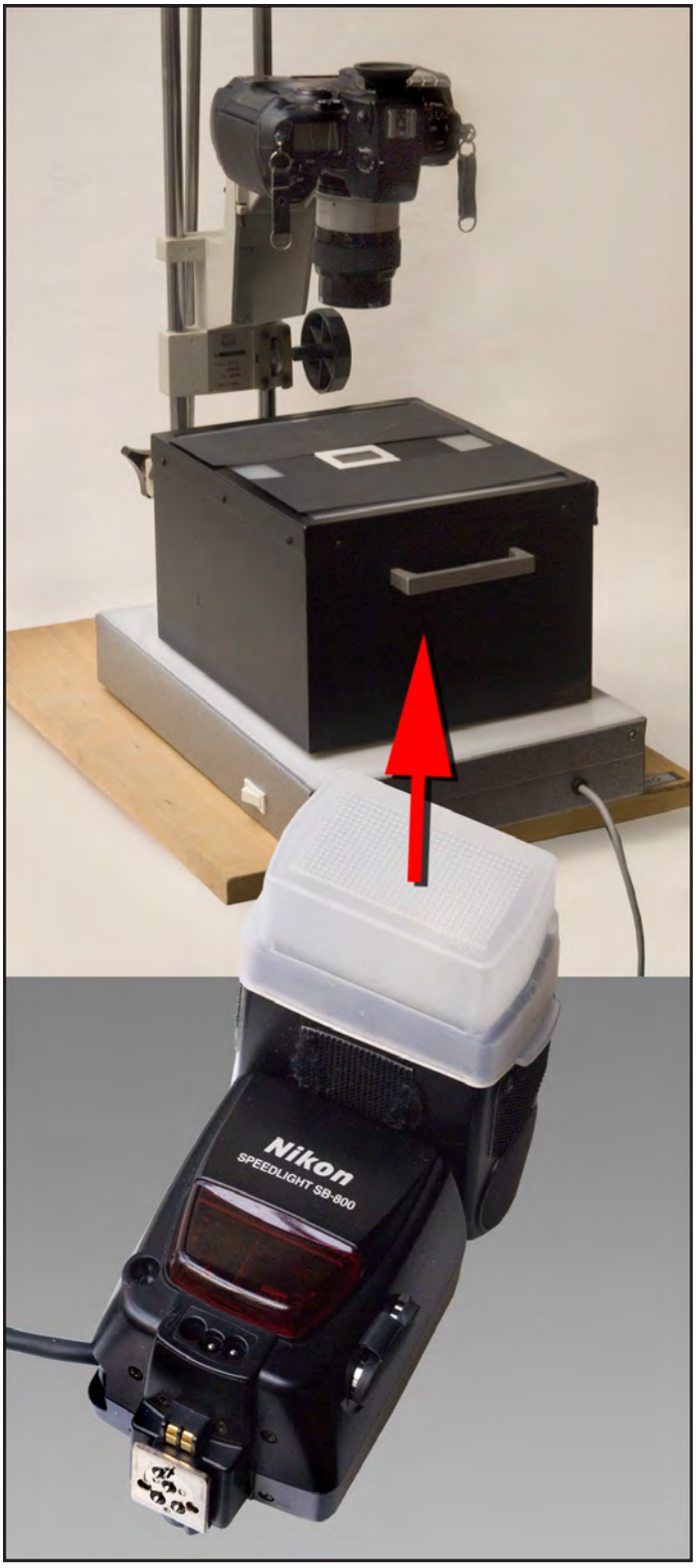
Depth of field is important when doing copy work from slides even though that seems counter-intuitive. After all slides and films are two dimensional and lie flat, so why would depth of field be important?

The answer lies in the fact that at the kind of super-close-up, "macro" focus range needed for slide copying, the depth of field is extremely limited. As a result, the curvature of the film, although slight, is enough to get out of focus. Corners in particular are places where focus falls off.

All films have some curvature. It is an inherent quality of multi-layer film construction. Simply put, the degree of expansion is unequal among the layers causing the film to curl in the direction away from the layer that expands the most. (See picture on page 81.)

Even scanners can have problems dealing with the slight curvature of film. To get edge-to-edge sharpness using a scanner is either difficult or expensive. But it is easy using the copy-stand technique.

In place of an "artificial" back-light source, natural daylight can be reflected with mirrors. Try reflecting either overcast skylight or sunlight onto a stage of "milk glass", frosted glass, white Plexiglas or other diffusion material.



A compact strobe with a diffuser makes a good source light when housed in a box with a stage of "milk glass", frosted glass, white Plexiglas or other diffusion material. More diffusion material can be introduced between the strobe and the stage if need be, as can neutral density gels or colored ones.

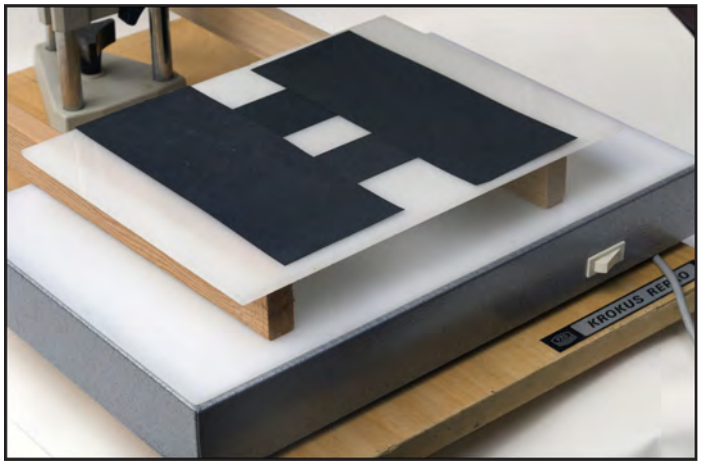
"Strobes" provide sufficient light to achieve good f-stops. The light of strobes (also called "flashes") is produced by Xenon tubes and has daylight characteristics.

Strobes can be used outdoors because the color of their light is about the same as natural daylight. Indoors, strobes are often filtered by professional photographers to bring their color temperature in line with other room lighting.

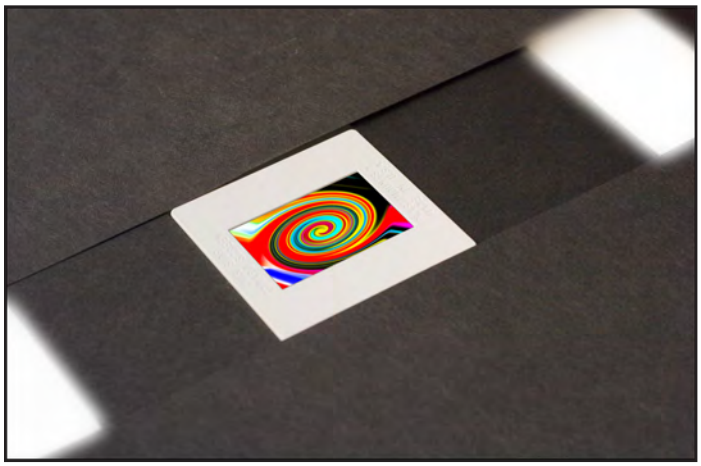
When being used for copy-work, strobes require either containment or flagging to keep the light from spilling into the surroundings which could result in reflections off the film backing or its cover glass.

Extra diffusion may be required with strobes unless you can keep the flash head far enough away from the stage to avoid hot-spotting.

Hot spotting can be eliminated with more layers of diffusion material. To save money, you can use wax paper. The trick is to keep some space between each layer of diffusion. We do that by making "sandwiches" out of layers of glass and diffusion.



A florescent light box with a second-level stage made of milky-white Plexiglas. Only certain kinds of florescent lights are "full" spectrum. Normal florescent lights require some color correction. 30-magenta reduces the greenishness and light cyan takes away yellowishness.



Black paper is used to mask light away from the edges of film being copied. When copying slides in their mounts, the curl of the film will cause uneven focus if there is insufficient depth of field.

Solving Depth of Field Problems

Remove the film from the mount (or sleeve) and place it between two sheets of glass. The top piece should be thick enough to flatten the film. We use 1/4 inch plate glass.

Place the "sandwich" of glass and transparency (or negative) onto the stage and copy in the usual manner. The light source for the stage can be the sun, or a strobe or even just a florescent light box.

You will want to be using f/11 to f/16 for this work. That provides good depth of field. Even though f/22 of more would provide even greater depth of field, lenses lose visual acuteness at their smallest apertures (and widest).

The shutter speed will be determined by what is required to achieve f/11 to f/16. If the shutter speed falls below 1/30 examine your copy pictures closely for signs of shutter blur. Even the internal workings of a single-lens-reflex camera can jiggle things enough to cause slight bur at slow shutter speeds. How much of a problem that could be depends on the sturdiness of your copy stand. Sand bags can help.

If you are shooting on a dark, cloudy day or with a florescent light source your camera might recommend an exposure of 1/4 or 1/2 second. Those are dangerous exposure times because the maximum jiggle occurs in the first 1/8 second. It would be better to use a much longer exposure of which the first 1/8 second is just a fraction of the total time. We use 4 seconds or longer.

If a 4 second shutter time forces you to a very high f-stop or one out of good-focus range, use ND (neutral density) filters to lower the light entering the lens, or scrim the source lights to lower the lighting level.

Whatever the source, getting the light even is critical. Using a double layer of diffusion with at least two inches between them eliminates most unevenness issues.

Top-Lit & Three-Dimensional Art

"Top-lit" is the term used for any art that is not "back-lit". Drawings and paintings are top-lit art, but *slides* of them would be called "backlit" transparencies.

Top-lit art presents the same challenges: even lighting that is full-spectrum daylight or tungsten. Fluorescent lighting is not recommended unless you are doing black-and-white work or the color isn't critical.

An incredibly diverse array of light-diffusion and control materials is available from suppliers to the Hollywood film trade like CineGel, Roscoe, Lee Filters, CMC, Gam Products and others. These include color gels and diffusion/reflection materials that are useful for effects.

Each different gel color has a well defined effect on the visible light spectrum, so the adjustments you make can be precise and specific.

Two- and three-dimensional artwork should be positioned to catch even light over its entire surface area. Professional diffusion materials or even just window sheer can provide additional diffusion. Even light is the goal.

With three-dimensional art, using enough diffusion is the key to shadowless light. Imagine the sky on an overcast day and observe how the light comes from everywhere and nowhere. Dome lighting is the equivalent and by aiming the lights at the ceiling, you can get a similar effect... even light.

How even it is depends on the distances and angles between the lights, the subject, and the ceiling. The greater the distances, the more even the light. As the distances

increase, so does the light "fall-off". More light is required when lights are farther away from the subject.

Using Artificial (Indoor) Lighting

It's strange to hear light called "artificial" but that's exactly what they call any kind of man-made light. The types commonly used are tungsten and fluorescent although you will occasionally run into sodium-vapor and mercury-vapor lighting, especially in large places.

"Tungsten" is the name for filament-burning lamps. The name derives from the metal used to make the filaments. It is an element on the Periodic Table used for light bulbs because it resists burning up longer than other materials when electricity runs through it. As a result tungsten burns bright and long, qualities people like in light bulbs.

Tungsten light burns at 3200° – 3400° Kelvin. 3200° is the color of standard light bulbs and 3400° is the color temperature of special-purpose "photo-flood lamps". Those are the two standards for tungsten sources used by the lighting industry.

Fluorescent lighting is a special case, although popular and available in a variety of colors. Light that fluoresces from a glowing gas lacks one or more specific wavelengths and is not full-spectrum for that reason.

Fluorescent lighting generally lacks reds and has weaker blues resulting in pictures with a green cast (using a daylight algorithm) or a blue one (using a tungsten algorithm). The green cast is correctable with a 30-magenta filter on the lens (possibly with some cyan filtration, for those "warm white" tubes that are yellowish). Digital cameras have fluorescent-light algorithms making filtration unnecessary.

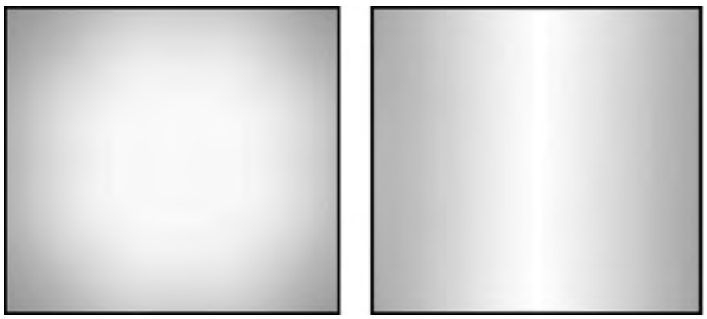
Sodium-vapor and Mercury-vapor lights also have missing wavelengths. These are the lights that illuminate highways and parking lots. You don't see mush sodium lighting anymore, as the Mercury type replaced it.

Sodium lighting produces a yellow cast, which can be mostly corrected using a tungsten algorithm and extra blue correction to remove the persistent yellow.

Mercury lights produce green casts, like florescent lights which are mostly correctable with a 30-magenta filter on the lens or by using the camera's fluorescent-light algorithms.

But it is unlikely that you'll be doing art-copy work in a parking lot or at the side of the road, at night. Instead you'll be doing the work in a studio of some sort, either professional or make-shift, using artificial lighting.

Obtaining even light is the main challenge of shooting indoors, not color temperature. Even lighting is needed to have an even camera exposure across the entire object being photographed.

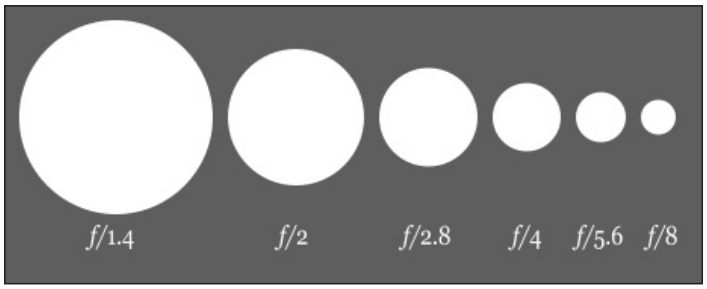


Examples of hot-spot (left) and banding (right) forms of uneven lighting. Both are "gradients", the gradual transition of one tone to another.

Graduation of the light across the surfaces creates a gradient of light. Gradients photograph worse than they look to the eye. Light increases or decreases *exponentially.*

Exponential growth (or decay) occurs when the growth rate of a mathematical function is proportional to a value. Intervals of exponential growth are unequal. Earthquake magnitude is measured exponentially, so are camera exposures. (Geometric growth has equal intervals that are also called a "geometric progression".)

Camera exposures work on the principle of "*double and half*". One f-stop more cuts the exposure in half. One f-stop less doubles the exposure. The exposure is the amount of light let in to reach the camera's sensors.



Each full f-stop either cuts the light in half, or doubles it.

Modern lenses use a standard f-stop scale, corresponding to the sequence of the powers of the square root of 2.

The result is rounded off (to remember easier) and the result is the standard f-stops we use: f/1, f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22, f/32, f/45, f/64, f/90, f/128, etc.

Shutter speeds also control exposures the same way. One step in the shutter speed scale corresponds to one stop in the aperture scale.

Opening up a lens by one stop allows twice as much light to fall on the film in a given period of time. Using a shutter speed twice as fast cuts the light in half, bringing the amount back to the original value. That is, opening the lens one f-stop increases 100 units of light to 200. Shortening the exposure time with a faster shutter speed cuts the 200 units in half, back to 100. That is a good thing if the sensor needs 100.

Camera sensors need a certain amount of light to function correctly. If the shooting situation has low light, a long exposure is required. Too much light requires a shorter exposure to reduce the amount of light captured. Exposure needs to be adjusted to give the sensors what they need, no more no less.

Lighting balance works the same as exposure. If there is half the amount of light on one side of the artwork compared to the other, it will have an exposure differential of one full f-stop.

Capture devices are more limited than the eye in terms of the number of tones they can "see" and record. The exposure range from the Black Point to the White Point is about seven f-stops or shutter speeds.

f/1, f/1.2, f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22, f/32, f/64, f/128

Above, the seven f-stop range (yellow) can "slide" from left to right on a scale from f/1 to f/128. Below, anything beyond f/16 will be white.

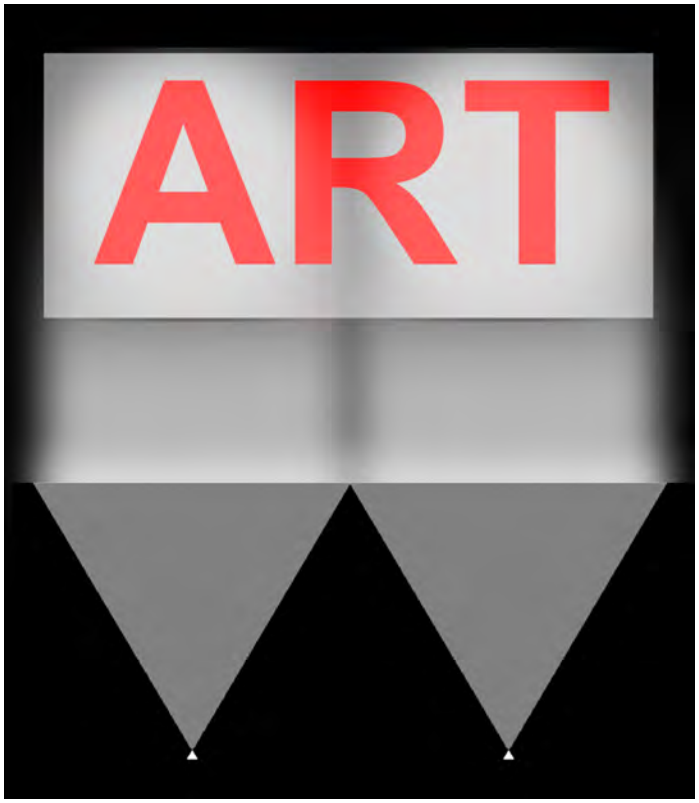
f/1, f/1.2, f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22, f/32, f/64, f/128

Using a device or film that has an exposure range of seven f-stops, if the White Point is at f/16, the Black Point will fall at f/2. Any part of the subject that needs an exposure longer than f/2 will be black. Any part of the subject needing an exposure less than f/16 will be white.

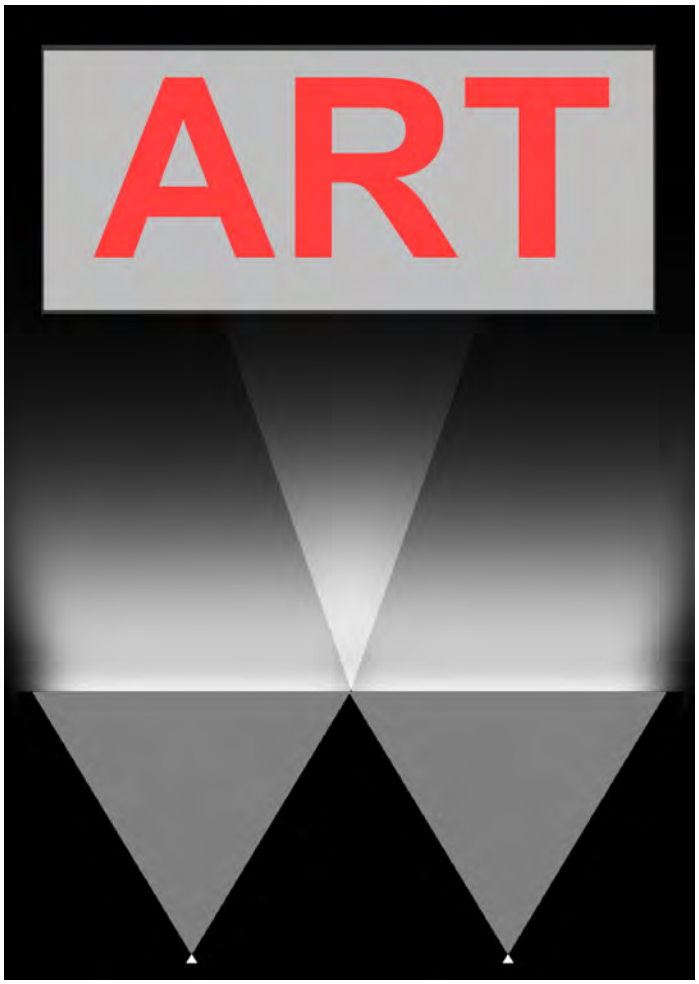
Given a seven-stop exposure range from the Black Point to the White Point, an exposure difference of even ½ f-stop from edge to edge of the subject will be very noticeable.

The three ways to even-out lighting are:

- Increase light-to-subject distance
- Diffuse lighting
- Cross-aim lighting



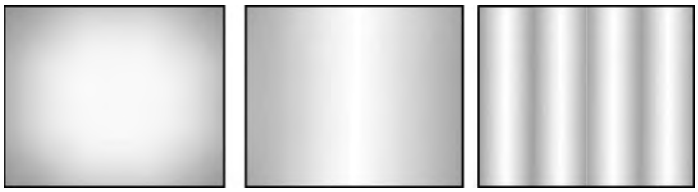
If the lights are too close (above) their hot spots are into the artwork. Moving the lights back puts the artwork into the hotspot(s).



Cross-aimed lighting helps even out lighting when space is limited. Aim both of the hot spots at the center of the art.

Bounce the lighting off white boards or bed sheets. Crinkled up aluminum foil stuck onto boards also works well. There are endless varieties of professional grade reflection boards and screens.

Source lights aimed through diffusion material like sheer curtains or more expensive professional grade scrims or sheeting. Roscoe and Lee Filters make a full lines of such materials, among others.



Common patterns of uneven lighting.

Avoiding Uneven Lighting

Move the lights away from the subject as far as possible, within reason. To copy a 16 X 20 inch original the lights should be ten feet away, and cross-aimed to avoid reflecting off the surface of the art.

Diffuse the lights. Either shine them through several layers of sheer curtains or bounce them off white boards or even bed sheets.

With so much distance and diffusion the level of light reaching the artwork will be low, requiring a long exposure.

It is not unusual for me to use an exposure of 10 or 20 seconds (using f/16 at ISO 100).

The benefit of long exposures is that shutter blur is eliminated. The down side is that longer exposures can build-up noise in the darker tones. Using the lowest ISO setting reduces noise.

F-stops higher than f/16 can degrade image quality as the aperture is so narrow that only the center most portion of the lens is utilized and that is not normally the "sweet" spot of a lens. Lens performance in terms of resolving power is generally best in the mid-f-stop range between f/8 and f/16.

Correcting Uneven Illumination

Original (above) shows lighting hot spot.

A gradient mask (shown above in small size) merges a correction for the hot spot that is on a separate layer.

If you are presented with an image that has been shot with uneven lighting making corrections is not difficult. Simply find or make a gradient that matches the one in the artwork and use its opposite (reverse) to blend in a corrected version on a separate layer.

Duplicate the picture layer and correct the part that is too light or too dark. Make the correction necessary to get the right levels. Apply a layer mask to that layer and make the gradient your mask. With a little tweaking, the job is done.

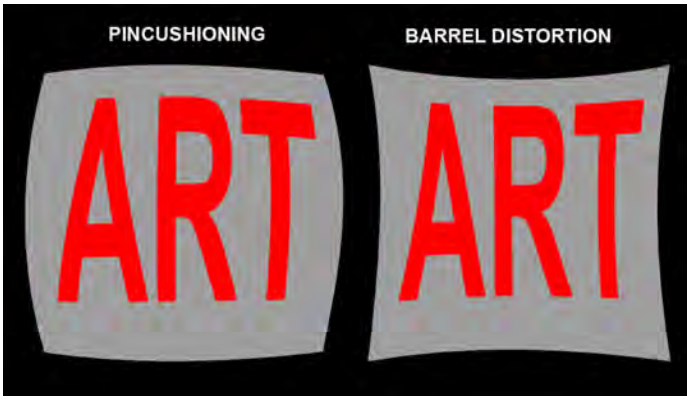
Sometimes multiple layers with different gradient layer masks is needed when the lighting imbalance isn't just in one direction. Photographers often use more than one or two lights, and there will be gradients for each.

Finished merged layers show even tones and no hot-spotting.

Another way is to make a corrected layer and let blending options do the work. If your correction layer should deepen tones, use the darken option, and vice versa.

Avoiding Distortions When Copying Artwork

"Flat-field" lenses should be used for copy work. These types of lenses produce little or no *pincushioning* or *barrel distortion.*



Pincushioning bends the picture outwards toward the center appearing like the bulge of a pin-cushion. Barrel distortion bends otherwise straight lines inward, "pinching" the picture into the center.

These aberrations are most pronounced in zoom lenses. Zoom lenses have "sweet spots" where the pin-cushioning and barrel distortion is minimum. As you zoom into or away from that point, the distortions increase. Fortunately, there are algorithms in the form of PhotoShop plug-ins that can fix these problems when they occur.

Pigments and Media

Just as cameras and scanners have their "sweet colors" giclée-printing machines also have theirs. No machine can print or show all colors equally well. For example, one of our machines prints warm tones better than greens and blues. Certain types of media and not others can exacerbate problems like these.

Most challenging is that the colors used by fine artists are not the same as the kind produced by giclée inks. Some artists' colors cannot be reproduced exactly.

Traditional printing processes can fix problems like that by adding a "spot color" which is a specially mixed color applied with a separate printing plate.

On traditional printing presses colors that must be an exact match for a PMS color and/or which cannot be accurately reproduced in the four-color process are printed using spot colors. However, giclée prints don't use plates so spot colors are not an option. There are ways to get very close even if you can't be 100% matched.

Make a test print of your picture on the selected media. Compare the colors to the original, using full-spectrum lighting, either daylight or *Solux* lights which are excellent viewing and shooting art.

In PhotoShop, duplicate the picture layer and label it "Picture2". Identify which colors are off, and what the issues may be (hue, saturation, and brightness) and fix them.

If a range of *similar* colors is the culprit, make global adjustments to the entire picture or selected areas by using Levels, Hue and Saturation, as well as Color Balance, then make a second test print.

What if one or two colors are wrong?

Segregate the offending colors onto separate layers for individual adjustment using the same tools.

Choose Select > Color Range. Sample the color to be corrected. Zero-in on the precise tone using the fuzziness setting. Wherever the selected color tone appears in the picture, those areas will be selected.

Enlarge the selection by one pixel using Select > Modify > Expand. After that use Select > Modify > Feather and soften the edge of the selection(s) by one-half pixel. The slight feathering helps the blend and the slight enlargement of the selection gives you some "cushion" that you can leave or erase away later if need be.

Copy the selection from the picture2 layer and paste it to a new layer labeled "Picture2_*Color Name*".

All instances of the defective color are now on a layer and can be individually adjusted using Levels, Hue and Saturation, as well as Color Balance.

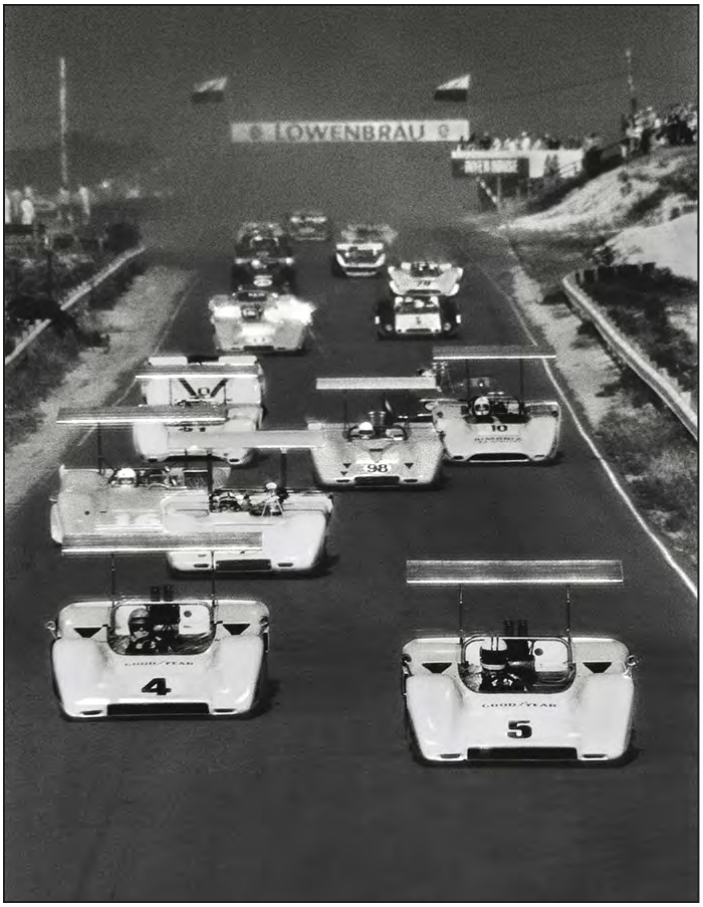
Repeat this procedure for as many offending colors as you have, with only one color per layer. Now, as you make further test prints or strips, you will be able to individually control the inking for those colors until you get them right.

After a while you may see that certain colors always need a push or a shove one way or another. That's the color "character" of your printing machine. Knowing that character, you can make some global settings adjustments on the printer (providing such settings are available, of course) or write a PhotoShop action to make the correction quickly and precisely.

Metamerism

Sometimes aberrations occur. Colors that look right under one kind of illumination look different under another. Or, two light sources, made up of different mixtures of various wavelengths, may appear to be the same color. This effect is called metamerism. It's a devil because it is un-fixable.

Position a Gray Card somewhere in the frame of capture, even a tiny bit is enough. By using the neutral "eye dropper" in curves and sampling the gray card, all the colors will snap back to normal.



With the captured image in PhotoShop, select Image>Adjust>Curves. Use the neutral eyedropper to sample the gray card swatch appearing in the picture. All colors will be adjusted to eliminate any tinting caused by even the slightest deviation of the source light from 5500 degrees Kelvin. You end up with colors that are as close to the originals as you're going to get from that capture device.

If you have a picture with no gray card swatch, look for any tone that should be neutral and sample that. In a street scene the pavement is usually gray, for example the track in this 1967 Bridgehampton Can-Am Race, *(left). It won't be as perfect as the gray card, but it will probably get you close.*

Duotone, Tritone and Quadtone pictures are black-and-white originals printed in two, three or four colors. For traditional printing the black plate is normal but the plates for the other colors are lighter. The colors used are normally PMS spot colors. The twin jets (below) have the look of a duotone made with black and reflex blue. The look was made by desaturating the original, then adjusting the color balance by adding 11 points of bright blue to the shadows, highlights and mid tones. The contrast was boosted a little to give the clouds some punch.

Angelique's portrait was restored by copying a black-and-white print made in 1969 lit with Solux lighting (Kelvin 4900°). The camera set for Kelvin 7300° to get warm blacks. Besides spotting, no other adjustments were necessary because the original print has a full tone range.

Angelique
© Douglas Mesney 1969-2010

Vashon Christmas Snow

Douglas Mesney 2008-2010

Giclée Prepress Workflow

Step Eleven

PRINTING

A Vision Materializes.

The Printing Environment

Printing rooms and work environments share many of the same requirements, with one exception: they should be brightly lit.

In the production room, your monitor should be the brightest light source in the room. No other lights should overpower the monitor. However, in the printing room the area lighting should be brighter than the monitor(s). Seeing the controls of the printing machine and the output is more important.

A viewing area for artwork should be set up near the printer. You should be able to glance back and forth between the output and originals or test giclées.

Illumination for the viewing area should be close to the same brightness as the nearby monitor. The pupils in your eyes should never have to contract or dilate for one or the other. The lighting should be even across the field of view be as close to 5500° Kelvin as possible ("daylight"). Gretag Macbeth and Solux lights provide ideal illumination.

Light-box viewing should be available for slides and transparencies. Daylight-balanced light boxes are readily available but expensive. Using unbalanced light boxes it will be more difficult to match the light color and intensity to the rest of the viewing area.

Light balancing and color correction gels are available in sheets and rolls at professional photography suppliers and good camera stores. Use the gels to bring the florescent source lights to the daylight standard used in the rest of the viewing area. Neutral density (gray) gels can lower the brightness of the light box, although making it brighter is usually the challenge.

Gretag MacBeth makes complete viewing set-ups with match lighting throughout. They also supply metering and measuring instruments and everything else needed for color management in the work area.

Solux lighting is favored for gallery lighting that is brilliant, daylight balanced and relatively inexpensive.

The temperature of the room is important, as is the humidity range. Giclée inks are blends of water and glycerin and their viscosity changes with the temperature. Viscosity regulates the piezo-dot size generated by the print heads spraying the ink. If the temperature is too low the ink gets too thick just like "molasses in January".

Affects of Humidity

Glycerin is hydroscopic… it absorbs water out of the air. Prints will take longer to dry in humid air as the glycerin absorbs water instead of giving it up, which it needs to do to percolate properly.

The media (and/or the ground on the media) will also be hydroscopic to some extent, delaying drying for the same reason, that the glycerin in the ink absorbs water from the media as well as the air.

Test Strips & Prints

The chances of getting a print right the first time are about equal to making a hole in one on the golf course. Test strips can therefore save money that might be wasted making unusable prints.

Getting it right comes with experience, like driving a car. Over time, everything that can go wrong will, and you will develop a "sixth sense" about the strengths and weaknesses of your printing machine(s).

One of the most important things you'll learn is how to translate what you see on an RGB monitor into what a CMYK print will look like. That takes time and experience. New machines, different kinds of media and changes in printing inks each come with new learning curves.

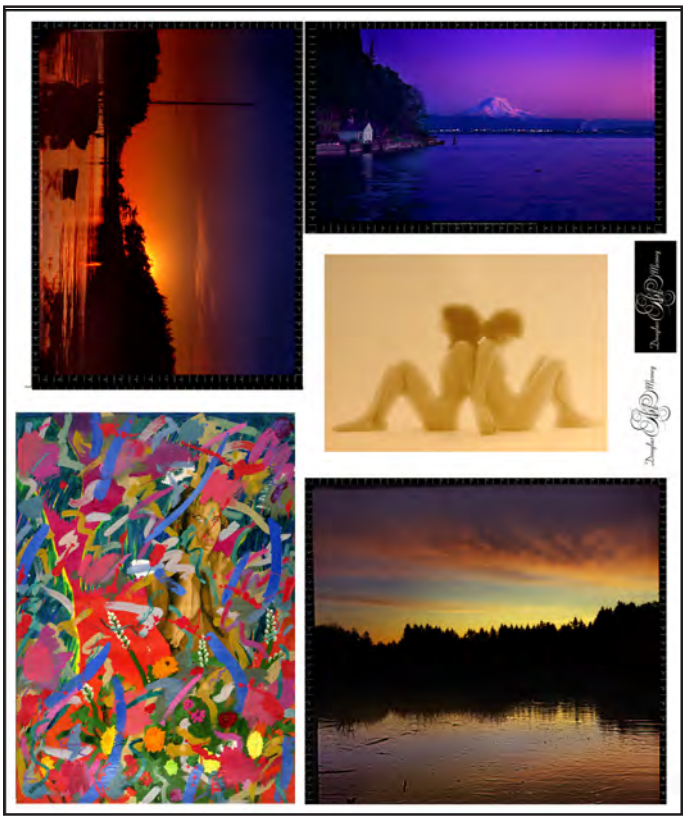
Test strips will confirm that all printer settings are correct. Even though you will be tempted to skip this step, the printing machine will eventually bite you if you do. Unless you are a printing prodigy you'll eventually forget an important setting.

Test-strip procedures

- Copy all layers and group them.
- Copy the group and merge it into one layer.
- Crop the merged group to the test strip dimension.
- Print the test strip and mark it Test Strip #1
- Compare the test strip to the original, analyze problems and make adjustments.
- Print a second test strip (and as many more as needed).
- Mark down the adjustments you made on each test strip... the more detail the better.

Include in the test strip any parts of the picture that you are concerned about, usually the lightest and darkest tones. If the picture parts of concern don't fit into a single crop, copy & paste them together into a test strip that is a collage of several problematic parts of the picture.

This abstract by artist Don Cole (above) has a very wide range of strong (pure) primary and secondary colors. No printing machine can get them all the colors right without adjusting some.



A half-size test print is made first to see which colors have problems. That test is ganged with others to be printed on the same media (below). Any empty spaces are filled with logos, samples and promotional items.

A second test is a collage strip of just the problem colors areas discovered in the first test print.

The clients order is also ganged up on a larger sheet to save money.

It is not vunusual to go back into an image and work further on the dynamic tone range after seeing test strips. No matter how good you are, there are so many subtle differences between RGB and CMYK colors that the results delivered by your printing algorithms may not show all the important tones.

Every first print is a test print. If test strip adjustments nailed it, your job is done and the giclée is ready for drying and finishing. Otherwise, the test print(s) can be used for further adjustments, striving for perfection.

You may choose to include test strips and test prints as separately billable items on your tally of service charges. That is the policy at my print shop, Vashon Island Imaging.

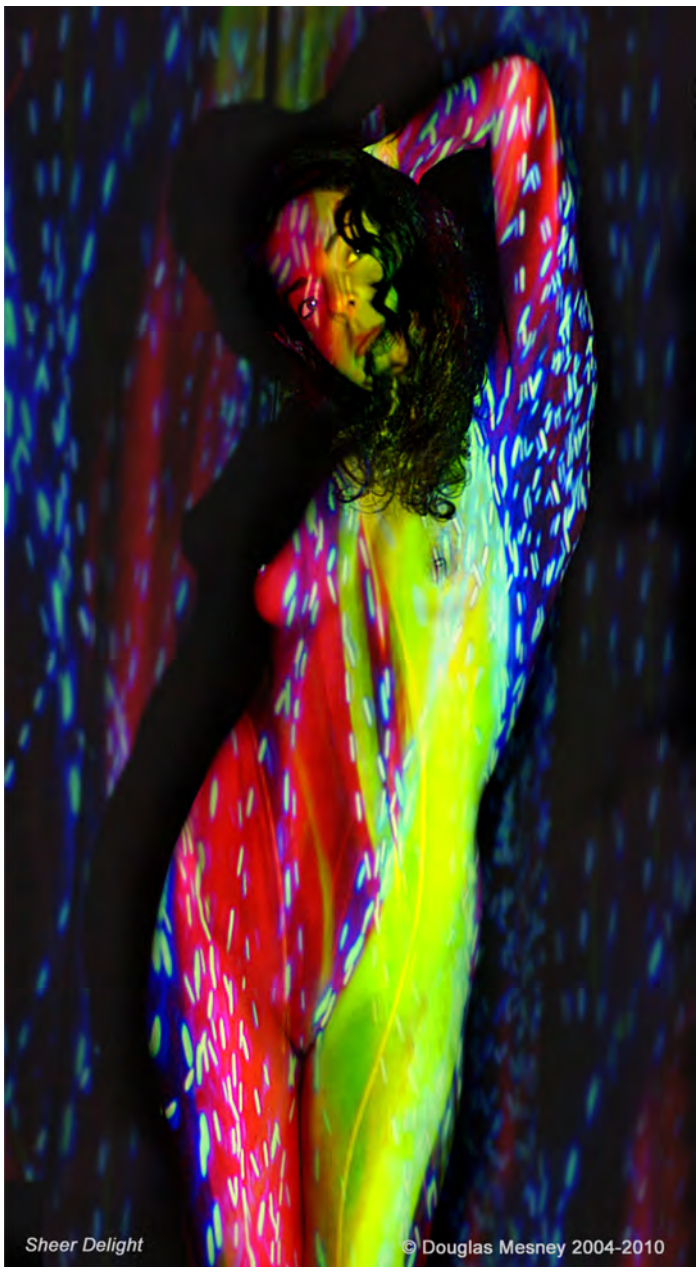
Test strips are critical for color-matching work. In some cases, it is best to start with a full test print, then make a Collage Test Strip by copying and pasting together all the problem colors in the picture.

Remember that every device has "sweet" colors and sour ones. How those problems play out will be different in every image. In some the problems won't show. Pictures featuring the problem colors will suffer badly and require some fiddling.

Gang-Ups To Save Materials

Everyone likes to save money and gang-ups are a great way to do that when you use a big piece of media to print a small picture. The extra space can be filled with some other image(s) so the trim area isn't wasted.

It doesn't always work out that a customer's picture fits exactly on a piece of media. There may be a little extra space or a lot. The space can be used to make your own samples, promotional pieces, signage and even ribbons imprinted with your logo to band rolled giclées.



Drying and Handline

Giclée inks are water-based blends of glycerin and dyes or pigments. Dyes are transparent coloring agents and pigments are solids. The colors made by dyes are more fugitive than solid pigments. Solid-pigment inks are therefore more archival.
Glycerin (an impure form of glycerol) is a viscous, syrupy liquid like honey. Glycerin absorbs water from the surrounding air, which means it is *hydroscopic*. If you were to leave some glycerin in the open, it would absorb water from the surrounding air to eventually become 20% water and 80% glycerin. Many things will dissolve into glycerin easier than they do into water or alcohol. So it is a good solvent.

The composition of inkjet printing inks, according to their patent(s) is as follows:

"*A process which comprises incorporating into an ink jet printing apparatus an ink composition comprising wafer, a colorant, and a borate ester, sold ink containing water in an amount of at least about 5 percent by weight and containing water in an amount of no more than about 50 percent by weight, wherein either (a) the ink also contains an amine compound, or (b) the borate ester is hydrolytically stable, and causing droplets of the inks to be ejected in an image-wise pattern onto a recording substrate.*

An ink composition comprising water, a colorant, and a borate ester, said ink containing wafer in on amount of at least about 5 percent by weight and containing water in an amount of no more than about 50 percent by weight wherein either (a) the ink also contains an amine compound, or (b) the borate ester is hydrolytically stable.

An ink according to claim 1 wherein the borate ester is disorbitan borate, disorbitol borate, a borate ester of glycerin monoethoxylate, diglycerol borate, N,N-dibutylethanolamine glycerol borate, sorbitol glycerol borate, bis-neopentylglycol borate, trimethylene borate, glycerol salicylamide borate, a borate ester of polyethylene glycol methyl ether, triethylene glycol monomethyl ether borate, salicylamide borate, N,N-dibutylethanolamine sorbitol borate, salicylamide sorbitol borate, N,N-dibutylethanolamine/triethylene glycol monobutyl ether borate, N, N-dibutylethanolamine/poly(propylene glycol) monobutyl ether borate, sorbitan glycerol borate, or mixtures thereof."

Note: Amines are used as a starting material for the manufacture of azo dyes. It reacts with nitric (III) acid to form diazonium salt, which can undergo coupling reaction to form azo compound. As azo-compounds are highly colored, they are widely used in dyeing industries, such as some printing inks.

That's a lot for your money, wouldn't you agree?

By "thickening" the water and readily absorbing dyes and pigments, the viscosity of the ink can be controlled with glycerin to formulate size of the piezo droplets sprayed by inkjet print heads with precision.

Glycerin Must Leach Completely Before Coating

Every manufacturer's ink blend is a State secret. What they share in common is that they don't dry like normal inks and paints.

Water and solvent based inks dry by evaporation. Glycerin does not evaporate it *expunges*. The definition of expunge is "to remove completely". But that oversimplifies the process because if glycerin doesn't evaporate where does it go?

Glycerin leaches *into* giclée prints. Leaching involves a process called *percolation*. Percolation involves a liquid passing through a filter (like a coffee percolator). In the case of a giclée print, the glycerin is percolating into the media or the ground on the media..

The percolation process involves the separation of water from the solution, by evaporation. First the water evaporates from the ink solution, leaving colorants and glycerin. The glycerin leaches into the media (or the ground applied to it) leaving the colorants either on the surface if they are solid pigments, or absorbed into the surface of the media as the glycerin migrates as a result of percolation.

There is no set time for the completion of ink percolation. Much depends on the absorbency of the media being used. As explained, giclée print drying is a two step process. Water is quickly evaporated or absorbed, but it takes some time after that for the glycerin to percolate to the bottom of the media.

Although a print may be dry to the touch that just means the water has evaporated, the percolation process could still be far from complete. Two days is the minimum amount of drying time for most giclée prints, before they can be safely coated. A fan or hot air or both (like a hair dryer) can speed up the process.

When using a hair dryer keep the nozzle about 6 inches off the surface of the print and make overlapping passes, as if spray painting. The speed of a pass should be slow, about one inch per second. The drying time in that case would be about a half-hour.

With a small fan keeping the air moving across the surface of a giclée print, the drying time can be reduced to 24 hours. The exceptions are prints that will be framed under glass, which need more complete curing.

Complete glycerin leaching from a giclée print can take weeks and in humid conditions the process may never complete given the hydroscopic nature of glycerin.
If the leaching process continues under the glass, trace amounts of glycerin are carried to the inner surface of the glass by evaporating water molecules resulting in a "ghost image" on the glass. The ghost image looks like a dusty glass that needs cleaning. It does need cleaning, from the inside, and you'll have to take apart the framing to do that. To avoid that problem, insure that giclée prints are thoroughly dried before framing under glass.

To save space drying prints can be stacked using slip-sheets of plain paper between all the prints. Blotter paper is best but expensive. Paper towels are the best alternative, as are plain copy paper or Kraft paper.

Display and Storage

How giclée prints are displayed and stored has direct impact on their archival qualities.

"Archival" is currently accepted pretty much as the standard term to identify an ink jet print with a longer display life. That definition has nothing to do with truly archival materials.

In traditional printmaking archival usually means prints that will last upwards of 500 years. Giclée print technology is moving in that direction but isn't there yet. Well made giclée prints are expected to last 100 years. Accelerated-gain test results for a wide variety of media and inks is readily available, but it is an imperfect "science".

How long giclée prints last depend upon the inks and media used. If the inks are high quality and UV resistant then the images will be less likely to fade. If the media used is a high quality material designed to receive good inks then this also inhibits fading.

Most testing by independent researchers like Henry Wilhelm rate watercolor papers as the best media for long lasting prints. Giclée papers are generally considered less durable as most have ground coatings which prevent the inks from penetrating the underlying paper, making them more vulnerable to damage and the effects of the environment.

How prints are displayed is a more significant factor in longevity than what they are made of.

Exposure to sunlight's UV rays is the primary cause of color fading. The speed and amount of fading increases with the brightness of the light and its UV component. Humidity also causes more rapid deterioration of inks and media. Finally there is also exposure to air born pollutants.

Shielding the giclée print from UV light and sealing it from humidity and air pollution prevents fading.

To protect giclée prints from these environmental factors they must be enclosed. This means framing prints under glass or coating them with varnishes, laminates or other coatings (see Step Twelve for more on coatings) and displaying the prints away from strong sunlight. Climate controlled environments also will increase the longevity of the prints.

Giclée prints not being displayed should be stored in darkness, keeping the humidity as low as possible and the temperature as low as possible. Glycerin doesn't freeze.

How long will giclée prints last? Although it is impossible to say, 50 years of enjoyment can be expected in most cases and even longer if the best materials are used and the right steps are taken to display and/or store them.

Art that stands the test of time will forever be the dream of Man.

Southern Cross
© Douglas Mesney 1994-2010

Giclée Prepress Workflow

Step Twelve

COATING & RETOUCHING

The Finishing Touch.

Strong saturated colors look best with glossy or luster coatings. Matte coatings reduce the contrast making dark tones suffer and killing black.

Whether a client chooses to have a giclée print coated is a matter of personal taste and preference. Coatings will provide a degree of protection. Purists might argue that coatings jeopardize archival qualities.

Coating giclée prints can protect them from harmful UV radiation, as well as some humidity and air pollution. The degree of protection depends on the type of coating.

Besides protection, coatings give a giclée its final look. Surface gloss and matte-finish scatter light affect the contrast in the giclée image.

Gloss finishes raise contrast while satin and matte finishes lower it. Generally it is a good idea not to mix finish types by using a finish that defeats the "character" of the image.

For example the low contrast of a matte finish might ruin strong saturated tones, while pastels and soft tones might benefit from the matte look. Beauty is in the eye of the beholder, your client.

There are no coating conventions for giclée prints as yet. They are being written as you read this. The giclée process is so new that to a degree everyone is experimenting.

Giclée is a printing technique that has not fully matured yet, in terms of there being a readily available range of post-printing finishing materials, techniques and equipment.

Traditional printing processes have abundant supplies and standardized procedures including nomenclatures and naming conventions. Giclée professionals have to make it up as they go along, in some cases, coatings being one of those.

When the discussion turns to archival and ecological issues, the sides are divided. For the organically inclined, varnish is your solution (pardon the pun). For the rest, the field is wide open. There are arguments to be made for both "organic" and synthetic coatings.

Synthetic Coatings

- Varithane
- Polyurethane
- Laminates
- Liquid laminates.
- Shellacs
- Lacquers
- Spray fixatives

Personally, I am a varnish guy… or was. Lately I am of two minds and I'll explain why so you can make up your own mind. Sometimes things are counter-intuitive.

Organic coatings include some kinds of varnishes, and that's about the end of the list for organic coatings.

The best and worst quality of varnish is that it never really dries. You may think it is dry, but you would be wrong. Simple proof of that is to place two varnished canvases face-to-face, or in this case varnish-to-varnish. In a fairly short time they will start bonding together and when you separate them you will pull parts of the surface from one or another or both. It is not a pretty picture. What's good about varnish? It can be removed, even after a long time.

Varnish is removed by applying paint thinners or turpentine. These solvents are themselves the source of other Eco arguments about their relative safety.

Besides water, there are only two "organic" thinners and solvents: turpentine and mineral spirits. Turpentine is made from the sap of (primarily) pine trees. Mineral spirits is semi-organic, considering it is distilled from petroleum.

Inorganic thinners and solvents can involve dangerous chemicals ranging from acetone, denatured alcohol, muriatic acid, *Toluol*, *Xylol* and more.

Lacquer thinner is primarily acetone, one of the harshest of all chemicals and totally dangerous to work with as it is readily absorbed through the skin, as well as lungs.

Toluol is a toluene based solvent for certain oil pants, lacquers, and adhesives. Used mostly by paint chemists.

Xylol is similar to Toluol, with a slower rate of evaporation.

Mineral spirits is an all-purpose solvent made from petroleum distillates. Like gasoline and other petroleum products, they are refined in a range of quality levels. Giclée prints need and deserve the most refined type.

Linseed oil is available in raw or boiled form. The boiled form can be added to oil-based coatings to speed film drying and hardness.

Paint thinner is made from various combinations of these ingredients:

- Acetone
- Mineral spirits
- Mineral turpentine
- Wood turpentine
- Naphtha
- Toluene
- White spirit
- Xylene

Denatured alcohol is great for use with shellac, but will not thin most other coatings.

Turpentine is a paint thinner and solvent made of oil and resin from conifer trees. Pure turpentine has been supplanted by synthetic versions, but it remains a powerful solvent or drying agent.

Acetone is serious stuff. Used as a thinner for lacquer, shellac and even *Fiberglas*,

Brush cleaner is a water-soluble, milder solvent for removing paint, shellac, varnish, etc. from natural and nylon paint brushes. Being water-soluble makes this kind of solvent is user friendly but not Eco friendly.

Is it art or is it a varnish pot? My 6 yearold varnish-mixing jar has enough patina to be art itself.

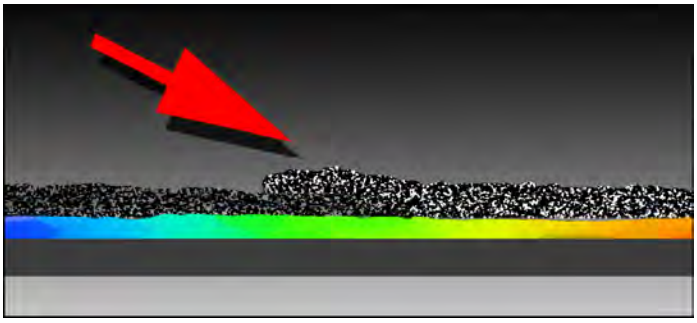
I'm basically a varnish guy. All was good in my world until it came time to offer matte finished canvas giclées. That's when I discovered the foibles and follies of matte-finish coatings. It was a frustrating process trying to work out a simple way to spread matte-finish varnish on a canvas without a sprayer. In the end, I gave up.

What follows is the story of why I eventually switched from organic varnish to a synthetic coating for matte canvas. Liquid laminate out to be an excellent coating system that is fast drying with UV protection equal to or better than varnish. It is like sealing the surface of your giclée with a real laminate. Now I like it better than varnish. Here's why:

Matte finishes require particulate matter to break-up light reflecting off the surface, creating what is known as "scatter light." The stuff they put in to do that is very fine like talcum powder or cornstarch powder. It is that particulate matter that gives matte-finish clear coatings a "milky" look.

The particulates in Golden matte-finish varnish have settled to the bottom of the jar making them easy to see.

When matte finishes dry, the particulate matter is visible if it is not evenly spread over the surface. If it "pools" or doesn't completely level, there will be more coating in some areas than others. Over-strokes and roller overlaps are particularly visible and hard to avoid. It's very fussy stuff.



Overlap of brush strokes or rollers is thicker leaving more particulates on the inked canvas surface which appear as faint streaks or bands.

The only way to get a good, smooth matte coating using liquids is to spray them. Brush and roller applications will be uneven.

Laminates provide the ultimate in protection. The giclée surface is covered with a film, not a liquid. Cold lamination applies the film by passing it through rollers exerting terrific pressure for a permanent bond. Hot lamination applies heat and pressure for the ultimate bonding, however the heat can damage some giclée media, especially those made of synthetic materials that melt or deform under heat.

Laminates have much better protection and cleaning characteristics. Having some real thickness (usually 3-6 mils) laminations are totally waterproof so they can be cleaned with a damp sponge or cloth. *Windex* can even be used on some laminates.

Mirror-like gloss finish laminates show the widest dynamic tone range by are susceptible to reflections and are damaged by any abrasives in the cleaning materials or solutions. Scratches and abrasions show badly.

Satin finishes keep good contrast with less glare and reflection. Although less easily damaged by abrasives, care must still be taken when cleaning.

For matte finishes, nothing compares with laminates except possibly liquid laminates.

Water-based liquid laminates are rapidly becoming my coatings of choice when varnish is not being used. *Clear Shield* is the one we use.

Excess dried Clear Shield *peeled from glass jar shows it to be like* Saran Wrap *in its characteristics.*

Clear Shield liquid laminate offers UV protection and totally seals the giclée in plastic, as does a real lamination. It dries fast and hard in an hour, although 24 hours is the recommended drying time, prints are ready to go out the door after just a couple of hours. Varnish-coated giclées must dry at least two or three days.

Shellacs and lacquers are not used in my studio as they are simply to harsh and dangerous to work with without a professional spray booth with filtered air and other protections for both the sprayer and the world we live in.

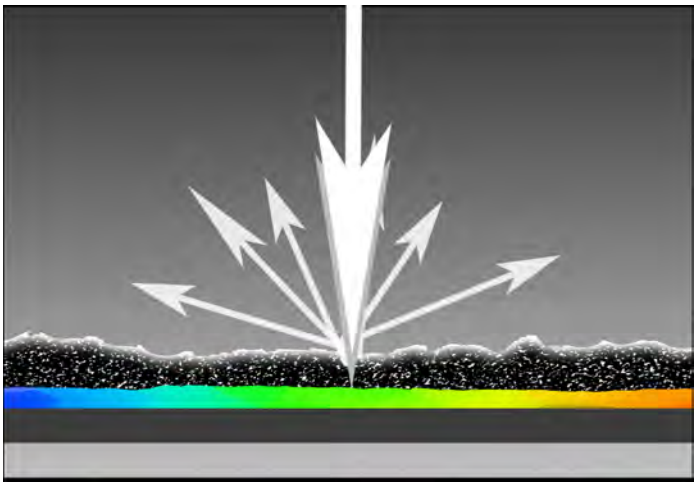
Varithane is a coating that I like for some applications (pun intended). It dries hard and comes in a variety of surfaces, including glossy, satin and matte, (which can be blended). However, it goes yellow eventually. That can be used to advantage to give a piece an "antique" look. But most folks don't appreciate the jaundiced alterations to their original print colors.

Varnish has been my coating of choice for many years, and still is for all the reasons discussed above. Besides those reasons, it is easy to work with, the fumes are less toxic (if you use pure gum turpentine with natural varnishes, like the *Golden MSP Varnish* range).

Glossy *Golden MSP Varnish* is thinned 1:4 or 1:3 for brush application and about 10:1 for spraying. Two to three brushed coats provides a nice even surface, which looks good on canvas giclées. To build-up the same thickness with spraying involves 6 to 8 coats.

Thinner varnish can also be brush-applied to save on materials while still providing sufficient coating. However, without a certain minimum thickness to the varnish coating, you wouldn't be able to clean with a wet sponge or *Windex.*

Golden MSP Satin Varnish and their matte varnish cannot be successfully brushed on. In fact, all matte and semi-matte surfaces are difficult or impossible to brush or roller on without visible strokes.



Particulate matter in varnish creates scatter light on the surface, which is the nature of all non-velvet matte surfaces.

It is the particulate matter in matte and satin finish coatings that become visible in the brush or roller strokes.

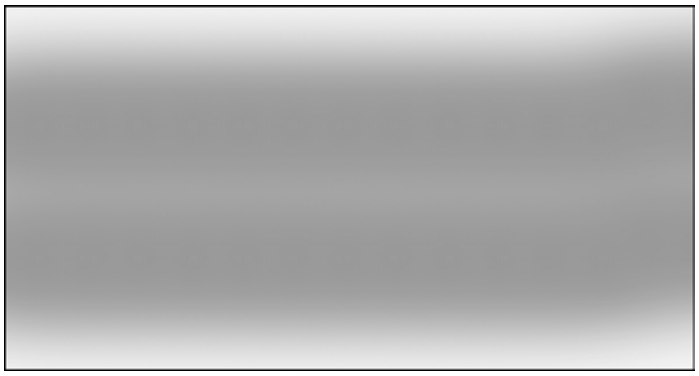
Finely ground matter is added to make it matte. The more particulate matter the more matte the surface.

Glossy varnish "*levels*" to a mirror-like surface with high reflectivity. Satin and matte surfaces level, but the surface is not flat, but looks "mountainous" through a microscope. Frosted and etched plastic and glass surfaces exhibit the same properties, creating *scatter light* instead of reflections.

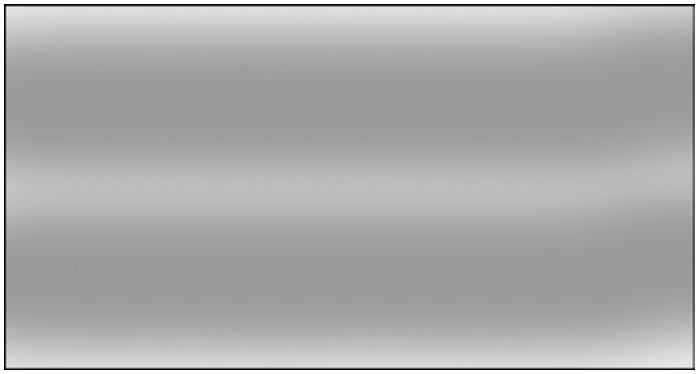
Scatter light is what destroys contrast in pictures with matte surfaces. The scatter light "fogs" all tones but is most apparent in dark tones. Satin and matte finishes optically lighten dark tones just as if you had moved the black point.

Instead of reflecting like a mirror, the particulates in satin and matte varnish break-up the otherwise smooth varnish surface and scatter the light. The same thing would happen if you sandblasted a mirror to give it a frosted surface.

Spray application is the best way to apply a coating to a giclée print however it is also the most problematic for a variety of reasons.



The narrow region between the two strokes (center) should have less coating, not more. Above, the overlap is good. Below, the overlap is not good... the two strokes are a bit too far apart.



Spray stokes should overlap between one-third and one-quarter of the diameter of the stroke, depending on the spray cone. Some prefer a circular spray cone, others an oval pattern. Over-spray varies with each individual spray cone.

Keep a "wet edge". The previous stroke should stay wet long enough for the next overlapping layer to dissolve into it. If the edge gets too dry too soon, the overlapping spray will have a different reflectivity than the areas that remained wet longer (the centers of the spray cones). The effect is reflective banding in the surface coating.

Spray cans are difficult to work with because they don't push enough coating to build and maintain a proper wet edge. There is so little paint at the edges of the spray patterns that they dry almost instantly. If the piece is small, that may be alright but on a mural you'll never get an even coating. The best you can do with spray cans is spray many thin layers, hoping to eventually rid the banding from view.

Spraying is best done with a professional sprayer powered by a quality air compressor. The compressors and other air-powered tool range offered by *Senco* is perfect for giclée finishing. With a professional sprayer you will achieve a spray cone of about 12 to 18 inches, with a good wet edge and a 3-4 inch overlap.

Whether sprayed, brushed or rolled, a print should lie flat during the coating process because all coating solutions level themselves to some extent. Good leveling makes for a mirror-like smoothness and fosters even drying. The amount of thinner used with a coating determines its leveling characteristics.

Use the minimum amount of thinner by gradually adding it to the varnish, lacquer or shellac. You know you've added enough when the coating flows freely. If too much thinner is added, the coating will run and drip and otherwise ruin your chances for the desired smooth, high gloss finish that shellac, lacquer and varnish are known for.

If you want brush strokes to show, use less thinner. The thicker the coating, the less it will level. Fast drying also prevents leveling. A hair dryer can be used while brushing to "freeze" the brush-stroke profile before it levels.

If brush strokes really turn you on, there are coatings specifically made for the purpose. One such product is *Brushstroke Gel,* (www.artandframingsolutions.com).

According to the manufacturer, "*Brushstroke Gel* is a a water-soluble acrylic polymer that is easy to apply. It cleans up with soap and water. The gel contains an UV inhibitor, which helps protect giclée art from yellowing, fading, and light damage. The *gel* comes in either a medium gloss or a matte finish and offers enhanced brush stroke definition. It is used for adding brush stroke texture to giclées or mounted prints."

"Once the giclée has been stretched or mounted, clear acrylic gel brush strokes are applied with an acrylic brush to give the work extra texture and a three-dimensional feel. The gel helps recreate the brush marks found on traditional oil paintings. You control the look you wish to achieve by deciding on the number of gel coats and the fineness of the brush strokes used to add detail. It dries clear in 1-3 hours, but should be left overnight for complete drying."

Adding glitter, sand and colored dyes to change the effect of the gel can create variations. Mix a small amount and test the effect on some scrap material before applying it to your artwork.

Roller Application of *Clear Shield*

Lay down a piece of clean Kraft paper that is big enough to allow over-rolling by at least three or four inches on each side.

Roller application of *Clear Shield* begins by mixing the stock solution 4:1 by volume with water (1 part water). Mix small batches of perhaps 1/2 cup. Use a 6-inch foam roller with a matching sized tray. The depth of the diluted solution in the reservoir of the tray should be 1/2 inch. Make small batches so you won't end up with leftovers and waste water.

According to the manufacturer, *Clear Shield* is fairly noxious stuff. One of the many warnings on the packaging concerns water safety because this product kills fish. From that we can infer that it can also kill people. We are very sensitive to these matters as our studio has a septic system and our water comes from a well nearby. So... what to do with the left-overs and water used to clean-up?

The solution (pun intended) is not to generate any waste. That can be done. You'll need these things:

- Six-inch foam roller
- *Snapple* bottle (small)
- Yogurt container (750ml)
- *Kretschmer's Wheat Germ* bottles (2)

A six-inch roller fits precisely into a small-sized Snapple *bottle creating an air-tight seal as the* Clear Shield *dries around the bottle neck.*

The roller is self-cleaning when inserted into the Snapple bottle where it will stay until next use. The yogurt container catches the spillover.

Using the *Snapple* bottle for storage, you'll never generate any waste water. I haven't tossed a drop of this water since starting to use *Clear Shield* several months ago.

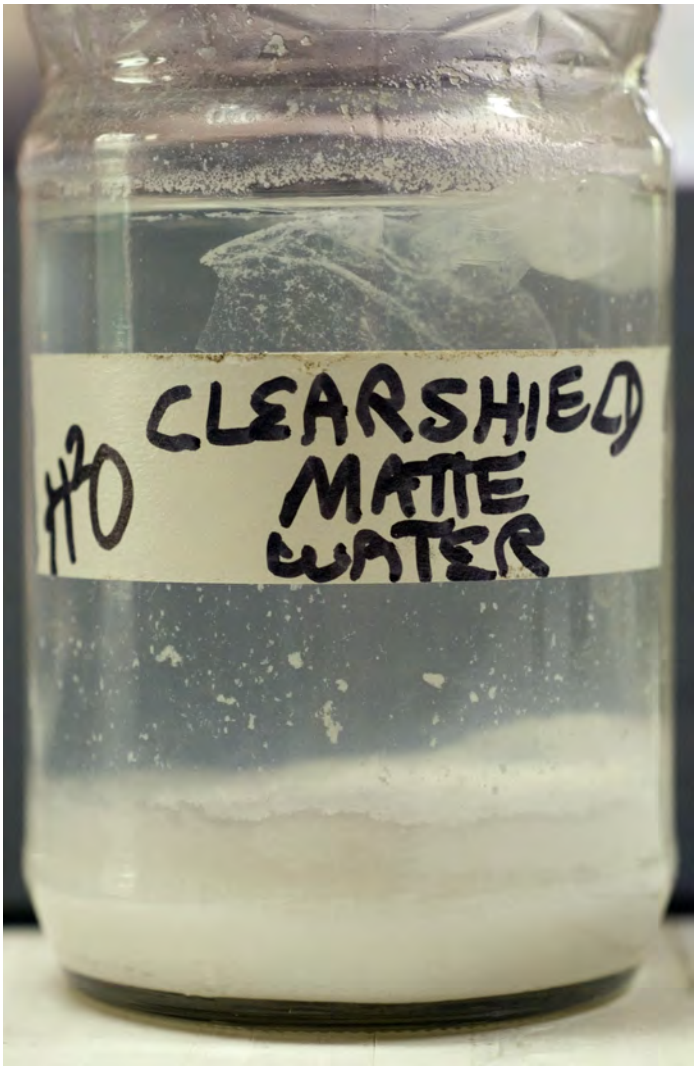
Any water used to clean is collected into a *Kretschmer's Wheat Germ* bottle and percolated through coffee filters for re-use to dilute new working solutions of the coating.

Eventually I'll have to replace the roller, but I've gotten a few months out of it so far... with no cleaning at all.

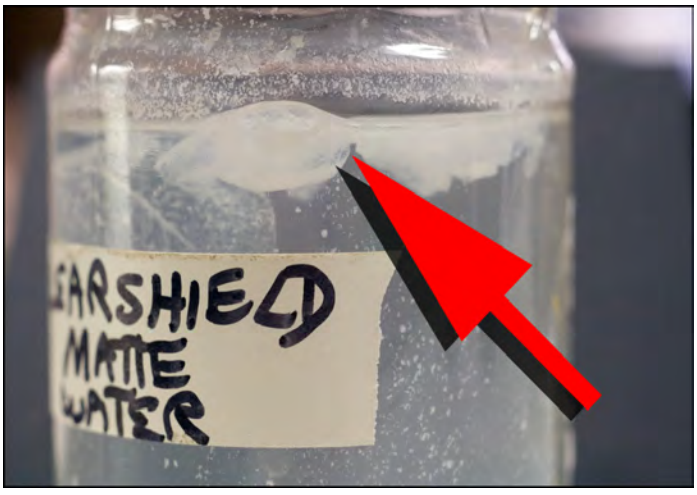
This experience has made me think twice about varnish. Even working clean, there's still a fair amount of thinner used for cleaning and keeping brushes from drying out between sessions. So, I wonder which is more Eco friendly in the end, the synthetic or the natural product?

A "rind" will form around the bottle neck from dried or drying Clear Shield. *The rind forms an airtight seal, protecting the roller from drying out. But the rind must be removed before using the roller again. Use a single-edge razor to create a clean, bevelled edge (below).*

Wear rubber gloves when slicing off the rind with single-edge razor.



After three dozen coatings sessions I have accumulated only a pint of left-over water as no new water is ever used. Water is reused to dilute concentrated Clear Shield to make working solutions. The particulates are removed by percolating the water through coffee filters.



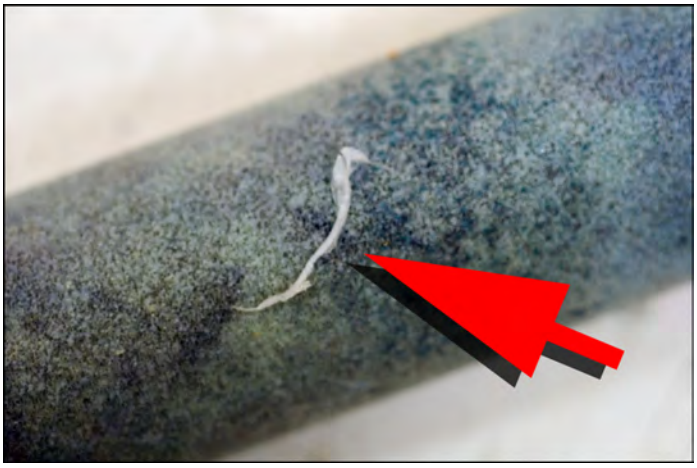
Most particulates settle out but some end up partially coagulating into gelatinous strands that must be filtered out. Pass the water through coffee filters before reusing it for working solutions.

Fill the roller tray by pouring the coating solution onto the diamond-treaded shelf. The treads catch rogue strands of partially coagulated particulates. If they escape into the reservoir they're hard to find.

Pluck out the rogue strands of coagulated particulates with toothpicks.

If you end up with a little too much waste water, let it dry up by evaporation rather than tossing it into the sewer. The world will be a better place if you do that.

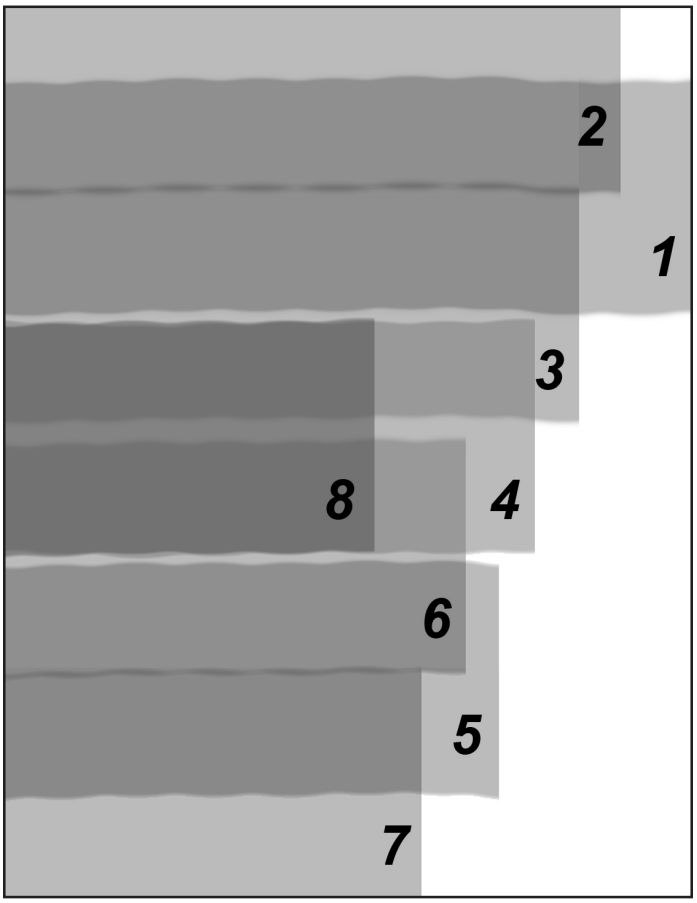
If you spray, be sure to wear breathing masks and have ventilation. But before you do that, you might want to think about the birds and the bees, in every sense. But enough of this preaching. Back to coatings.



No matter how careful you are, a goopy sting of quasi-clotted coating will eventually make its way onto your roller. Once on the giclée you'll have to act very fast to pluck it away. Clear Shield *dries fast.*

Rolling Procedures

Load the roller and roll out part of it back into the tray. You don't want the roller to be dripping wet as you move it into position. On small to medium sized giclées up to 20 X 24, work from the center out.



Six-inch-roller sequence and overlap on 24-inch-high sheet. Use strokes 1-4 to unload the coating from the roller. Then reload for strokes 4-8. Another eight "dry strokes" are needed to roll-out the overlaps. Note that strokes are stepped leftward only for illustrative purposes.

Conceptually, you are creating a reservoir in the center of the giclée and rolling it out to the edges. Depending on the size of the picture, you might need to double dip the roller and use two centers, as in the diagram (lower left).

For example, a 20 X 24 sheet needs two loads of coating for good coverage. The sheet should be mentally divided into two zones... top and bottom halves.

Each half gets one load applied to its center and worked outwards in three strokes. The fourth stroke is across the boundary between the top and bottom zones. It is important to work efficiently and waste no time between the two loads.

Then reload the roller and repeat the procedure in the other half of the sheet.

Right away, unload the roller completely on some clean Kraft paper and go after the uneven ridges with the "dry" roller. Work in the same direction as the application passes. Aim the round end of the roller toward the side you will start on. Work toward the other side in as few passes as possible, with one-half-roller overlaps. A dry roller is needed to do this and you need to act fast, before the coating starts to dry. After about two minutes it is too late.

Wait for the first coating to dry enough (about 1/2 hour with a fan blowing air that is 80°F). Then apply the second coating using up-and-down passes instead of side-to-side strokes.

More than two coats aren't really necessary, but they won't hurt either and may be needed to eliminate any imperfections in the second coat.

Alternate roller directions between coats.

Clear Shield dries fast. Between coats, keep the roller and coating "active" by periodically sloshing them around in the tray. Even with that precaution, some "clotting" and "stringing" may begin if the surfaces of the tray and roller start to dry, creating a thin film of semi-hard coating.

The "clots" and "strings" are like the film that you get on the top of milk that is coming to a boil. They can mar the surface of the giclée, and you should have a few toothpicks on hand to pluck them off the coated giclée surface. Use a "semi-dry" roller to smooth out the repaired area if need be, then re-roll the whole surface. Act fast!

For convenient roller storage use a small-sized *Snapple* bottle. The neck is the exact diameter of your 6-inch foam roller, and the bottle depth is just right, too.

If your batch was the right amount you should have very little leftover solution. The 1/2 cup that we usually end up with is stored in the *Snapple* bottles together with the roller.

The roller unloads almost completely as it squeezes through the snugly fitting neck of the bottle. To catch the spill, keep the *Snapple* bottle in a 750ml yogurt container. Done right, you never have anything to wash-up. That is a good thing because the warnings on the *Clear Shield* label and instructions clearly state that the stuff is a poison.

Avoiding any clean up at all makes synthetic *Clear Shield* even more environmentally friendly than organic varnish and turpentine. However, fast and total drying makes it unfriendly when it comes to occasional hairs and "hickeys".

Removing Hairs and "Hickeys"

Eventually a hair or other bit of aerial "flotsam" will land on a freshly coated giclée making a "*hickey*" if you don't act fast to remove it.

"Hickeys" in traditional printing jargon are small bits of paper that get caught-up between the rollers and printing plates, marring the transferred ink(s) surface.

It's best to prevent these situations, of course. Wearing a cap and coating prints in an area free of breezes is about all you can do, short of building a filtered-air spray room with positive pressure. That is why I say it is inevitable that you will eventually find yourself looking for a way to remove the hickey or hair.

If you'll be using a fan to speed drying, turn the fan on a few minutes before coating the giclée to blow away any dust that may be lurking. Turn the fan off while coating the print, to promote slower drying for better leveling. After the coating has leveled, turn the fan back on.

When lifting off hairs and hickeys keep the Exacto *knife blade flat to the print surface and avoid puncturing it.*

Tools for hickey hunters. You cannot have enough different kinds of tweezers. The use of a painters arm brace helps get to the center of large pictures where a hickey is the most likely or so it seems.

Be extra careful using a hair dryer, as you'll probably lean over print while drying it that way. It's a prime time for a hair, a flake of skin or a tuft from your clothes to mar the surface of the coated giclée.

Avoid wearing sweaters and other fluffy fabrics. Wear a cap or a hair net (so stylish). Long-sleeved shirts are best. If you are bearded, you might consider a facial bandana to hold back hairs.

An *Exacto* knife with a long, thin blade works well to lift hairs. Keeping the blade flat to the giclée surface, slip the point under the hair and lift slightly, grabbing the lifted "loop" or end with your fingers or a pair of tweezers. If the coating is a synthetic, you'll have to act fast as these dry or set-up quickly.

Lacquer and shellac dries so fast you may be out of luck. With other coatings, use a pair of long, needle-nose tweezers to pull the offending hickey away from the print.

Depending on your timing, the coating may not level out after the hickey's removal. If the coating doesn't level there will be a mar that requires another layer or two of coating to cover it over. If it is a small enough hickey you can soften the coating where the hickey once was. Using an eye dropper or fine brush, drops some thinner in the hole and hope it slumps into the level surface around it.

Use a fine brush to apply a drop of coating solvent right where the hickey used to be.. Hopefully a small amount will "pool" in the trough left by the hickey and soften the coating and allowing it to level better.

The same technique can be used to paint diluted coating into deep pits and troughs left by pulled-out hairs.

Varnish is unique in that it never dries completely. That makes it possible to get in and remove a hickey or hair even after it has dried.

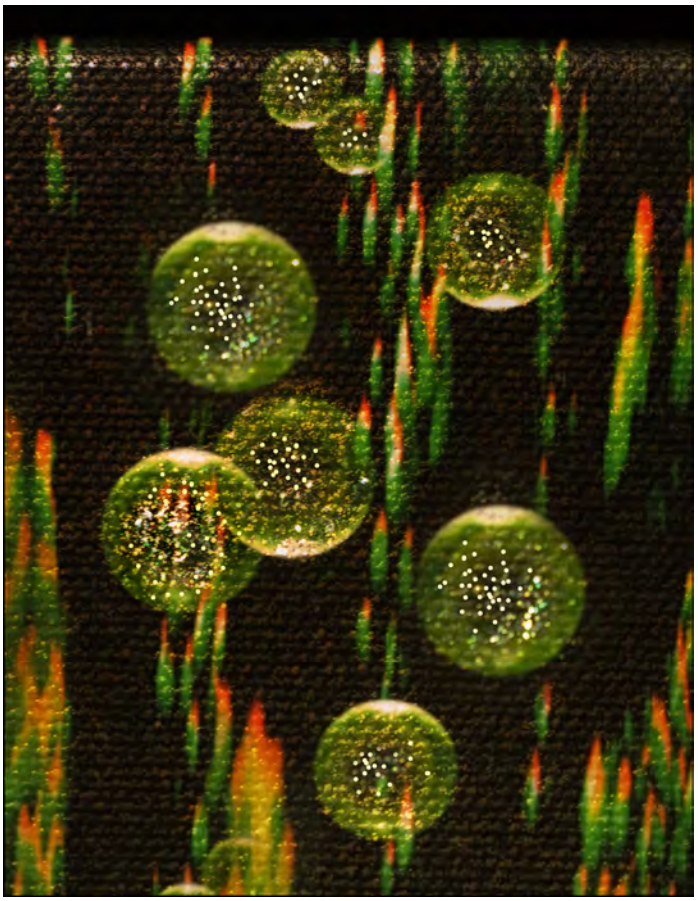
Do that by using a fine brush to "paint" the hair or hickey with turpentine, mineral spirits or paint thinner. An alternative is to use an eyedropper to place a small droplet of thinner on the offending mar. Use small amounts of solvent and repeat the application frequently.

Once the varnish has sufficiently softened, lift off the hair or hickey with tweezers, or lift it up and off with an *Exacto* knife. Fill the hole with thinned varnish. Apply a new top coat for a smooth surface after the hickey holes have been filled.

Hand rests help If you are removing a hickey from a large print.

Special Effects

Coatings can be used creatively. Special effects made with coatings can add a certain "*je ne sâit quois*" to a giclée, a kind of magic. Glitter and varnish variations are two of my favorites. Any kind of effects moves your work away from so-called "fine" art into the *kitsch* category.



Bubbles have extra sparkle created by sprinkling a pinch of glitter while the coating is still wet.

Glitter Adds Sparkles

A small amount of glitter added to the coating can put some sparkle into parts of an image. There are many kinds of glitter, all with different effects. My favorite is the ground-glass type, which acts like little crystals or prisms creating sparkles in rainbow colors.

Whatever type you use, that glitter will be like hickeys, visible in the surface of the giclée (unless hidden in the crevasses of thick-weave canvas or rough textured giclée paper). An extra topcoat or two of varnish or liquid lam over the glitter layer solves those kinds of problems.

Glitter can be mixed with the coating if you are brushing or rolling it on, but it clogs up sprayers. For tiny areas just use your fingers to add a "pinch" of glitter by sprinkling it on.

Another application technique is to use a small tea strainer and jiggle it over the surface, making "snow" of the glitter. Make sure the windows are closed and the fan off if you use that technique.

Keep glitter brushes and solutions well isolated from the rest of your coatings and application tools.

Multi-Surface Coatings Provide Emphasis

Two-tone or tri-tone coatings also help lead the eye to specific parts of a giclée. Printers have long featured gloss/matte-coating combos.

Art directors sometimes specify gloss varnish for pictures and matte or satin varnish for the rest of the page(s). The differences are visible in the surface reflections as well as in the contrast differences between the tones of the matte and gloss finish areas.

Fireworks are a perfect place for a sprinkle or two of glitter.

Coatings can be graduated from gloss to satin or matte, adding depth to landscapes and cityscapes. That effect is best done with sprays.

Coatings Reduce Ultraviolet Light Sensitivity

In some cases coatings actually work against you, as is the case when using 'UVM' (ultraviolet media) which is paper or fabric that glows when exposed to UV light. I use it for night scenes, space effects, etc.. Kids love it.

Any media with a lot of 'cotton rag' will glow under UV light the way your tee shirt and false teeth do at the disco. These effects can be used boldly or with subtlety.

Many of my own illustrations are night scenes which the ultraviolet effect enhances. To my dismay I discovered that any kind of coating decreases the UV sensitivity.

Wherever some protection is needed, lamination is the best choice together with more UV light to compensate for the reduced UV reflectivity.

Retouching

When a giclée emerges from the press, close examination may reveal spots that need touch-up. Or, you may feel that an area needs creative work. The nice thing about canvas giclées is that you can paint right on them, to whatever extent you want.

Do as much physical retouching as you can before coating the print. Such work will be hidden under the varnish or other finish coatings. Retouching done on top of the finish coat may be visible and appear as a 'blemish'. Coating over retouching helps hide differences in surface texture and reflectivity.

"Spotting" Before Coating

Spotting should be done before coating, using water based dyes and pigments. Most giclée inks are water-based so they can be touched up the same way you used to 'spot' color photos, with Easter-egg colors and a fine-tip brush. More care must be taken however, because there's a major difference between a photographic print and a giclée.

Photographic media have "*emulsions*". The color is within the emulsion and an integral part of it. Emulsion colors cannot be wiped off or dissolved.

Giclées have a different kind of emulsion, called a "*ground*." The difference is a giclée's color is sprayed on as a coating that sits on top. Although capillary actions draws some of the inks into the surface, most remains on top and are susceptible to damage by running and smearing when wet, and to dissolving, scratching and possibly flaking when dry. The harder the ground surface, the less the ink penetrates.

Glossy-finish polyester "papers" have the hardest surfaces. Wet ink is very fragile on these glass-like surfaces and smears easily until it is completely dry. Luster-surface polyester papers also have hard surfaces. The inks are absorbed a bit more but remain fragile. Matte-finish papers are softer and more absorbent.

Transparent dyes are good for retouching giclées. If you can afford them, *Dr. Martins* dyes are the colors of choice for retouching professionals and have been for decades. Otherwise, good old Easter-egg colors also work fine. Watercolor paints with solid pigments will show as dull areas on any surfaces except matte. Oil-based paints will not spoil the water-soluble giclée inks.

Retouching After Coating

Oils also work well if the top surface is varnished. In fact, a little varnish can be mixed with color(s) to make blending as close to invisible as you can get.

It is more difficult to retouch topcoats of hardened lacquer, shellac or liquid laminations. Oils or acrylics can be used sparingly for spotting. No broad-area work is possible without it being noticed in the surface reflections. Another topcoat will be necessary in some cases.

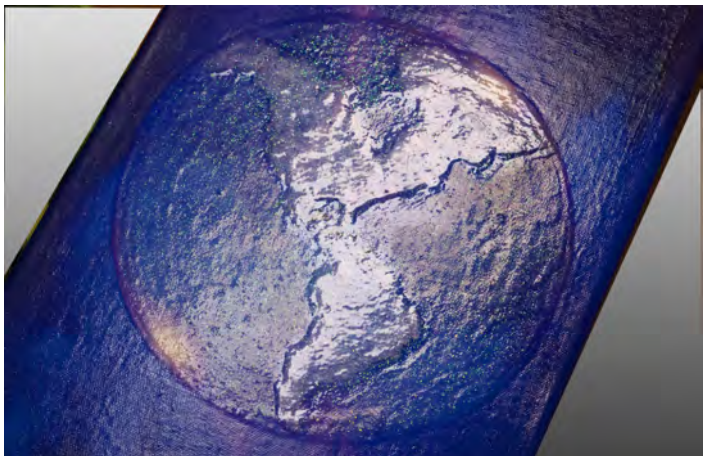
Extra topcoats are not necessarily a problem. Many of my own works have three, four and more coats of gloss varnish. The extra layers add more and more depth to dark tones and more overall gloss. When you get up to 6 and more coatings pictures start to take on an "antique" look, especially when brush strokes are slightly visible.

Your client is probably unaware of the many different coating possibilities that are available. At our studio we offer "creative varnishing" services and charge by the coat. Bring up the subject of coatings during your initial consultation.

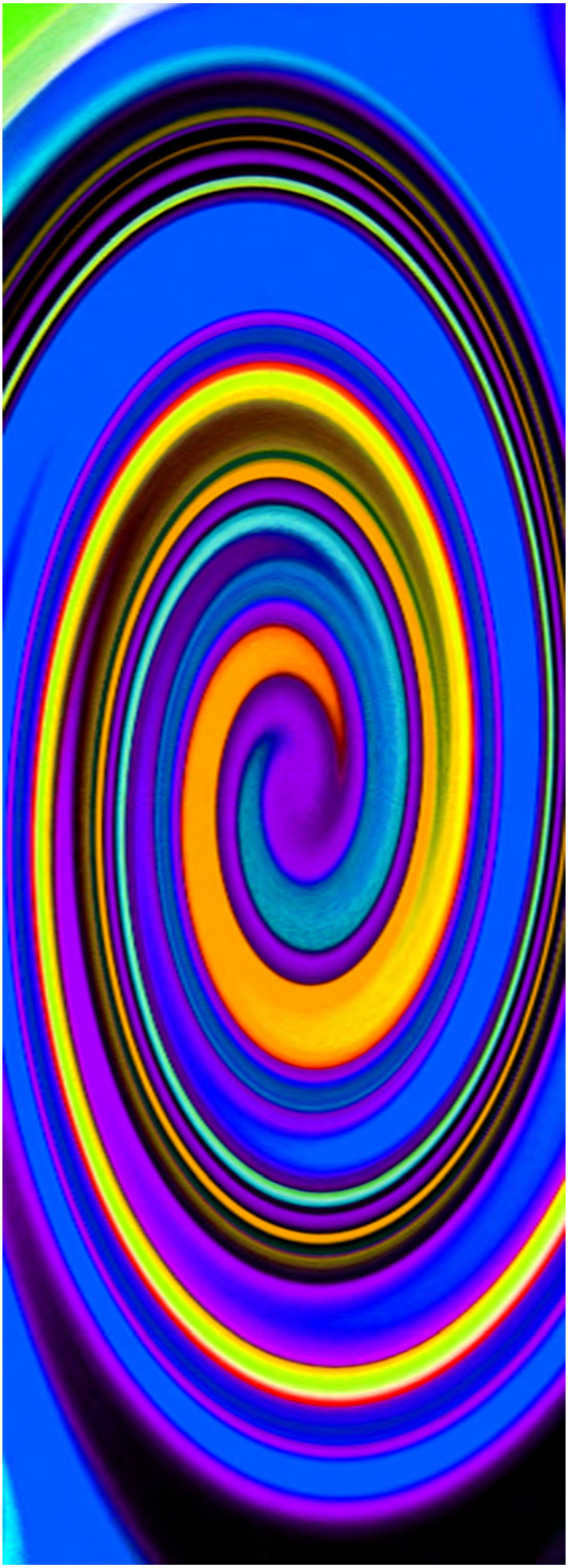
Glitter and special effects are left in the hands of the client as preferences are as personal as sugar in coffee.

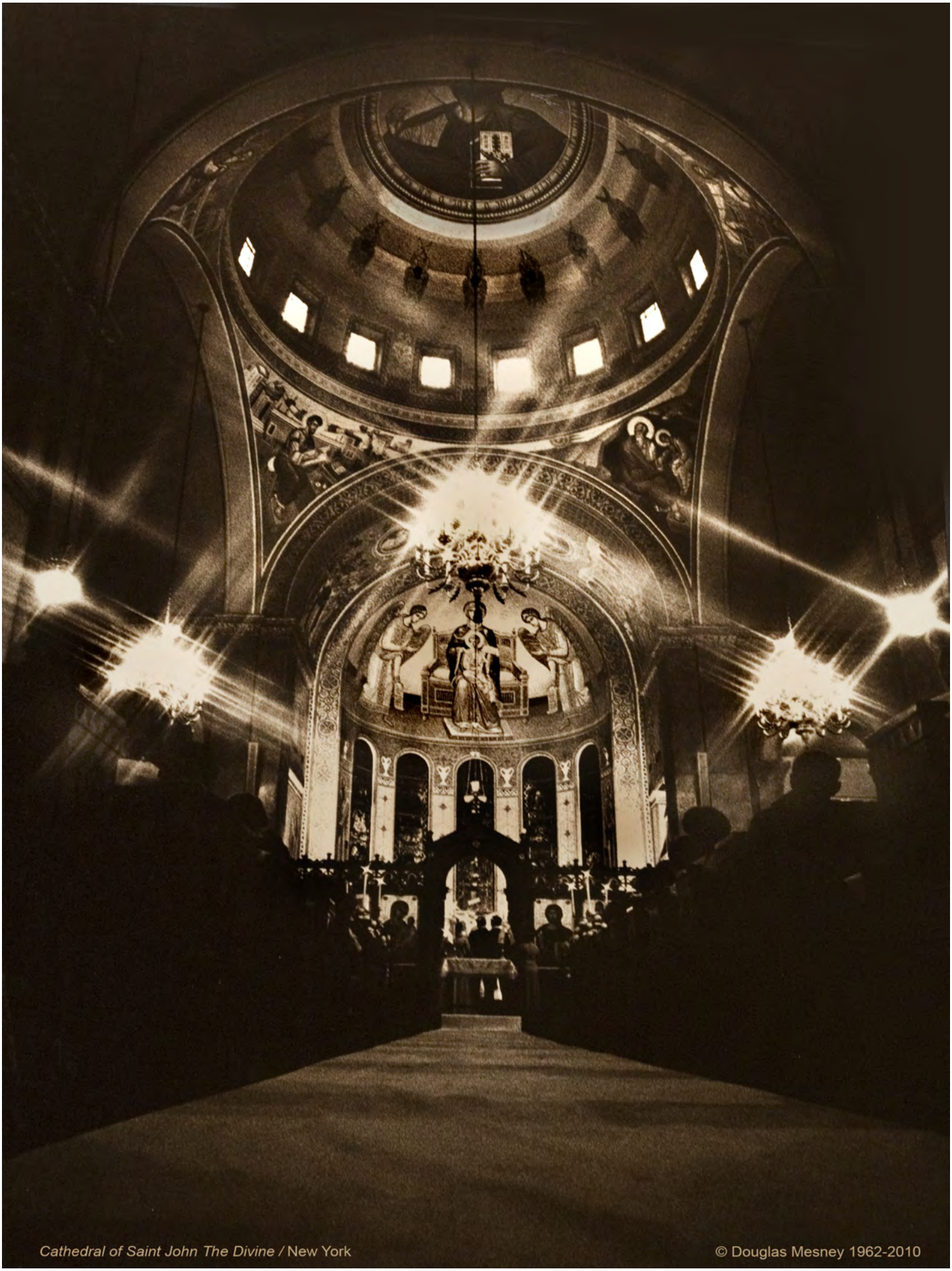
Now you masterpiece is ready for the finishing touch.

Above, detail from Cistern Dancers *shows a very subtle "ether" through which the dancer peers at the viewer, The ether was created by using six thin layers of varnish. A pinch of glitter was sprinkled on each layer. In this way, the glitter that lands on the different layers is oriented toward the light differently and the effect sparkles more. A special kind of glitter is used that is made of ground glass to refract light rather than simply reflect it. Collecting odd kinds of glitter has become an avocation.*



Below, Bubble No. I *features continents built up in twenty layers of varnish (above) which appears only as relief with side-lighting and is otherwise totally transparent.* Golden MSA Gloss *varnish was used to build the layers over a three-month period (to allow drying).*

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Giclée Prepress Workflow

Step Thirteen

FINISHING & DISPLAYING

Stretch Your Canvas ...and Your Mind

Stretching Canvas Giclée Prints

Canvas giclée stretching is a two-step process. First you make the *stretcher* from "stretcher bars" and some hardware, then you stretch the canvas giclée onto it.

Building Stretchers

Stretchers can be assembled from pre-fabricated bars or you can make your own.

Pre-fabricated stretcher bars come in several "weights". Lightweight (left) stretcher bars handle anything up to about 2 feet. Medium weight stretcher bars (the other three) are good for giclées up to four feet; and heavy duty is for extra large pictures. Richardson *stretcher bars (right center) are used at the Vashon studio. In Vancouver we use the* DeSerres *variety (left center). Long lengths come without slotted corners (right).*

Ready-made stretcher bars don't always come in the size you want. Up to about 20 X 24 the range of sizes is good. Beyond that you are limited. Odd-numbered sizes are often hard to come by. No problem, as making stretcher bars is relatively simple carpentry.

Assembling good quality stretcher bars is easy. All you need is a rubber mallet and an 18-inch carpenter's steel square. The pieces slide together and a tight fit is achieved with the mallet. Depending on the quality of the bars, they fit together square if you're lucky. Usually, some adjustment is needed with the help of carpenters' steel squares.

Carpenters squares (bottom and center) and a standard T-square used by graphic artists (top).

Making your own stretcher bars is also easy. When shopping for materials make sure no pieces are warped or twisted, two common problems of wood products. The better the quality of the wood, the nicer the stretchers will be. Avoid knotty pine.

Cross-section of "quarter-inch, quarter-round" moulding stock.

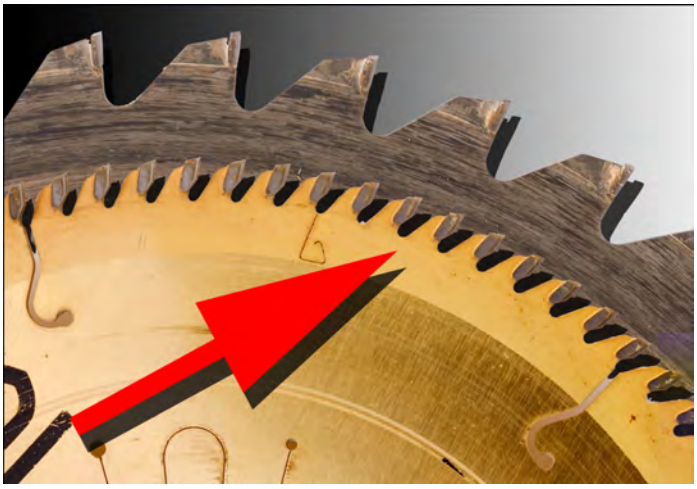
"MDS" is another material to avoid. It's a composite material made of wood grindings and sawdust with binders. It works well enough but your giclée deserves better.

Glue the quarter-inch quarter-round moulding strip to the edge of a 1 X 2. The round part of the profile should face into the frame center, which is the long side of the 1 X 2.

Medium weight stretcher bars can be made from standard 1 X 2's and quarter-inch quarter round moulding strips. Line them up on a flat edge before the glue sets. Use clamps for long lengths to hold the quarter-round in place.

Stretcher bars should have a profile that "lifts" the canvas off the stretcher bar. One-quarter inch is "just enough".

Depending on the quality of the quarter rounds, the edges might be too sharp and require light planing or sanding. An edge with "blunt" sharpness is what you're after. If the edge is too sharp the giclée's ground emulsion and/or coating may crack. This can also occur with some ready-made stretcher bars. The way to tell if it is too sharp is to press your finger into the edge, hard. If it hurts, the edge is too sharp.



Use a good chop saw outfitted with an 80- or 100-tooth blade to make your cuts. (Gold blade is 80-tooth, gray blade is 40-tooth.) The saw should be adjusted to make accurate miter cuts (cuts at 45-degree angles) for the corner joints.

Lay out the stretcher parts on the worktable.

Use the carpenters' steel square to line-up and glue-together two pieces into the first of two "L"' sections. Use a nail gun (not a hammer) with thin, 1 1/2-inch nails to fasten the two glued pieces together.

Glue reinforcement pieces in the corners and fasten them with the nail gun. Clean-up the excess wood glue with a damp cloth or sponge. Repeat the process to make the second of the two "L" pieces needed for the stretcher.

Corner reinforcements are all that's needed for most stretchers 20 X 24 inches and smaller. Make them out of the leftover pieces from your miter cut corners.

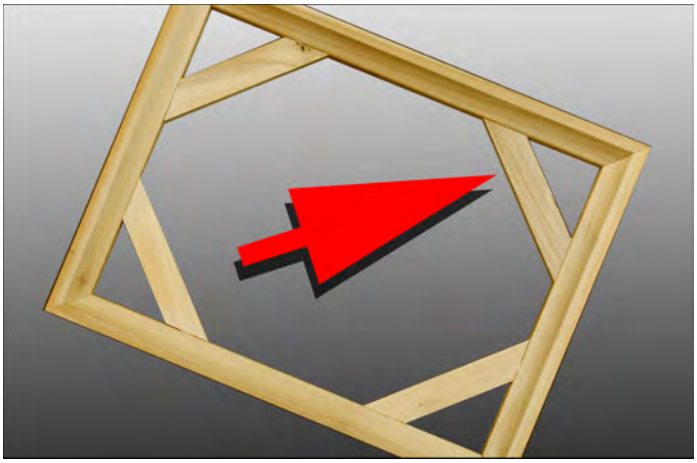
Use thin 1 1/2-inch nails to fasten glued corners (above) and hold corner reinforcements in place (below).

Corner reinforcements are made from the "waste" pieces left over from cutting mitered corners.

Join the two "L's" before the glue sets. Some adjustment may be required, hopefully not much. Clamping the first "L" to the tabletop and using two steel 18-inch angles makes fitting the second "L" easier and more precise. Glue, fasten and fit with corner braces in the usual manner.

Crossbars and mitered corner braces provide enough support for giclées up to four feet in any dimension.

Any dimension exceeding 24 inches should have the support of at least one centered crossbar to prevent any sagging or bowing when the forces of canvas stretching are applied.

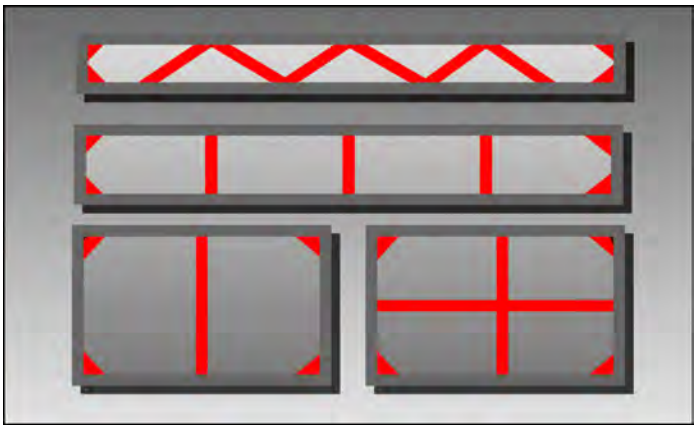


Additional reinforcement is needed when any length gets beyond two feet. Between two and four feet, centered crossbars will do nicely, as will mitered corner braces. Beyond four feet torque *sets in, big time.*

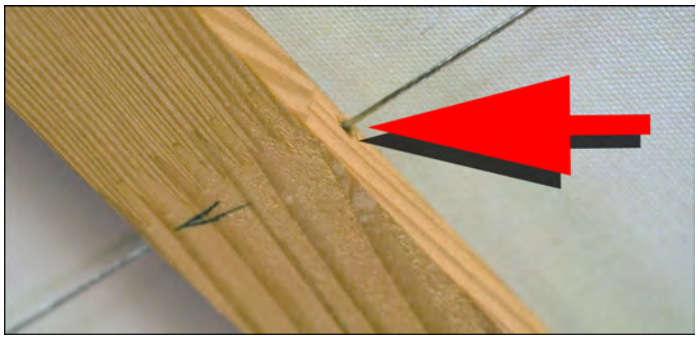
"Torque" means twist. If a picture won't lie flat, it's torqued. Stretchers can get torqued because of twisted components, badly angled miter cuts, or insufficient strength to resist twisting during stretching and subsequent handling. Using damp wood will almost always cause torquing as the stretcher bars dry.

A panorama shape is structurally stronger than a more square shape and inherently resists torque more than a square, requiring less cross-bracing. A square is most subject to torquing. If a stretcher torques it is usually hopeless but there have been cases where we have been able to salvage it. Lay a 1 X 2 on the floor and put the stretcher on it so that it goes across diagonal corners with the high points up. Push the high corners down. Good luck.

Beyond four feet heavier materials are needed for greater structural integrity with more resistance to torque and bowing. Additional bracing is needed, too. Maximum strength is achieved with truss-pattern braces.



Truss-pattern bracing (top) provides maximum resistance to torque and bowing. Cross bracing for a panorama should support the long sides (center). Cross-bracing patterns for more square canvases (bottom).



Running the hanging wire through the cross braces is easier than installing several wires in sections.

Don't install the felt pads yet. Wait until the canvas is stretched.

Fit the assembled stretcher with its hanging hardware before *stretching the giclée in order to avoid having to handle the stretched canvas unnecessarily. There's not much room for tools when the canvas is attached to the stretcher as you can see in this picture.*

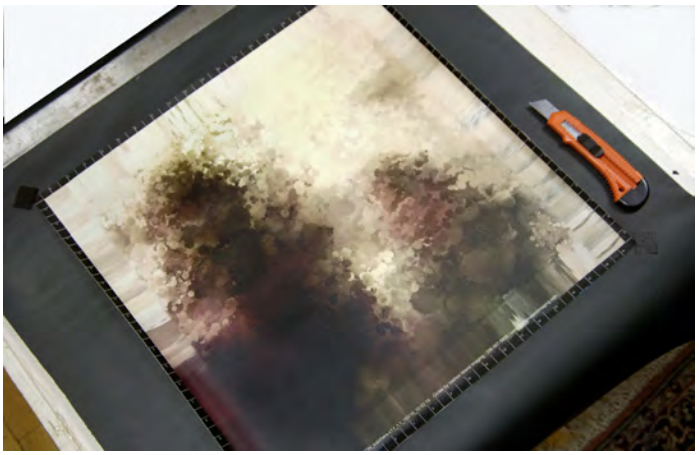
Stretching Canvas

Plenty of room is needed to stretch canvases; more than you think. Flipping, swinging and turning them every which way can take a lot of airspace if you are working on an 8-foot panorama.

Work surfaces should be white or black so you can see things. Not only your tools, but also odd bits of scrap like rogue staples and blade tips that can mar the surface of a giclée. The work surface should sweep or blow clean easily.

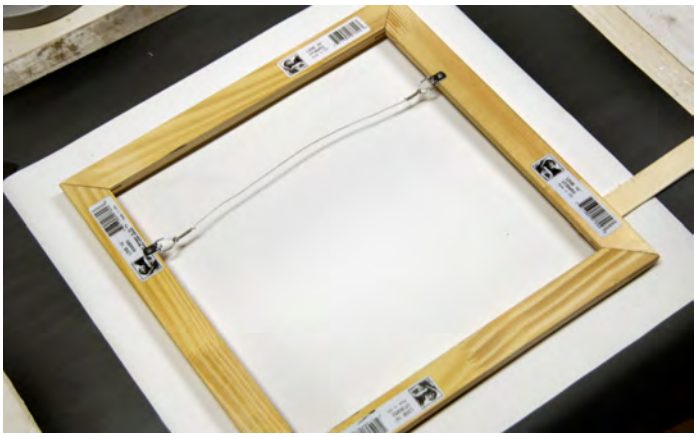
Some prefer a carpet surface, but I like matte board as it can be readily cut into and it easily replaceable when it gets too ratty. Under the matte board are two layers of 1/2 – inch *Foamcore* board and under all that the tabletop. In this way I keep a sharp blade tip longer while doing serious mat-knife work on stuff like *Gator Board*. Polypropylene cutting boards are terrific, but also terrifically expensive. Glass is best for fine and delicate cutting work using thin materials with razor blades or *Exacto* knives.

Trim the giclée to the outer edges of the rulers (*Step Four* has more information about adding rulers to border giclées). The rulers and giclée border wrap should be two inches if you are using "normal" stretcher bars and three or four inches if you are using heavy duty stretcher bars.

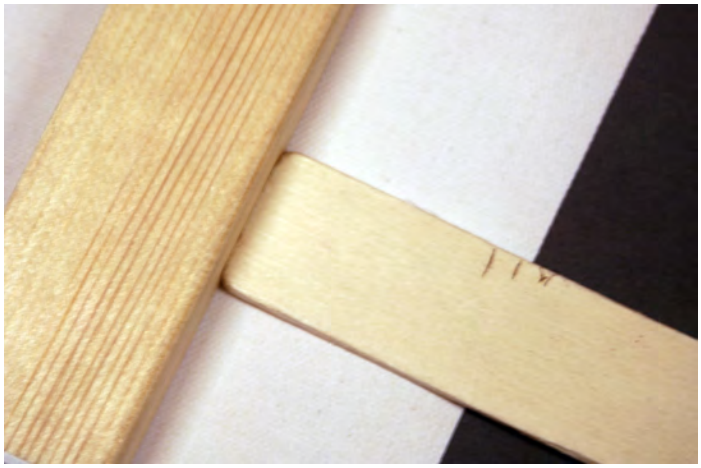


16 X 16 giclée centered on a 20 X 20 canvas. The canvas lies on a larger piece of black Kraft paper.

The 2-inch borders of this giclée have rulers and 1 1/2 inches of Faux Wrap *border. The identification caption text can be seen in white.*



Lay the giclée face down on a piece of Kraft paper that is at least six inches larger. Center the assembled stretcher on the back of the giclée.



"Paint-stick ruler" is easy to see when centering stretcher on giclée.

Tack down three sides (top, bottom, right) in their centers. These staples will soon be removed so set them in on an angle, leaving an edge to grab with fine-nose pliers (detail below).

"Tack" staple is shot on angle for easy removal.

Use 1/4-inch staples as deeper ones are harder to remove. *Arrow's* front-oriented *PowerShot* gun is easier to use than the traditional type. Of course, power tools are nice but not needed.

Double check now that your orientation of stretcher to canvas is correct. Double check that up is up for both. From now on, backward steps are painful.

Stretch and staple down the left side working out from the center, one staple per inch. Staple spacing is why the rulers are there.

Use only moderate force wrapping the canvas around this first side, but be firm. You'll see uneven stretching if you pull too hard. It's important that this side goes down straight and even. Don't try to pull it too tightly because it is only single-tacked on the three other sides. Those three tack staples were put in to give you "just enough" anchoring to staple down the fourth side. Getting this first side down straight is your goal.

Fine-nose pliers with curved tips make staple removal easier.

The opposite (right) side is next. Pull out the tack staple on the right side. Stretch the canvas with some added pressure and apply the first staple dead center.

Some people use special gripping tools, but I use my thumbs to do the work. If you do a lot of stretching, you'll want to invest in a stretching *machine.* (You'll need to do a lot of stretching to pay for it.)

A note of warning to those who stretch a lot of canvas: I have developed occasional problems with thumb splits possibly caused by prolonged contact with varnish while stretching canvases over a period of six years. The skin just splits and the wound is slow to heal. Be careful.

Using your thumbs as I do, there's a limit to how much pressure you can exert, and that's probably "just enough". If it isn't enough it will be obvious because the canvas won't be tight.

What is tight?

Your thumbs can't match a stretching tool or machine, which can stretch giclées almost as tight as a drum skin. However, I find the stretching tool awkward and don't do enough to justify the costs of a machine (yet).

My advice is that you get to be friends with the stretching tool if you're going to be doing a lot of stretching. If you stretch occasionally, thumbs will be OK... if you are strong enough. My wife would not be able to get a canvas tight enough using her thumbs and possibly you can't either.

Whether with your thumbs or a tool, work from the center out. Don't apply maximum force to the first few staples. Instead, build up the force rapidly reaching full force by the 5th staple.

Work back and forth left to right, one staple every inch. At the 7th staple, pull out the top and bottom tack staples using fine nosed pliers. (They are the ones to the left and right of the side you are working on, side two).

"Full force" does not mean "as hard as you can". It means that "moderate" is less forceful. The idea is to gradually increase the stretching pressure as you work outwards.

*Modified "*hospital corner*" folding. The upper flap folds* up and back *instead of down.*

With the left and right sides stapled down, fold a variation of "hospital corners".

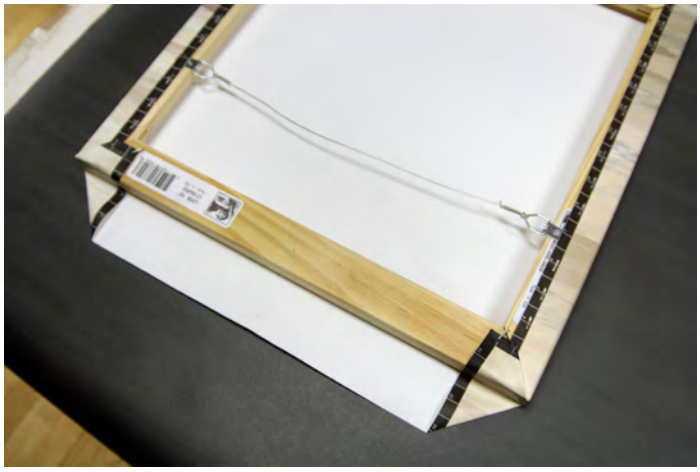
First step of "hospital corner" folding procedure.

Second step of "hospital corner" folding procedure – upper flap back and tacked.

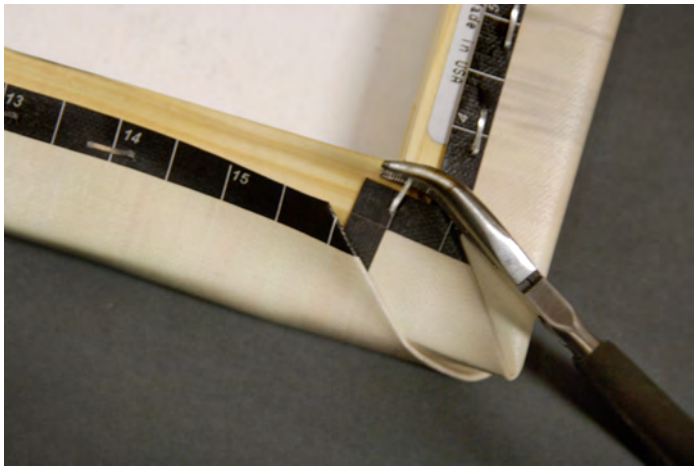
Using the modified hospital-corner folding technique, the upper-corner folds *up and back* instead of down. Tack it temporarily into position.

After getting the corners tacked, fold up and staple down that side, starting in the center and working out in the usual manner. Use moderate force on this third side. Save full force for the fourth side, where you will see how much "full" should be.

By the time you begin the fourth side you should already see that things are going well. If they aren't stop now and go fix what's wrong. Continuing will make things worse, I guarantee it. Assuming things are OK, use the force necessary to get the canvas as drum-like as you can. You may not be able to use it for your bongo practice, but that's OK if it looks nice and flat with no stretch marks.

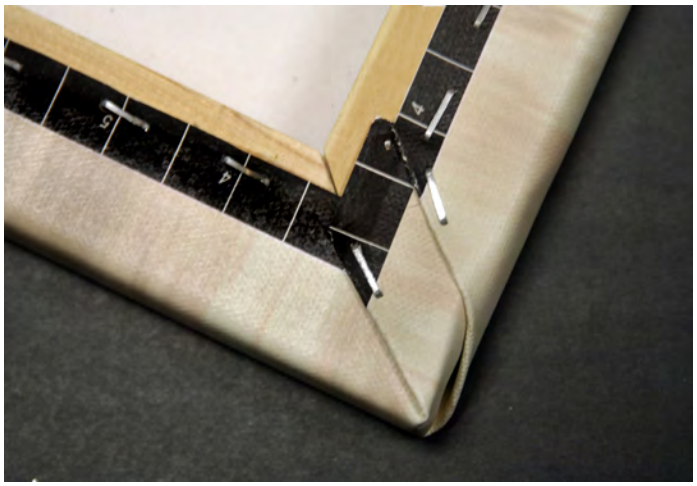


Ready to stretch top edge.



Remove corner tack staples when you are two inches away.

Two inches from the corner pull out the staples tacking the upper folds and finish the modified hospital corners. Pulled staples should be put into a little container and not left on the work surface where they can escape and become "rogues of ruin".



Modified "hospital corners" completed.

Some folks cut out wedges from the corners to avoid bulging. These make cleaner corners that are more squared, fitting into frames better.

Finish with pads on the bottom corners (or all four) to prevent any staples from scratching wall surfaces or table tops.

The larger the picture the more important it is to work from the center outwards. Going back and forth left to right and right to left gets boring, to be sure. Think Zen.

Going too far in any one-direction risks uneven pressures which will show up later. If stretch marks show up, you'll need to pull all the staples out of the offending side(s) and start over.

Removing staples is a chore. Stretchers made of softwood allow the staples to really sink deep and there's not enough edge to grasp with needle-nose pliers.

Those staples need to be dug out from under using a small, flat-head screwdriver. Push the flat head under the center of the staple and lever the staple upwards enough to grab it with the pliers. This procedure requiring a deft hand to avoid puncturing the canvas with the screwdriver, .

Hardwood stretchers can be infuriating for exactly the opposite reason… staples seem to bounce off instead of sinking in.

Those must be nailed down with a little hammer. To avoid surface marring during the nailing procedure, place the giclée on a piece of felt or thin, hard carpet.

Mounting on Boards

Canvas and paper giclée prints can be mounted on boards by dry mounting or by various brush-on and spray adhesives. The various natural and synthetic substrates we use at Vashon Island Imaging include:

- Art papers and card stocks of various types
- *Bainbridge* & *Strathmore* board
- Illustration board (acid free varieties)
- Mat board (acid-free varieties)
- *Foam core* board (Polystyrene foam inside Kraft paperboards)
- *Gator foam* board (like extra durable *Foamcore* board)
- *Sintra* PVC foam board (like super durable *Gator* board)
- *Masonite* (hard to avoid it bowing without framing)
- Teak & other hardwoods (luxurious)

Dry mounting is our favored bonding method and we use that technique on all thin mounting substrates.

Brush-on glues are impossible to get smooth but that can be used to advantage to create the look and feel of long-grain, rough-surface wood.

Spray adhesives are banned from the studio as they are too dangerous and because their dusty residue gets into everything, including your expensive giclée printing gear.

3-M Repositionable Mounting Tissue is an excellent though very expensive alternative to dry mounting. It is especially good for mounting very large sizes that don't fit in the dry-mounting hot press.

The instructions are quite specific about certain limitations in temperature range, and the jury is out about how long the bonds will hold using this finicky, fussy, fantastic stuff. We've had several 8-foot murals on the wall for a year with no problems so far despite temperatures as low as 40°F and as high as 100°F. That temperature range should have revealed any thermal expansion conflicts between the giclée, substrate and RMT. So, we are confident about this adhesive.

Dry Mounting Procedures

Dry mounting begins with making sure the work area is free of any potential hickeys, rogue staples, sawdust, etc. Brush it off, blow it, use a vacuum or all three. Anything that gets trapped between the giclée, mounting tissue and substrate will mar the surface. You can't be too clean or too careful.

Fans off? Windows closed?

On a work surface that facilitates cutting, roughly trim the giclée but leave at least one inch of extra border, to be trimmed off later.

Lay down a piece of Kraft paper slightly larger than the giclée. Lay the giclée face down, centered on the Kraft paper. Lay on a sheet of dry mount tissue that's slightly larger than the giclée.

Use a hot iron to tack the dry-mount tissue onto the giclée's backing in the border area of two corners. Make sure the tissue is lying flat with no buckling both before and after tacking. If there's any buckle at all start over with a new piece of mounting tissue.

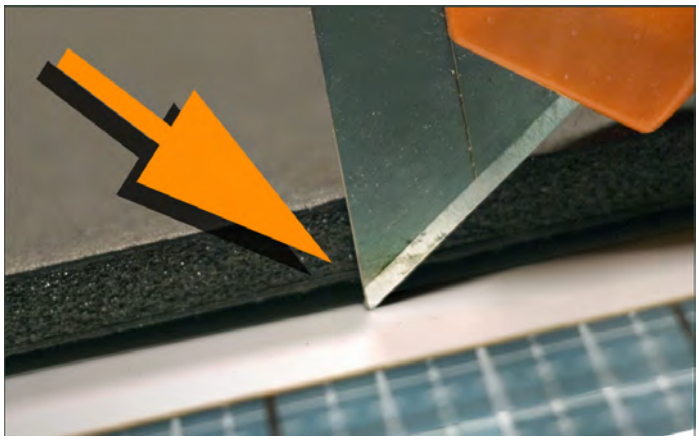
Turn over the giclée so it is face up. Pull the Kraft paper from under the giclée and lay it on top, exposing only the edges to be trimmed.

Use a steel T-square or straight edge and trim off the excess borders from the giclée-and-tissue "sandwich" using a very sharp utility knife or box cutter. The cheap disposable type with a "snap-off" blade work well. There's no excuse for a dull blade when you use that type. The blade must be super sharp. The cutting surface type depends on what's in the "sandwich" being trimmed.

Cutting Surfaces

- *Plexiglas*, plate glass and polished stone are the surfaces of choice for very fine blade work on thin giclée substrates like single weight papers, transparency films, light weight art papers, vellums and the like.
- Polystyrene cutting boards are good for general purpose trimming of heavy art papers, canvases, illustration boards and *Foamcore*. You can get them at art supply stores but if you need really big ones go to a plastics supplier.
- *Gator board* requires considerable pressure to cut through. If you use a hard surface like glass, *Plexiglas* or polystyrene you will damage or break the blade. Instead you need something with both thickness and softness. *Foamcore* covered with illustration board provides firm support and a soft surface that cutting blades can penetrate (intentionally). Use a double thickness of 1/2-inch-think *Foamcore* (or four layers of 1/4-inch) surfaced with illustration board. The illustration board disintegrates from all the cross cutting, but that's OK you just replace it when necessary. This is what I use.
- *Masonite* is excellent and like illustration board eventually the surface disintegrates from all the cross cuts, requiring replacement.
- Wood and plywood is too resistant to the blade and also disintegrates. (Exception is butcher-block.)
- Carpet is OK if it is flat and tight. However, it will make fluff and stuff that can float around in the air and screw up your coatings. It is not easily swept or blown clean.

The giclée is made slightly larger than the pre-cut backing. The slight overhang is trimmed as a last step after the giclée has come out of the mounting press.



Use the utility knife blade against the (hard) mounting substrate, which acts, as it's own steel straight edge.

Don't use aluminum or plastic straight edges for trimming. Your blade will eventually cut into them instead of against them, damaging the straight edge and possibly you.

After trimming off excess borders, position the giclée tissue-side down onto the mounting substrate.

Tack one corner with the hot iron using plain paper over the giclée to protect its surface. Tack an additional corner, making sure the print is not buckling. Bean bags are a great way to keep the giclée lying flat.

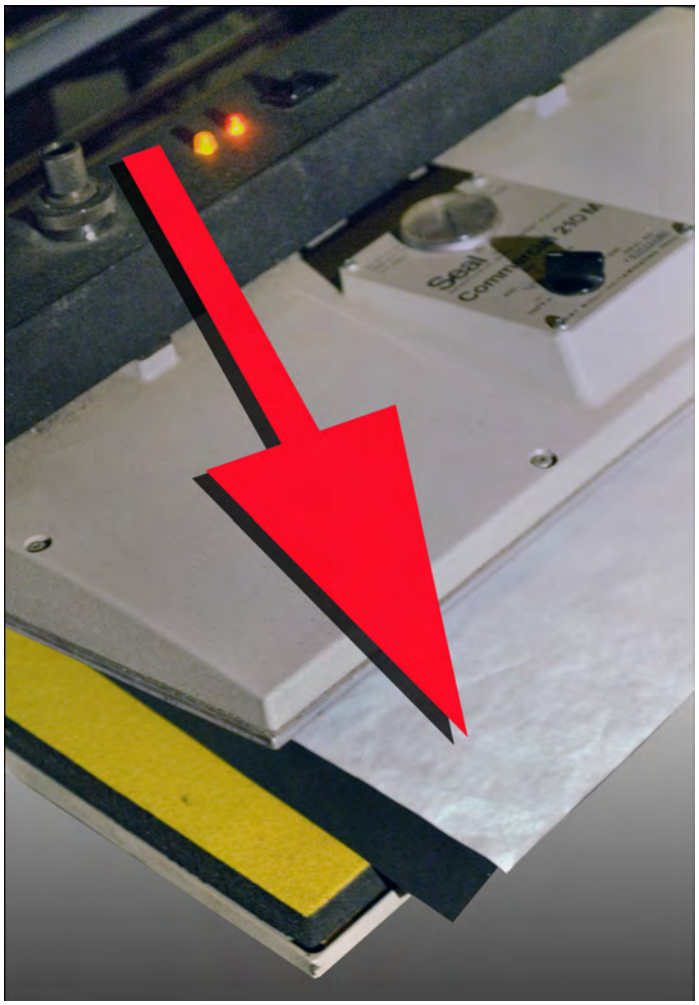
If the tacking iron is too hot, this is what happens to a "plastic paper". The ground emulsion blisters off the substrate. That this burn's shape resembles a frowning face is purely coincidental.

Place the covered giclée and mount board into the hot press for the recommended time, usually one-minute.

Most dry mount tissues call for a hot press temperature of about 210°-220° Fahrenheit. Even at that temperature, *Foamcore* and some other soft substrates will "slump" and continue slumping as the temperature rises. What started out 1/4-inch thick could end up 1/8-inch.

Substrates that deform cannot be used for mounting pictures larger than the hot press platen. You'll end up with indentations at the edges of the mounting press platen. The platen edges show because softening and deformation is not uniform. Sectional mounting requires a substrate dense enough to resist slumping and heat-related compression. Or you can try a heavier cover sheet but then you have to cook the sandwich a lot longer.

Avoid any flexing when removing the hot giclée from the press. Use a "peel" made anything flat and light, like corrugated board or *Foamcore*.



Before putting the giclee-tissue "sandwich" into the dry mounting press, place a cover sheet of Kraft paper over the top surface. If another kind of paper is used as a cover sheet, make sure it isn't coated and that it isn't made of something that will melt under heat. Test, test, test.

Slide the mounted giclée out of the press and onto the peel. Let it cool on the peel for few minutes. Even when cool and hardened, dry-mount tissue can let go if the mounted giclée is flexed too much.

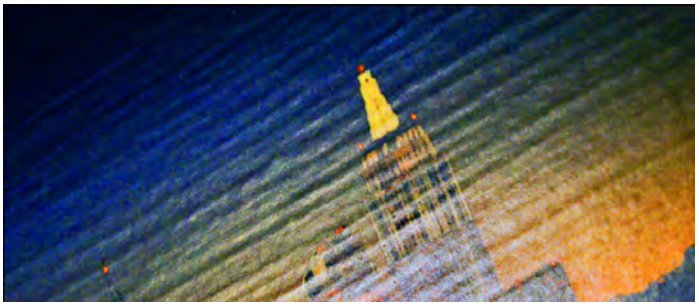
If the platen of the mounting press or the paper covering the giclée in the press have anything on them, marks will be pressed into the surface of the giclée.

Keep a source of compressed air nearby and blow out everything, every time.

Things To Consider

- Canvas should be dry-mounted before coating.
- Pebbly and rough-surface s do not dry mount well.
- Ultra-smooth surfaces don't work well either. Masonite and *Plexiglas*, for example, should be roughed up with steel wool or light sandpaper.
- Clean the surface thoroughly of any detritus.

Sunset Strip *features wood grain surface texture enhancing both the giclée and the 10-foot-wide teak-wood plank it is mounted on. The surface was coated with Varithane which dries with a yellowish cast that gives giclées an antique" look. (See texture detail below).*

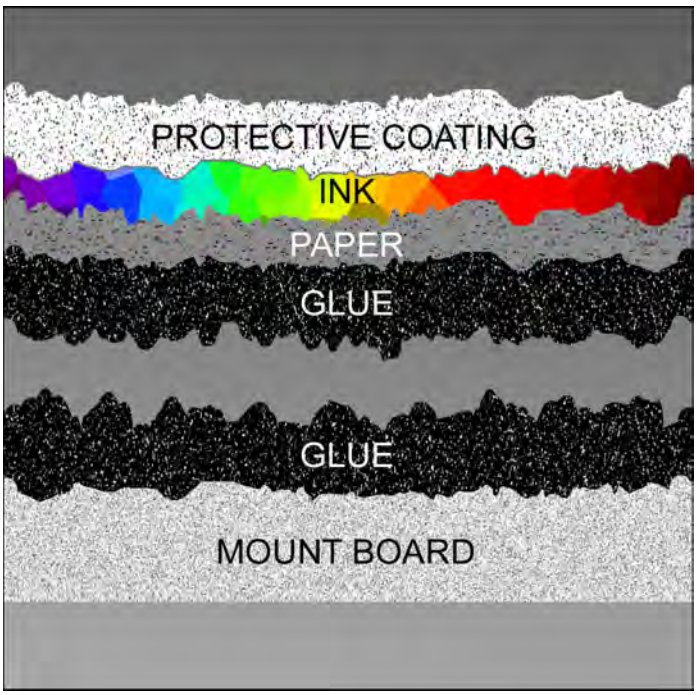


Detail of Sunset Strip *panorama (above) shows a wood-grain texture made with l-o-n-g brush strokeswith* LePage Contact Cement. *The "faux grain" enhances the teak-wood board this giclée is mounted on.*

Brush-on and Roll-on Adhesives

Getting a smooth surface using brush-on and roll-on adhesives is nigh on impossible. Don't even try.

The problem is that adhesives don't "level" very well. If you put down a drop it stays a drop, maybe a droopy drop but still a drop.



The high points of glue collide and make lumps in the surface texture. This makes brush and roll-on contact cements difficult if not impossible to use for a smooth surface.

If viewed in cross-section, brush and roller strokes have profiles of varying thickness. The "hills and valleys" in the profile of the wet glue don't level out completely and an uneven surface is the result.

Combine that with the fact that both the giclée and substrate are normally coated, and you have a doubly uneven combination that makes a lumpy surface.

This disadvantage can be turned to advantage. You can create streaks and other patterns. Use stiff brushes, "rakes" or roller(s) to create surface textures that can enhance the presentation of appropriate giclées.

A favorite technique at Vashon Island Imaging is to use a stiff brush to streak the glue on both the substrate and giclée to create a faux wood grain surface texture. Combined with mounting on a plank of fine wood, like teak, and a coating of yellowish Varithane, the look is perfect for Polynesian environments like *Trader Vic's.*

RMT -- Worth The Effort and Expense

Repositionable Mounting Tissue (a *3-M* product) is about the only way to easily mount large giclées, without benefit of roller presses and expensive bonding machines.

A big bonus for RMT is that it can be used with *Foamcore*, which a hot press deforms.

Working with RMT is tricky and fussy. Practice on small giclées that are disposable because this material takes some getting used to.

First, it sticks to anything and is like a gooey web. Little balls of the stuff form easily and have to be removed. When you try to pick them off, they stretche like little rubber bands and snap back onto the RMT surface. Yuk.

As you start to roll it out, getting a good start is imperative. If you get off to a bad start, quit while you are ahead and start over. Remove RMT with a runner cement pick-up.

RMT is an adhesive film clinging to a non-stick backing material. You burnish it down onto the backing side of the giclée. The success of this burnishing determines your fate later, so do a good job. There are many types of burnishing tools available. The best have a slight curve on a long edge that allows you to bear down without the risk of a corner digging in and leaving an indentation marks on the surface.

A variety of burnishing tools. The one on the right is the most used and valued for its ultra-smooth rounded edges. Good burnishing tools allow you to apply firm pressure without tearing into the RMT backing paper.

After the RMT is burnished onto the giclée roll it up loosely adhesive-side out. Don't roll it too tight or the backing will start to separate from the adhesive. Now the fun begins. The curl direction needed for the adhesive side to be out is the opposite of what you would want it to be, making it harder to "see where you are going".

Lay a slip-sheet made of the non-adhesive RMT backing material over the mount board leaving *only one inch* of the exposed giclée adhesive in contact with the mount board. Position the leading edge of the giclée roll over the exposed 1-inch strip of mount board and burnish it down. An extra set of hands comes in handy, as do marble bags.

Two *slip sheets protect giclée during RMT mounting procedure. The black slip sheet protects the surface of the giclée from the burnishing tool. The beige slip sheet is a piece of RMT backing material to which the exposed RMT adhesive won't stick.*

Slide away the slip sheet slowly to reveal one more inch of mount board and continue burnishing. Watch to make sure the adhesive is releasing from the giclée correctly, that none is left behind. If some is stuck, use toothpicks and tweezers to pull it away. Its tricky and that is why your success burnishing the first edge determines your fate.

The top surface of the giclée should be covered with a second slip sheet of Kraft paper. Burnish lightly. At this stage you are "tacking" it down. Especially at the beginning, you want to be able to reposition it if need be.

(After the *entire* print has been lightly burnished on, *then* go back over it, burnishing harder.)

Slowly reveal and burnish, inch by inch. Easy does it. Never expose more than three inches of adhesive and even that much is risky. It takes a l-o-n-g time to do a big print… but your patience will be rewarded. Any little balls or strings of the RMT that go rogue have to be removed at the risk of them making a lumpy surface. Extra hands help.

After completing the rollout with light burnishing, lay the non-stick-backing sheet on top of the Kraft paper sheet covering the giclée. Be *absolutely* sure there is no RMT on the backing sheet. If there is, just rub it off with your fingers or use a rubber cement pick-up.

The RMT backing sheet makes an ideal surface to burnish, being slick and non-stick. Using that slick cover sheet, burnish down *hard* being careful to see that your burnishing tool isn't leaving any pressure marks on the surface of the giclée. This precaution is absolutely necessary if you are burnishing onto a soft substrate like *Foamcore* board. The burnishing tool you use is all important. Try to find one that looks like the beige one on the right in the picture above. You can make yourself special sizes and shapes using strips of 1/4-inch Plexiglas with a heavily bevelled & polished edge.

Displaying Giclée Prints

Selective Vision

People's eyes scan pictures, picking out key points. When you see a face you first look at the eyes then the mouth and nose, then onwards to other parts. Most people don't look at all parts. They scan past parts that are unimportant to them. Nobody ever sees a picture as completely, except perhaps the artists themselves (and their agents).

Lighting is an excellent way to highlight key points in pictures. Having slightly brighter light in the most important part of the picture will add dimension and lead the viewers eyes to the key points in the giclée.

Display Lighting

Artificial lights come in a variety of colors.

Daylight (5500 ° Kelvin) is the standard for art galleries, as well as the printing, photographic and film industries. Other light temperatures (colors) will affect how the dynamic tone range of a giclée is perceived. Light colors other than daylight make the colors in the picture look different. The balance between the colors and their interrelationships is also affected by the type of light illuminating the giclée.

Tungsten (3400 ° Kelvin) light will favor warm tones, as the light color is redder than daylight. Blues, cyans and other cool tones will appear darker and dirtier (more gray, less saturated). Red and warm tones will pop.

Fluorescent lighting should be avoided, unless it is the (expensive) type used for photo, film and video lighting. No fluorescent lighting is full spectrum. The colors dropped by the fluorescent source will cause the drop out of the complementary tones in the giclée image.

Lighting should be carefully aimed to avoid unwanted reflections. The best lighting for a gallery type display is a dome-shaped skylight or a "glowing" ceiling that is actually like a giant light box facing downwards. Although technically the best for seeing the full dynamic tone range of a giclée, such light is boring from the standpoint of interior design. Lighting design is an entire industry, as you are probably well aware.

Most people like to spotlight their artwork. *Solux* makes the best lamps for such purpose. The Kelvin temperature of *Solux* lights is 4900 °K. Although daylight is 5500°K the *Solux* lights have the full spectrum needed to make all colors visible in the giclée. They are also appropriate for photography when real daylight is not available. Set the camera for daylight if a Kelvin setting is not available.

Have *slightly* brighter light in the most important part of the picture. It will add dimension and help the viewer see the key point(s). In a portrait that area is the eye, nose and lips; and in a sunset it is the sun.

When spotlighting is used, the diameter of the spot should be sufficient to evenly illuminate the entire giclée (unless another effect is desired). Second and third spots can add emphasis to certain areas of the picture.

Using color gels and/or mixing tungsten and daylight illumination can create special effects. Day-to-night transitions are two favorite lighting tricks. One is done with dimmers and the other with mixed lighting.

Dimmer Magic

As lights dim they get redder. Using dimmers to control the intensity of tungsten lights, the relationship of colors in a giclée will favor red tones as the light dims. This can boost the drama of a sunset scene.

Programmed lighting that gets dimmer over an extended time period can enhance the realism of the sunset in the picture. The effect is further enhanced if a double-dimmer lighting system is used, one dimmer with daylight lamps and another for tungsten (or gelled) lights.

UV and LED Lighting

UV (ultraviolet) lights can provide a realistic night effect. Only certain media will respond to UV light, those with a high cotton-fiber content. *Epson Enhanced Matte Paper* (now called *Ultra Premium Presentation Paper - Matte*) provides excellent UV light reflectivity, which benefits night scenes considerably.

As UV lights require darkness to be perceived, they won't show much effect during the day. But as day turns to night, they will begin to shine with all their UV glory. Combining programmed tungsten lights that dim into UV is a very dramatic combination.

LED lights are becoming very popular because of their low-electrical requirements. Although cheap to operate, you get what you pay for in terms of their spectrum. LED lights are not full spectrum, they are blue spectrum. Their Kelvin temperature ranges from 8000° to 10,000° or more. That is the same color light as you find in areas shadowed from the sun, or on very cloudy days. The colors in a giclée will not appear correct. Reds and greens will suffer.

Metamerism

Sometimes aberrations occur. Colors that look right under one kind of illumination look different under another. Or, two light sources, made up of different mixtures of various wavelengths, may appear to be the same color. This effect is called metamerism. Older giclées suffer from this problem more as newer inks have largely solve the problem. Dye-based inks are more susceptible to metamerism than pigment-based inks. If you encounter the problem all you can do is change to lighting to what works.

Light boxes

Light boxes featuring giclées printed on transparent or translucent films present artists with attention getting and captivating ways to display images.

A "wash" of tungsten light from a light-strip illuminates the entire picture. An ultraviolet (UV) black light enhances the night qualities of the giclée's right half. Orange-gelled tungsten spotlight illuminates the sunset portion of this giclée bringing out red tones. Dimmers are used to get the right balance between the three sources.

Backlit Transparencies

Backlit transparencies have always been a favorite of sign-makers and advertisers. Stroll through any airport or station and you will see light-box displays of backlit transparencies everywhere. The quality of the imagery in these displays can be excellent, making the technique a good one for fine arts as well as commercial arts.

Until the era of giclée printing began, *Kodak Duratrans* material was used, and still is. *Duratrans* is a photographic material, like giant slide film. It has a translucent backing to diffuse backlighting and reduce "hot-spotting". Now, it is possible to get similar results by using the giclée printing process.

Light-box construction is a relatively easy affair. The biggest part of the investment is in the *Plexiglas* diffusion material backing the film giclée.

The greater the distance between the lights and diffusion material, the more even the light across the surface will be. It's a balancing act because you don't usually want the light box to be too deep. Thin-profile light boxes are more desirable, and more expensive to buy or build.

Using a double thickness of diffusion material (with spacing) will provide more even light with thinner profiles. The double thickness of diffusion material soaks up a lot of light.

Light boxes that we build at Vashon Island Imaging have two kinds of lighting in them: daylight-balanced fluorescent tubes as well as "white" LED lights. The LED's provide a low level "night-light" mode that uses virtually no electricity. Note that LED lights are not full spectrum. Colors look "off".

Density in the blacks (called "dmax") can be an issue when making giclées for light boxes. The inks used by many printers don't have sufficient density and dark tones suffer. One solution is to double-up two giclées in a sandwich between the two sheets of *Plexiglas*.

8-foot high lightbox art makes a dramatic impression day or night. The dynamic color range of backlit pictures is stronger and more saturated.

Day-to-night transition of lightbox art. These lightboxes have two sets of lights. Normal mode is bright fluorescent light (top and middle). A second set of "white" LEDs (which are actually a light shade of blue) provides low-level lighting. We market this mode as "Nite Lites", together with giclées printed on UVM (ultraviolet-light-sensitive media).

Density masking can also help build contrast and dmax. A density mask is a high-contrast positive printed on another sheet of backlit-transparency material and made part of the "sandwich", lying under the picture to add density only in the blacks and dark tones. More on density masks can be found in the *Appendix*.)

Taj Reflections

Taj Reflections *shines extra bright under UV light which brings out the night qualities of the scene. Many of my illustrations printed as* "Nite Lites" *that are lightbox and/or UV art.*

Douglas Mesney
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Temple Towers

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Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

APPENDIX

Douglas Mesney Art Vancouver, B.C., Canada

English Bay Fireworks
© Douglas Mesney 2006-2010

Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

APPENDIX

The Devil Is In The Details.

Following now is more detailed information about a few subjects that may be of interest. Although the links of these subjects to prepress may seem obscure at times, they all come to bear on the why's and wherefore's of the craft behind the art of giclée.

Everyone's path to understanding is different. Enlightenment can spring from undercurrents. Sometimes coming to terms with the fundamental theories of things can help with the day-to-day *detalia.*

What could be a more appropriate way to begin shedding light on these subjects than a discussion of the theories and practice of light and exposure measurement?

Exposure Measurement

One of our services at Vashon Island Imaging is artwork copying. There are a lot of artists on this Island and some of them are starting to release limited editions instead of single originals. There's nothing like an original, but these days fewer people can afford them.

Step Six in *Section Two* discusses the basic procedures for copying artwork. What follows here is a more detailed discussion of how to approach exposure measurement.

Fortunately, the light meters of most cameras are accurate and good quality pictures result. But what is going on behind the scenes? How is the measurement made? The answer to that question also reveals some common problems with the pictures made by many capture devices.

Light meters per se are a thing of the past for most professionals, now that everything is automatic exposure. However, whether built-in or external, light meters are necessary to determine the exposure required for a device to able to record an image. Is there enough light energy? How much is enough?

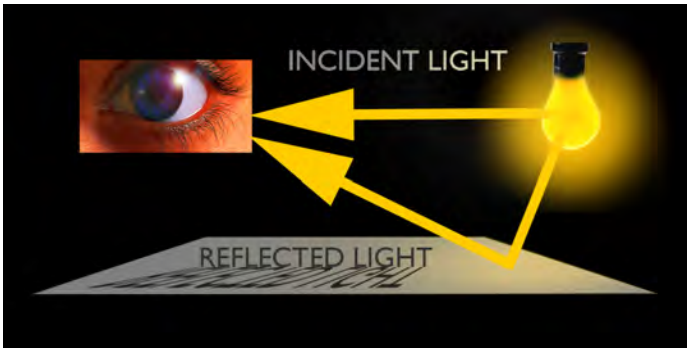
Some devices are more sensitive to light than others. Light sensitivity can also be adjusted in most cameras. (Film is also made in different "speeds" with greater or lesser light sensitivity.)

Whatever the sensitivity, if the amount of light hitting the sensor (or film) isn't correct, the result is under-exposed (too dark) or over-exposed (too light).

Exposures are correct when the device captures the maximum dynamic tone range. The total number of tones decreases with under- and over-exposure. The more tones, the wider (and better) the dynamic tone range.

The capture of any image is therefore an exercise in matching the tone range of the subject with the tone range of the recording device. Whether you do it or your camera does, the light in the scene must be measured and the correct exposure determined based on standard values. Gray cards provide such a standard.

18% Gray Cards are used to obtain an average exposure for Mid-Tones. They also establish the point of color neutrality.

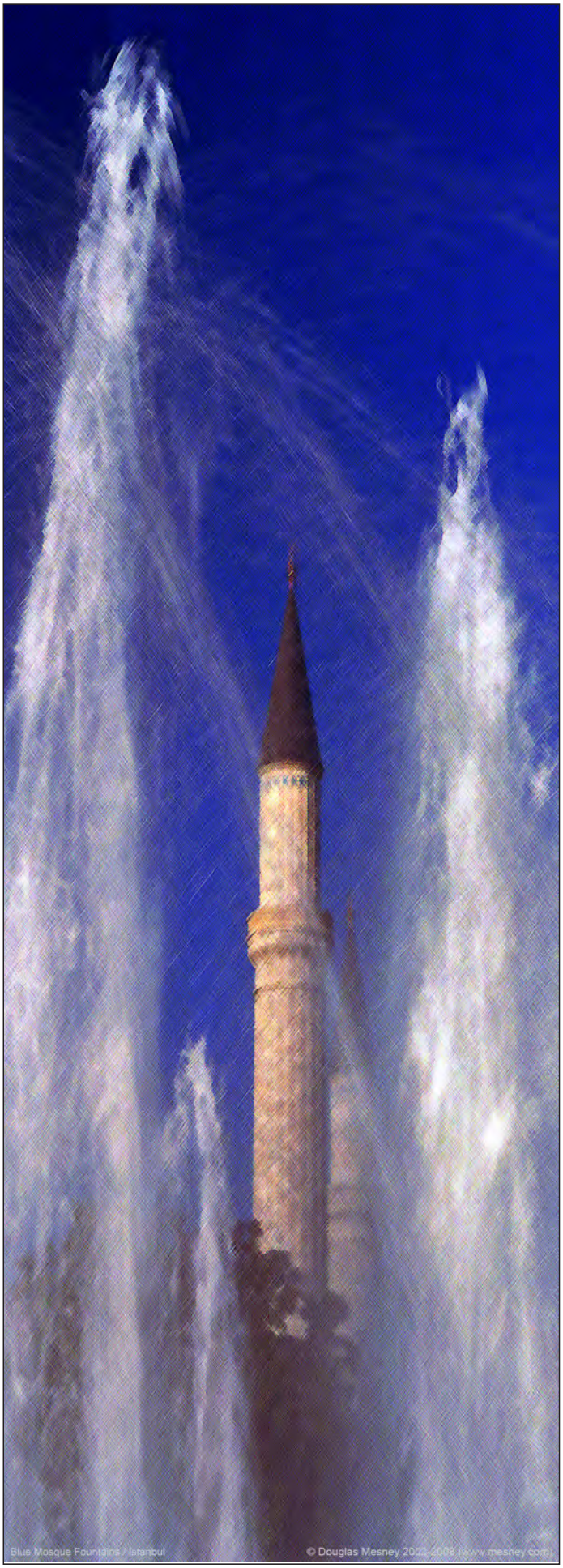


Emitted light comes from a source and reflects off the gray card.

There are two ways of measuring light and therefore two kinds of light meters, one for *incident* and the other for *reflected* light. Some light meters (and cameras) can do both, but not at the same time.

There are two types of light meters. One kind of light meter measures emitted light, called an "incident light" reading. The other kind measures the bounce light and that is called a "reflected light" measurement. Both ways provide measurements for mid tones, specifically 18% gray.

Using the exposure given, a photograph of a gray card will look exactly like the gray card… same hue, saturation, brightness and contrast.


Blue Mosque Fountains / Istanbul
© Douglas Mesney 2002-2008 (www.mesney.com)

Incredible
Images
Happy
Holidays
Light Christmas
© Douglas Mesney 2004-2010

Including a piece of Gray Card in a picture when it is captured will allow you to snap to the right colors by sampling the gray swatch with the neutral sampling tool in Curves.

Incident light meters have dome-like diffusers that gather a hemisphere's worth of light and mix it up to obtain an average measurement.

The job of the light metering system is to permit you to successfully capture and reproduce 18% gray. It will try to make anything you point it at like itself, gray.

What if you point it at a white shirt?

It will try to make it gray.

What if you shoot a black tuxedo?

It will try to make it gray.

Using an incident light meter, you point it at the source light. Using a reflected light meter, let the source light fall on the card then aim the meter at the card and measure the light reflecting off it.

If you have no gray card, there may be something in the scene that will work as well. Look for something that looks like a gray card… a dark gray suit or the pavement of the road come to mind. Zoom in on that and measure the exposure in that area. The light meter reading can be used to calculate the white, black and mid-tone points, according to the sensitivity of the film or capture device.

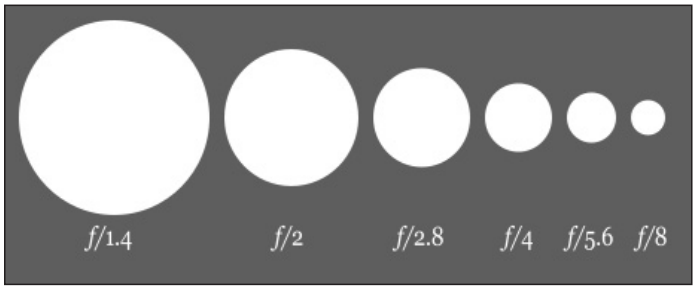
The range from black point to white point is referred to as "*latitude*". More shades of gray between the black and white points means you have a wider latitude.

f/1, f/1.2, f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22, f/32, f/64, f/128

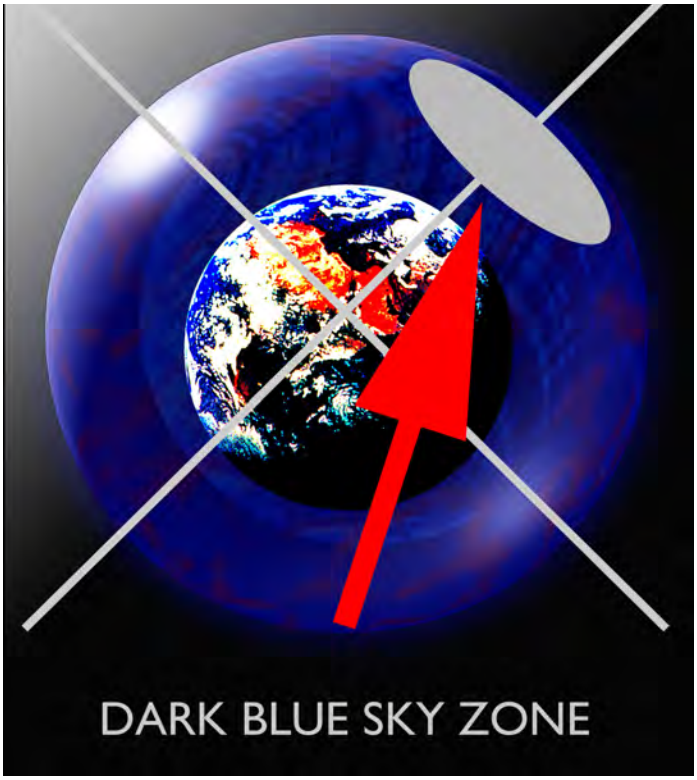
The average latitude of a camera is about seven *f-stops* (we'll call them just "stops"). For example, if the bottom of the range (black) starts at f/2 the white point will be at f/22, a difference of seven stops.

f/1, f/1.2, f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22, f/32, f/64, f/128

This Gossen Lunasix *light meter from the 1960's has a slider that allows the user to switch between reflected light and incident light.*



The diaphragm in a camera lens controls the amount of light passing through the lens. As they get larger, each f-stop allows twice as much light. As they get smaller, every f-stop cuts the light in half. Shutter speeds function the same way, allowing half or twice as much light.



On a sunny day, you can get an approximate gray card value if you find the darkest part of the blue sky. It will be in the zones that at right angles to the direction of the sun. Face the sun, look to your left or right, half way between the horizon and the zenith.

Changing the exposure moves the seven-stop range to the right or left across the scale.

To capture highlight detail in a bright scene you might move the scale to the right. Dimly lit scenes would need the range to be moved to the left.

All imaging devices have limited range. Anything outside the range is lost. The latitude of films and cameras is almost always exceeded by reality.

When a scene is at or near the recording limits of the capture device, extra precision is needed to determine the correct exposure. Instead of calculating from the mid point out, you calculate from the end points -- the black point and white point.

"Spot meters" are used to make precise measurement of specific points in a scene. You can find the black point and white point of scenes, and exposure for any mid-tone in between. Spot meters measure only a tiny part of the scene, as little as 1° in some cases. Good cameras usually have a spot-metering capability built-in.

Black point and white point measurement will yield the correct exposure for highlights (light tones), mid tones, and shadows (dark tones).

To demonstrate, if the black point is at f/2, and if the sensitivity range of the capture device or film is seven f-stops, then the white point will be at f/22, and the mid-tone called 18% gray will be at or near f/5.6.

Hollywood lighting directors use fill-light to bring dark tones within the sensitivity range of their cameras. That is called "light balancing".

The best sequence for determining an exposure is to find the white point exposure first and from that calculate where the black point should be. If the white point is f/22 and you are using film with a latitude of five f-stops, then the black point is at f/4. Anything that measures lower than f/4 will be black.

Many cameras have built in flashes that can be used for fill light, so that shadows are lightened and details are retained in the dark tones.

If balancing with fill light isn't an option you can use a double exposure technique by which two different exposures are combined into one.

To use the double-exposure technique it helps to have the camera on a tripod and a subject that sits still. Take one exposure favoring the light tones and another for the dark tones. Take even more if you like.

Shooting in extreme lighting conditions, like into a setting sun, you might want to bracket by a half-dozen exposures or more. In PhotoShop put each exposure on a separate layer and combine the best parts of each by erasing through one to reveal the other. Combine the best light tones with the best dark ones. Experiment with the blending options for the layer(s) by switching the settings between normal, lighten and darken.

Programmed cameras (and some output devices) handle exposure even more accurately, by comparing the subject with a memory bank containing thousands of pictures. If it "recognizes" your kind of picture, the exposure will be known.

If no reference picture in its memory bank matches yours, then it will measure the scene like any other incident- or reflected light-meter. Those measurements will be averaged with a bias for the mid tones. That mid-tone bias will cause the light and dark tones suffer to some extent.

The simplest thing is to remember that the light meter is trying to make things gray. It the subject is light, open up the exposure and if it is dark then close-down the f-stop from what the meter recommends.

The mission is to match the dynamic tone range of the scene with the tone range of the device recording it. Once recorded, the dynamic tone range of the picture is truncated to fit into the film or camera's "*color space*".

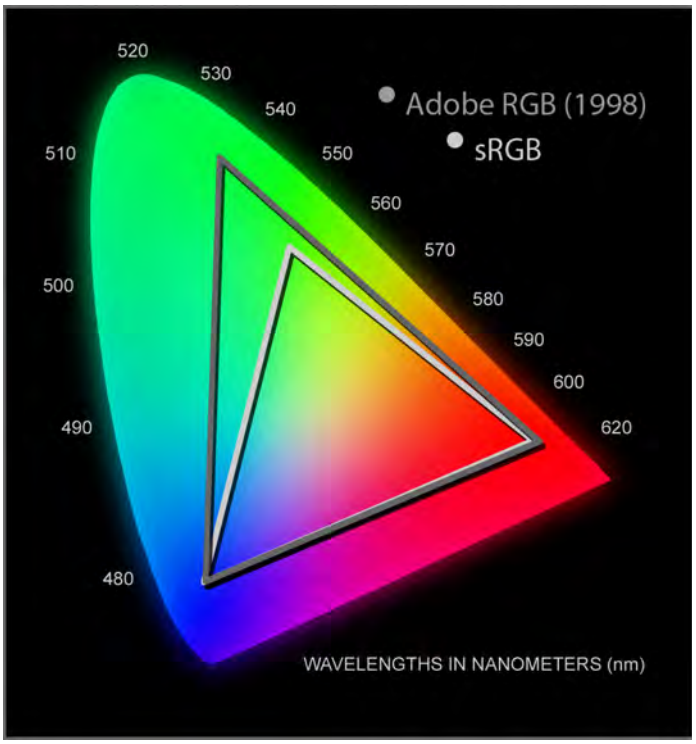
Color Spaces Are "Procrustean Beds"

Procrustes is a mythological innkeeper. His inn has only one size bed. The guests are made to fit the bed. Their legs are chopped off if they are too long, or stretched if they are too short. And so it goes with color spaces.

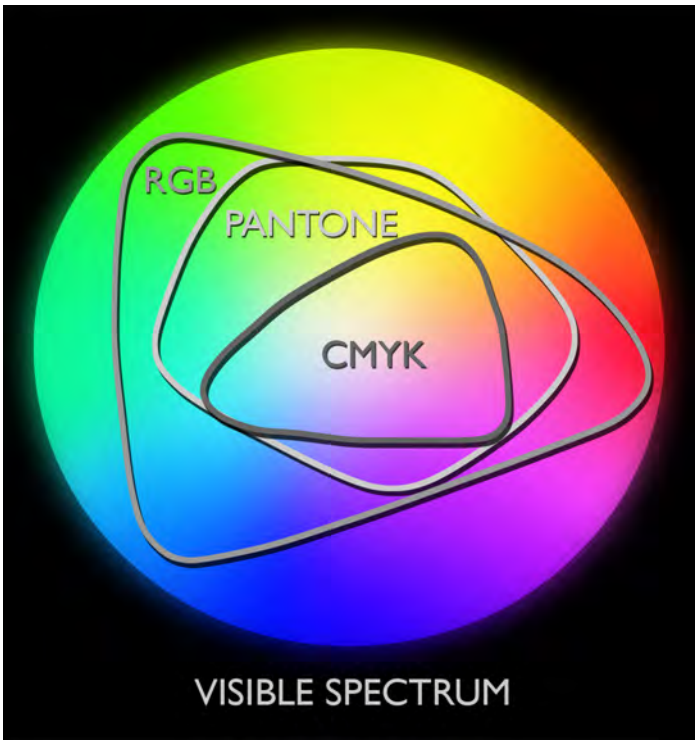
Color spaces are like warehouse spaces, some are bigger than others. Bigger color spaces hold more colors.

As color spaces enlarge the number of tones increases. Primaries are blended to become a range of tones that theoretically extends infinitely from white to black, the limits of the visible range. The eye can see infinitely more than any device. Different devices

"see" or produce only portions of the visible light spectrum. Likewise, PhotoShop color spaces like Adobe RGB (1998) and sRGB can only show portions of the visible spectrum.



Comparison of gamuts shows why images made in sRGB have more saturated colors and appear more contrasty than the same images made and displayed in a larger gamut like Adobe 1998.

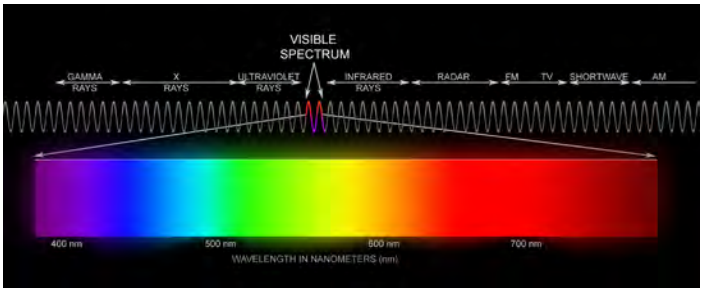


Color spaces are also referred to as "gamuts". Color gamuts for CMYK are much smaller than the RGB color space. Pantone colors, though a wider gamut than CMYK, are still less than RGB.

Colors don't photograph the way they look because of the restrictions and characteristics of the capture device color space. If the color you are shooting (or scanning) doesn't exist in the capture device's color space, it will use the closest color it has available.

Colors sometimes appear *very* different. The more primary the color is, the more a light meter is "fooled". Recall that a light meter is "looking" for averages, like gray. Whatever is sampled, the exposure calculation will aim for the mid-tone (18%-gray value equivalent).

Colors are not created equal. Blue and red light have more energy and exposure power than green light, for example.



The visible spectrum is a small part of a much larger energy spectrum. Blue and Red extend well beyond the visible spectrum becoming ultraviolet and infrared. Green is kind of trapped in the middle, girdled by the other two. Not surprisingly then, green light is less powerful than red or blue. Red light is much more powerful than green and blue is the most powerful. That means each color needs a different exposure.

Close-ups of red flowers show color definition problems. Individual petals meld into one another for lack of edge definition and tone differentiation. There are not enough different shades of red to see details.

Pointing a light meter at green trees will render an exposure that will be under-exposed. Red measurement will result in slight over-exposure and blue in under-exposure.

A picture of a red bird in a green tree against a blue sky cannot be correct for all three colors. Usually it is the green that suffers.

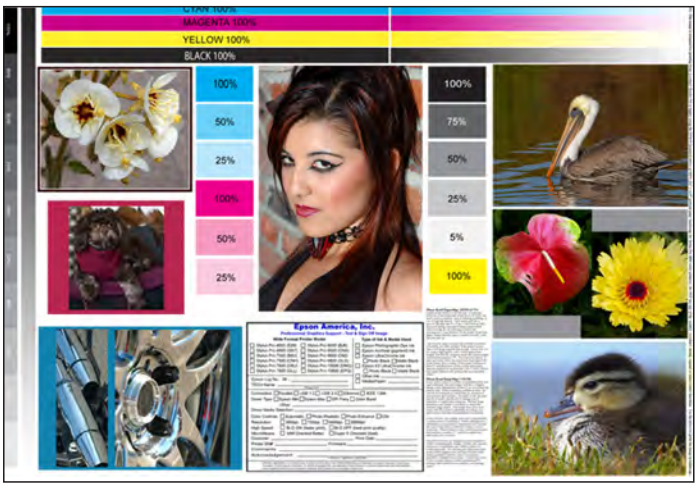
Capture devices and media also have problems recording pure primary colors. Most of the problems occur at the ends of the spectrum, differentiating between red and blue tones. Reds have always been a nemesis, since the days of film.

The same problems extend into output. Different printing methods and display techniques have problem colors that can't accurately produce. Printing color problems are usually more with dark tones and over-inking. Monitor and projection problems are more frequently with light tones because as displays age, their source lights dim resulting in less brilliance and lackluster highlights.

There are two ways to fix the problem: change the color, or change the exposure… maybe both. Usually, it's just a question of knowing the deviance from the norm. That is, if the device is capturing that red -2 stops (darker) than the original, then an exposure of +2-stops should fix that. Or, if a giclée print is off by 11 points of blue in the light tones, it's a quick fix using Image > Adjust > Color Balance.

However, it just might be that the particular color can't be made from the inks being used. In that case the colors in the original are outside the gamut of the printing process. The gamut of giclée printing is far greater than any other printing process, so almost any CMYK dynamic tone range can be printed.

Test Charts



Epson Test Chart for giclée printing machines.

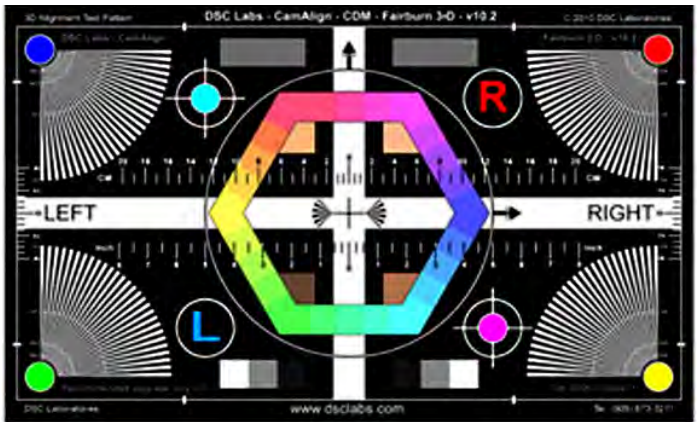
A good way to see the limitations of your giclée printer with specific media is to print a test pattern or test chart. Epson test patterns serve us well at Vashon Island Imaging. They are more concerned with color than resolution because with giclée printing machines there is so much resolution that, compared to traditional printing processes line resolution ceases to be an issue.

You can put together your own test charts pretty easily. Just follow these parameters from the Epson chart (above):

- The color bars on top are solid on the left and graduate from pure to white on the right.
- Percentages of cyan, magenta and black are shown, but not yellow (strange).
- A variety of pictures show how the machine is handling uue, saturation and contrast.
- Fine print reveals any resolution difficulties.
- Space is provided to record pertinent data about the test, for example the media type.

In the film and video industry, a standard color chart like the one that follows is included in "head frames". The head frames are later used for color management of copies and displays (monitors or projectors). They are also handy for giclée printers as well.

AV test charts can be used by giclée printers as well to measure color tone reproduction as well as resolving power, Black Point, White Point and Mid Tone gray values. Any tints will be immediately seen in the grays, which should be neutral.

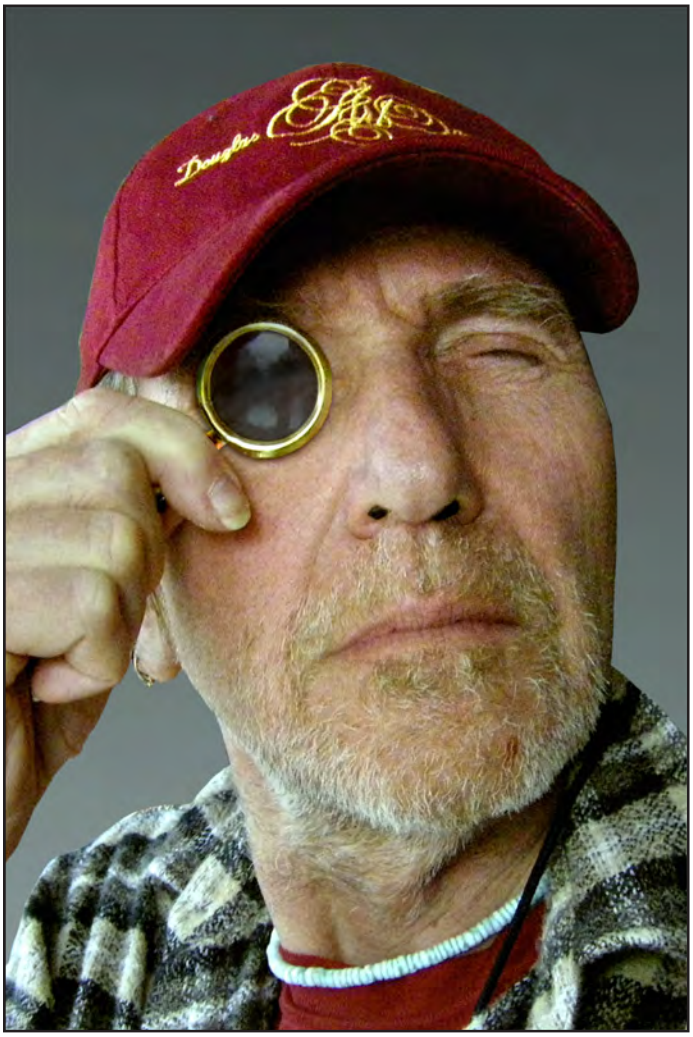


Video and film color test chart by DSC Laboratories.

Through the Looking Glass

You can train your eyes to look at a scene and see where the problems are. Keep the dynamic tone range in mind and remember you can't have it all. Pay the most attention to the dark zones.

Hollywood lighting directors use special viewing filters to observe scenes and determine where fill-light is needed to expose the details in shadow areas and other dark zones.



The author himself peering through a viewing glass. Using this technique provides a reason to buy those expensive designer sunglasses.

Viewing filters can be used to preview dark-tone problems. They are dark gray glass. Neutral density filters can be used.
The purpose of a viewing filter is to limit the eyes' perception to the latitude of the capture device, generally in the 7-stop range. Viewing through the filter makes it difficult to see into the shadows, which is the point.

While viewing a scene through the filter, direct fill-light into the dark tones until their details can be discerned. If you don't have a viewing filter you can squint your eyes or use dark sunglasses.

This is a quick way to balance the lighting in three-dimensional scenes. It does not replace more precise measurements with light meters. However viewing filters are useful as a means of quickly sorting out dark-tone lighting problems.

The amount of fill light used is a matter of taste. Some prefer deep shadows of "available light" photography while others prefer the "open" shadows of studio lighting. Whichever look you like, the latitude of the capture device or media determine the light levels needed to achieve it.

In the same way, some prefer strong and saturated colors while others prefer a more pastel look. Those are personal preferences which are especially important to the prepress artist who can (and should) interpret the 'look' the client wants and then do all possible to achieve it in the giclée print.

With film-based photography, it is the ability of the darkroom printer that determines the quality of the finished picture. Hollywood films are also "printed" and their equivalent to a darkroom wizard is called a "*Color Timer*".

Ansel Adams' dramatic black-and-white photographs result from complex printing procedures involving burning and dodging. Without those adjustments, the pictures would look more ordinary. So involved is the printing of Adam's pictures that only a few master darkroom printers are allowed to do so. And so it goes with giclée printing. Prepress work can develop an ordinary looking picture into an extraordinary one.

Prepress is a "black art" because so much is interpretive. It's like cooking. Style plays an important part. Different prepress artists will handle a given picture in different ways. That's what gives individual prepress artists' work unique styles.

That is not to say that all pictures need prepress. If the original digital image files were created by artists experienced in PhotoShop and printing (or display), there may be no problems to fix at all.

Algorithms Aren't Created Equal

Many camera manufacturers have their own proprietary software to "develop" pictures taken with their cameras. An OEM's image-processing algorithms will work best on shots taken with its brand(s) of camera. That is true whether the camera saved the image as a RAW file or a JPEG.

For example, I use Nikon gear and my pictures will look better if I first open the files in Nikon software (called "*Capture*"), and then pass them on to PhotoShop.

The work flow should be to first prepare the image using the camera's or scanner's software, make as many adjustments as possible, *then* bring it into PhotoShop.

Do as much work as you can in the device's proprietary software. The result will be better than starting in PhotoShop and worth the extra steps and time.

By the time the image gets to PhotoShop it should be as near perfect as possible. PhotoShop should be used for fine tuning and to prepare the file for the giclée printing machine (or other output device).

Quality digital cameras offer the choice of working with color depths of either 16 bits or 8 bits *per color channel.* The result is either a 48 or 24 bit color.

24 bit produces "*True Color*" which is adequate. There is really no pressing need for more.

Doubling that to 48 bit does produce many more rare tones, but file sizes will be *four times* bigger and image processing four times slower. While it is nice to have as many tones as possible, do you need them? Will you be able to see them? Probably not.

Monitors for Prepress

Whether you choose an LCD or a CRT (Cathode Ray Tube) monitor is a matter of choice. However, an LCD doesn't show as many colors as a CRT so if perfect color is your goal the choice is obvious. Moreover, LCD displays show banding problems where none may actually exist. As a result you may find yourself wasting time trying to fix things that aren't broken, but look like they are.

LCD Displays

LCD displays frequently use dithered 18-bit color.* This limited color gamut achieves faster transition times because the file sizes are smaller so there is less retrieval time required and fewer colors speed video processing (needed by motion graphics and video games). * 64 × 64 × 64 = 262,144.

"*Truecolor*" produces over 16.7 million distinct colors**. That is calculated by using 8 bits to represent red, 8 bits to represent blue and 8 bits to represent green, which equals 256 levels for *each* of these three colors. ** 256 × 256 × 256 = 16,777,216.

256 levels are why colors in PhotoShop are measured in brightness (whiteness) from 0 to 255. "0" (zero) is the 256th number and represents black.

Thus, 255 represents white and 0 represents black. All other numbers between 0 and 255 are shades of gray or *values of brightness.* For example, you might have red with a brightness value of 222. That color is red that has been blended with white. With a value below the midpoint*** the red is blended with black. The *"purity"* of a color is measured by the amount of white or black it has been blended with. *** 256 / 2 = 128

"*32-bit color*" is generally a misnomer referring to 24-bit color images with an additional eight bits of non-color data (for example, transparency), or sometimes even just plain old 24 bit data.

High-end graphics workstation systems sometimes use up to six colors instead of the usual three. Red, green and blue primary-color channels are augmented with cyan, magenta and yellow

(secondary colors). With 8 bits are used per color, such six-color images have a color depth of 48 bits. These displays have the widest color gamut, making a wider dynamic tone range visible. Remember, you can't work on something you can't see.

Giclée printing machines also extend their gamut by using more than just the primary colors. Epson machines currently use 8 colors. In addition to CMYK there are two shades of light gray as well as light cyan and light magenta. These extra colors generate thousands more rare tones. The rare tones add richness and depth to the prints, which would otherwise look more contrasty.

The differences between 16 bits and 8 bits are very hard to see. So are the differences between giclées printed at 1440 instead of 2880. Most people probably wouldn't even see the difference between 720 and 2880, either. However, ink usage is considerably greater at the higher numbers where thousands of more rare tones are involved.

Recreating the Look of The Past

Old pictures have a look that easily distinguishes them from modern ones produced digitally. The look resulted from the limitations of photomechanical reproduction tools, materials and chemistry.

Using traditional photomechanical reproduction methods (film, paper and chemicals), every generation or step involves tone loss in the form of increased contrast. The contrast build-up reduces the dynamic tone range. More contrast gives old photographs a "snappy" look (pardon the pun, I couldn't resist).

Forty-step gray scale.

After one photomechanical copy there are fewer grays tones.

Even fewer gray tones are left in the second copy.

The contrast build-up can be seen if we photograph a gray scale with traditional film and then print it onto photo paper. The reproduction will have fewer tones. The white and black ends of the scale have started to encroach into the lightest and darkest mid tones and there is more contrast as a result.

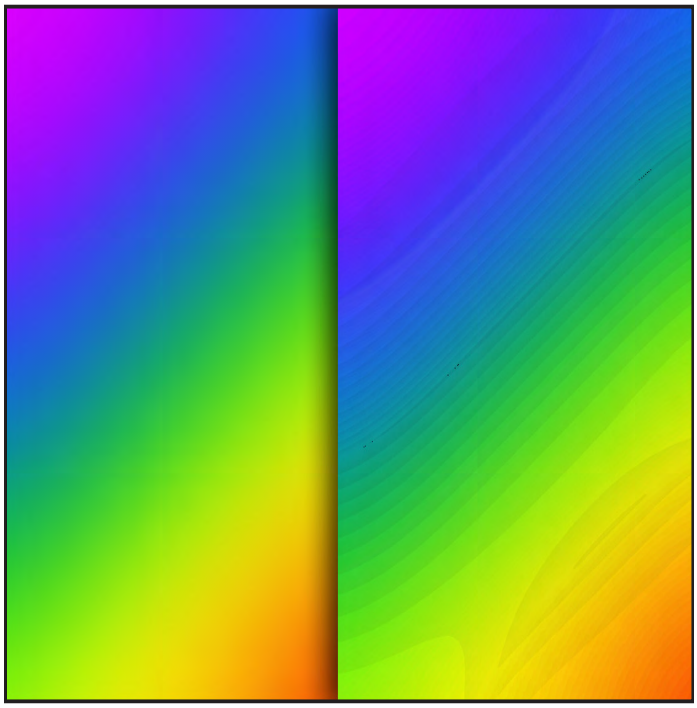
Repeating the process (re-photographing the first copy print) results in even fewer mid-tone values. After a few more repetitions you are left with only black and white.

The same thing happens with colors. Contrast build-up *saturates* the colors because as mid-tones are removed the purity increases. Eventually, as the colors get closer to primaries, pictures take on a posterized look, which is technically referred to as "banding". If you see banding it is either because your monitor can't show the colors or because your color space is too small.

Although contrast build-up doesn't occur when copying digital files digitally, it still happens whenever there is a photomechanical step, when light passes through an optical system, like a camera or scanner.

For example, if I copied a giclée with a digital camera or scanner, then printed the result to a new giclée, the second giclée would have a more limited range of tones.

Light passing through an optical system is partly to blame, producing distortions of edge sharpness and contrast. Another part of it has to do with the recording capability of the digital light sensors in the capture system. Still another is that the image will be processed by another set of algorithms trying to "normalize".



The rainbow on the right shows "banding" (also known as "posterization") as a result of being in a smaller color space with a narrower dynamic tone range. This type of banding is what you see on LCD monitors when they cannot reproduce the colors specified.

If you know that the print you are making will be photo-mechanically copied again with a camera or scanner, the dynamic tone range should be adjusted to flatten the contrast. Since copying builds contrast, the print to be copied should be low in contrast and 'flat' or 'dull' looking compared to a print with a full dynamic tone range.

Giclée prints are generally made for exhibition, not photomechanical reproduction. Most often, with giclée printing people are after the richest range of tones possible. That means deep blacks and darks tones as well as light ones that you can see into, and highlights that aren't just white.

To recreate the look of old color pictures, contrast and saturation will be the key adjustments. Old black-and-white prints have fewer mid tones than today's.

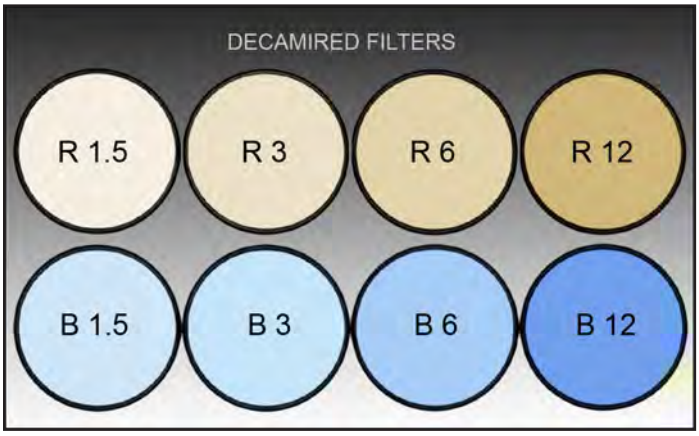
To recreate the look of a faded photograph or picture, contrast should be reduced and the black point moved into the dark gray zone. Reduce blue to simulate fading. The blue goes first in old photos and last in old posters.

Balancing Light Color

Sunrise and sunset light is redder than noon light, and noon light is bluer than sunset and sunrise light. As the sun arcs across the sky the Kelvin temperature of its light changes from being around 2900 at sunrise, to 5500 degrees at noon, back to 2900 at sunset.

If your capture media is not set for the correct light color, the colors in the picture will be 'off.' That is why photographers use light balancing filters to 'correct' the light back to either of the 5500 (daylight) or 3400-degree (tungsten)light-color standards used by the film and TV industries.

There are three different filter systems used to balance light. They all do the same thing, warm up or cool down the light.



Decamired filters were the first type used to correct for the excessive warmth of morning and evening light and the excessive coolness of light on a cloudy day or in the shadows.

Light Balancing filters perform the same functions as decamired filters. The warm shades (that block excessive blue from overcast skies and shadowed north light) are 81A, 81B, 81C, 81D and 81EF. The cool tones (to block excessive red at sunset and sunrise) are 85A, 85B, 85C and 85D.

Europe's "KR/KB" color balancing filter system uses Mired values. Pinkish colored KR3, KR6, KR9, KR12 filters block excessive blue, and bluish KB3, KB6, KB9, and KB12 block excessive red.

Color Correction filters come in both RGB and CMY ("K" filters are shades of gray called "*Neutral Density*" filters). Each color comes in a range from CC05 (pastel) to CC100 (pure color).

Digital cameras have presets and programs which are algorithms that simulate the effects of light-balancing filters. The presets have names like "Outdoors" or "Indoors" or "Cloudy" or "Shadows". The presets correct for the average excessive blue or red in those kinds of scenes.

Creative Color

Beyond use for color "correction", filters and algorithms can be used creatively to alter and enhance the colors in pictures. If you like strong color, you can use filters and/or digital-camera presets to get more of the colors you want. You can shoot "day for night" or make sunsets and candle-lit scenes even more warm and wonderful.

If you want a sunset picture or a candlelight scene to look more orange, set the camera for 'Cloudy' or 'Shadow' or set the Kelvin temperture for a very high number (above 6000 degrees). By doing so you fool the camera into thinking the light is too blue, so it will add red/yellow to 'correct' the color.

Do the reverse to shoot "day for night". Tell the camera you are indoors, or set the Kelvin temperature for a low number (like 2000 to 3000 degrees). The camera will think the light is too red, and add blue to compensate. Underexposing slightly adds to the night effect.

"Tri-Color" (three-exposure) pictures create an interesting effect using primary color filters. The camera should be on a tripod for this trick. Make one exposure using a 47B filter, capturing only the blue component of the light. *Move the light source* and change to a 29R filter to capture red. Move the source light again and switch to a 61G green filter and move the source light again for the third exposure. The result will be off-color contours.

Shadows and highlights caused by contours in the object being shot will be filled with different secondary colors (cyan, magenta, yellow) while the main portions of the picture will look normal, having received even amounts of all three of the primary colors.

Automatic Light Balancing

High-end digital cameras have the capability to analyze light balance. Like an incident-light meter, the sensor is a translucent window that diffuses and 'averages' the total input of all light sources. This is especially useful because virtually every indoor scene is lit by a combination of many kinds of light, creating very odd combinations.

A room might be illuminated by daylight mixed with some combination of incandescent (tungsten) and fluorescent lights .This is a conundrum because compared to each other, daylight is blue, fluorescent light is green, and incandescent light is red. This situation can create a "cross." Crosses are tints of one color in the light tones and their complementary color in the dark tones. Correcting one worsens the other.

Magenta/Green crosses used to be common in *Kodachrome* slides, seen as pinkish clouds and shadows with a green cast. A cross of opposites like this cannot be easily fixed by traditional photomechanical methods. Magenta added to neutralize green further warms the clouds. Green added to neutralize magenta in the clouds beefs up the green cast in the dark tones.

Only by taking the picture apart and separating the light tones from the dark ones can individual corrections be made as needed to each. That is easy to do now with digital tools, but very difficult using traditional photo-mechanical tools and materials.

Even if there isn't a classical cross of opposites, odd combinations of source lights produce Kelvin temperatures and color tints for which there are no presets or filters. Instead, a combination of filters must be used that includes a light-balancing filter to correct the Kelvin temperature of the source light, and color-correction (CC) filters to remove any color tints. Tints result from a variety of sources like fluorescent lights, which lack specific wavelengths and are not full spectrum, as well as by light which has reflected off colored objects.

Color-temperature meters can be used to measure the color components of mixed source lights and find the necessary corrections. The light is sampled through a diffusion filter that blends all source lights together and averages the result. Corrections for Kelvin temperature are expressed in decamired and light-balancing filter values. Those for tints in expressed in CC (color correction) filtration values.

Digital cameras can automatically find the right correction by sampling the light through a built-in diffusion filter and applying algorithms based on a neutral point, like a gray card. Focus on a gray card to sample the light. Algorithms take care of the rest and get close to "normal" or "correct" color.

No matter what method is used to manage the color it always helps to include a gray card or something of neutral color value in the picture. Later, the "neutral eyedropper" tool in PhotoShop "curves" can be used to sample the gray or neutral-color swatch in the picture and restore colors close to "normal".

Fun with Filters

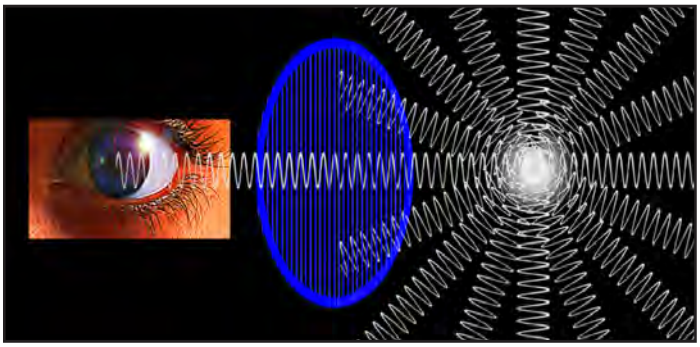
Photographers who shoot black-and-white can make the sky darker using yellow, orange and red filters. The greatest effect is with a 29R filter, which allows passage of pure red light only.

A related trick is to shoot with infrared light using an IR 'cut-off' filter. This is a tricky filter because you cannot see through it so you can't apply it to the lens without first composing the shot. That is why you normally only see infrared pictures of objects that don't move and which can be shot with the camera on a tripod.

(You can have digital cameras converted so that the CCD sensor is sensitive to IR light only which means that you need no filter and can see through the lens.)

You can't use a red filter on color film, however (unless you like red). To darken the sky and boost overall saturation when you are shooting in color use a "*polarizing*" filter.

Polarizers take away scatter and bounce-light. This is done by using two opposing 'grids' that only allow light waves with a like orientation to pass through. It's like slipping an envelope through a mail slot, or your hand through a picket fence. The grids are made of long-stand molecules that absorb light rays.



Polarizers block light waves with paths that collide with its long-chain molecules. The "stripes" of molecules create a "picket fence" that absorbs the light that hits it. Only light of one axis can slip through the pickets.

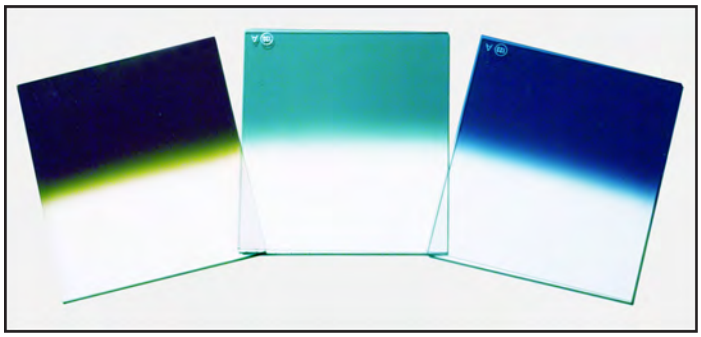
The term "*polarize*" refers to the *poles* of a compass or magnet. Electromagnetically charged particles will be attracted to one pole or another depending on whether they are positively or negatively charged.

In light the term relates to the direction of a light wave. Light from the sun or any emitted source is unpolarized and vibrating waves radiate out in all directions. When light reflects off a surface it is partially polarized according to the angle of the reflection.

Polarizing filters usually have two grids in crisscross arrangement. Rotating the filter adjusts which reflections are allowed through and which are blocked. Since the filter only stops polarized light, only reflections are removed. The net result is more saturated colors by the elimination of reflected scatter light.

Graduated Filters

Graduated filters provide another way to control the brightness and/or color of skies, oceans and other large areas of a picture. Although the effects of a graduated filter are easy to mimic in PhotoShop, the actual filters used over the lens when capturing the scene will have a dynamic effect rather than a linear one.



Shown above are three of a multitude of graduated filters (aka "grads") made by Cokin. *Although primarily intended for sky control these kinds of filters have plenty of other uses. Cokin filters are made of plastic, making them affordable. Glass grads made by* Tiffen Optical Company *are Hollywood's favorites, though they are very pricey.*

The difference between a dynamic and linear filter effect is like the difference that tinted glassses would make if you were looking at a real landscape or a printed picture of the same landscape.

In the real landscape, lit by the sun, the levels of contrast in the scene are much higher than those in the print. In life, the real colors in the scene absorb of reflect more than the printed colors on paper.

The greater the contrast, the greater the saturation. That means fewer mid tones. That, combined with the normal tendency of highlights to burn through and appear lighter, means that the tint will be seen more in the deep tones. On the other hand, the print will show the tint more in the highlights and mid tones because its contrast is lower. Which is better? That is up to you.

The Working Environment

The corner office may have a better view but it's not the best place for giclée prepress work because it is too bright.

Prepress work should be done in subdued light. If you like your

view as I do, use transparent "sun shield" over the windows. Your monitor should be the brightest light source in the room. Any other lights should not overpower the monitor. Neutral colored walls avoid any color interference (as does a plain gray monitor desktop).

A viewing area for artwork should be set up near the monitor. You should be able to glance back and forth between the pre-press monitor and originals (or giclées).

Illumination for the viewing area should be close to the same brightness as the nearby monitor. The pupils in your eyes should never have to contract or dilate for one or the other. The lighting should be even across the field of view, and the same color temperature as your monitor and both should be as close to 5500° Kelvin as possible ("Daylight").

Monitors

Monitors used in the viewing area should be profiled, as should your working monitor(s). Part of the profiling procedure involves setting the monitor brightness, contrast and color temperature.

CRT monitors have larger color spaces than LCDs and show more tones as a result. CRT monitors also allow more precise control of their overall color balance.

High-end monitors allow individual control of three RGB channels. Others have presets for a few different Kelvin temperatures. Common presets are 9300°, 6500° and 5000° (D50).

The factory default of PC monitors is frequently 9300°, which gives a bluish tint to everything. 9300° is often used for CAD work stations or in video games where maximum color contrast is desired.

Use 5000° for your setting, as it is the standard for photography. However, if your monitor shows whites as "dingy" or yellowish, a better choice might be 6500°K (or D65).

Most monitors reach useful brightness levels much more easily at 6500°K/D65 than at 5000°K/D50. Also, some monitors display reddish highlights at D50. Adjust monitor settings and decide which looks best.

Before making adjustments, make sure your monitor is warmed up and running for at least 15 minutes if it is a CRT.

You can make basic settings using Adobe Gamma or get professional profiling packages from a variety of suppliers like *Pantone* and *Gretag MacBeth*.

The most basic calibration tool is Adobe Gamma. The PhotoShop procedure is problematic because calibration by "eyeballing" is influenced by ambient lighting. If your work environment is set up as suggested above, ambient light should not be a problem.

If you have a LCD screen and your calibration system allows using the native white point, do so. This preserves the maximum possible color range on LCD monitors.

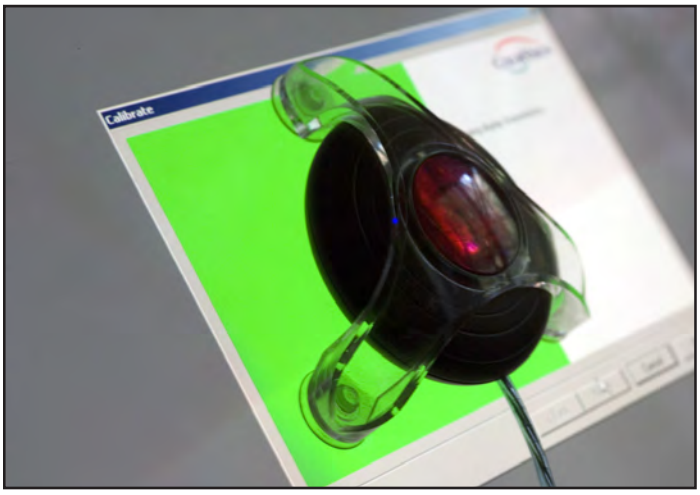
In Adobe Gamma, select the gamma to use. The traditional value for older black and white Macintosh CRT monitors is a gamma of 1.8. Today's CRT monitors have a native gamma of close to 2.2. Ideally, 2.2 is the monitor's native gamma.

Next, set the Brightness (black) and Contrast (white) levels to their optimum values. Start by setting the black to zero and the contrast to 100%.

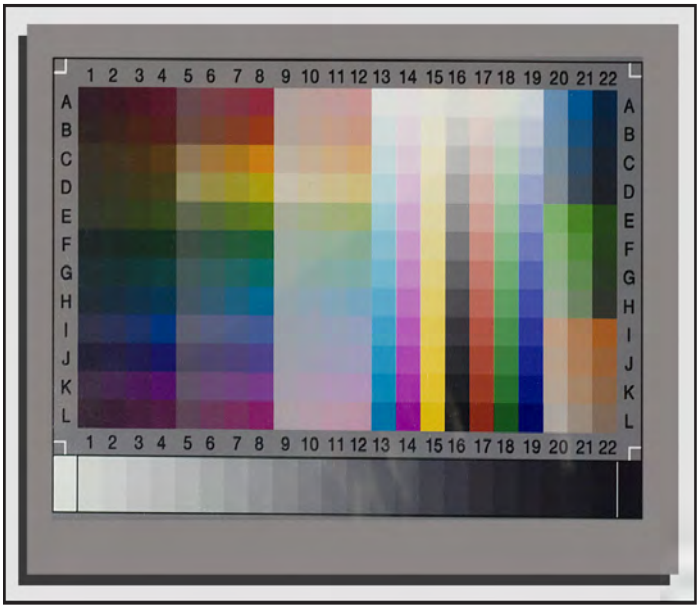
On CRT monitors, contrast at 100% usually gives the most possible colors. LCD monitors may need the contrast reduced slightly to avoid blowing out all fine details.

Brightness should be set so dark gray "almost" black is just barely distinguishable from pure black. If the brightness is set too low, shadow areas will appear too dark and you may over-lighten dark tones inadvertently while trying to make them look right. If the brightness is set too high, you may over-darken them to rid the washed out look. That is why the monitor has to be the brightest light in the room when calibration is done, and why too much ambient light in the work environment will show up in the dark tones of your giclée prints.

Neutralizing the white balance is next. The Red, Green, and Blue guns of a CRT monitor need to be balanced otherwise neutral tones will show a color cast.



Pantone Color "spyder" on CRT monitor during profiling.



Color calibration chart by Monaco Systems.

If you are using professional monitor profiling devices and software, you will be guided through the gun-balancing process with the assist of a "spyder" which is affixed to the monitor screen to measure the tones produced by the monitor.

The software will direct the monitor to display a variety of tones for the spyder to measure. The tones include the Black Point, White Point, a series of Neutral Grays and finally the primary colors, Red, Green and Blue in fixed steps from "pure" to pastel.

Calibration is the next step. Comparing the colors your monitor produces to a standard set of tones, each color is identified according to its official number. Open the Color Picker in PhotoShop (click either of the two color swatches on the Toolbar) and there you will find all of that kind of information.

Once profiled, a number representing a "known" color identifies each color tone in an image. The next device can use those numbers, which are embedded into the image as a "sidecar" file, to render the image on its monitor with the same colors used to make the image. The calibration information tags are called a Profile.

You can see which monitor profile PhotoShop is actually using by opening Edit / Color Settings. Expand the RGB working space list, and scroll up. You'll see a line with "Monitor RGB - xyz." The file listed instead of xyz is the profile PhotoShop is currently using. This is important to check. If the profiling software writes invalid profiles PhotoShop ignores them and displays images in a default color space that does not match your monitor.

Color swatches and calibration charts will help you "eyeball" monitor adjustments when a hardware method is not available.

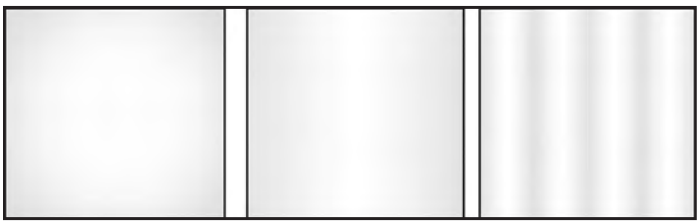
It is a good idea to re-calibrate and profile your display periodically because with use the colors eventually change. The frequency depends on how long your monitor stays on. Some say to re-profile every week or two.

Light Boxes

Light-box viewing should be available for slides and transparencies. Daylight-balanced light boxes are readily available but expensive. Using "unbalanced" light boxes can make it difficult to match the light color and intensity to the rest of the viewing area.

Gels for light balancing and color correction are available in sheets and rolls at professional photography suppliers and good camera stores. Use the gels to bring the florescent source lights to the "Daylight" standard used in the rest of the viewing area. Begin with 30M (magenta) and add more magenta and possibly some cyan as needed. Neutral density (gray) gels can lower the brightness of the light box, although making it brighter is usually the challenge.

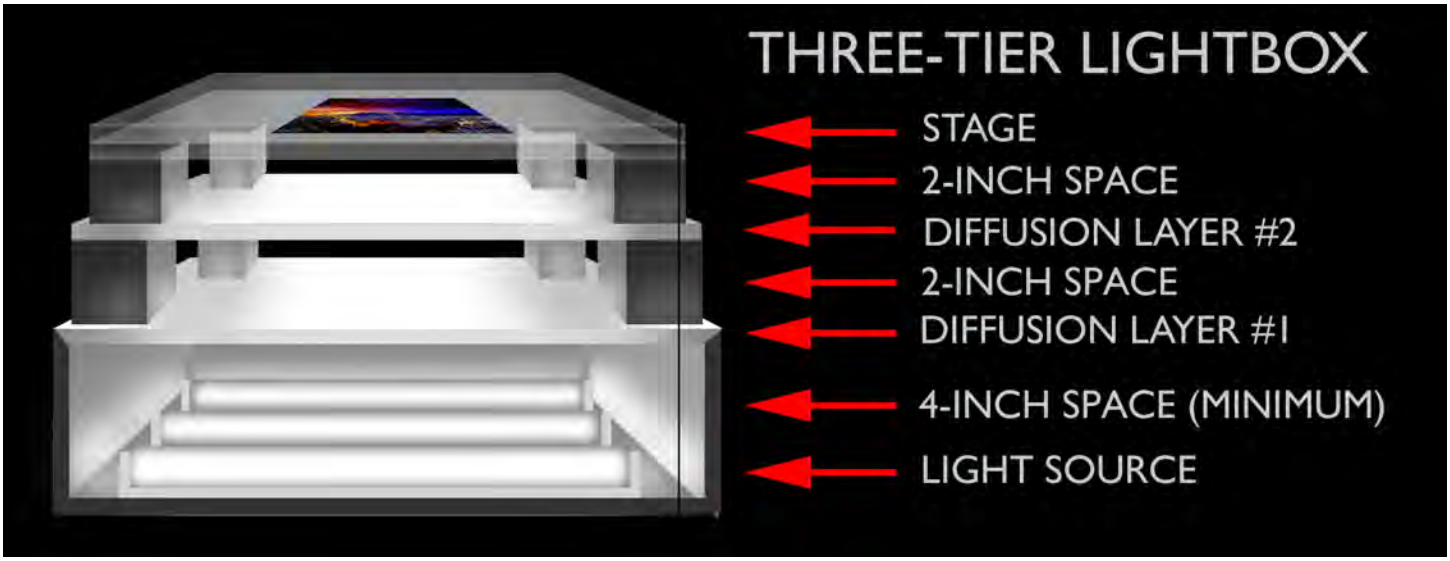
Light boxes are worth "tweaking". They can double as a backlit stage for copying transparencies and negatives. For an even better light box use *Gretag MacBeth* or *Solux* lighting, both of which are daylight balanced and bright. *Gretag MacBeth* makes complete viewing set-ups with match lighting throughout. They also supply metering and measuring instruments and everything else needed for color management in the work area. *Solux* lighting is favored for gallery lighting that is brilliant, daylight balanced (mostly) and relatively inexpensive.



Light box problems include "hot-spotting" (left) and "banding" (right). Positioning fluorescent tubes too close to the stage or using material that diffuses insufficiently create these problems.

The top, working surface of a light box is called the "stage". Plate glass stages are best. You can work with blades on plate glass and single-edge razors can be used to clean-up any residual tape adhesives, glues or clear nail polishes used to affix transparent artwork to the stage.

The three-level arrangement facilitates placing color correction and light-balancing gels well under the stage (if they are needed), on one of the two diffusion levels. Masks, flags and other light-controls can also be laid or affixed to either or both surfaces beneath the stage... as can special effects color gels, etceteras. On the uppermost stage, use strips of black paper to mask off all



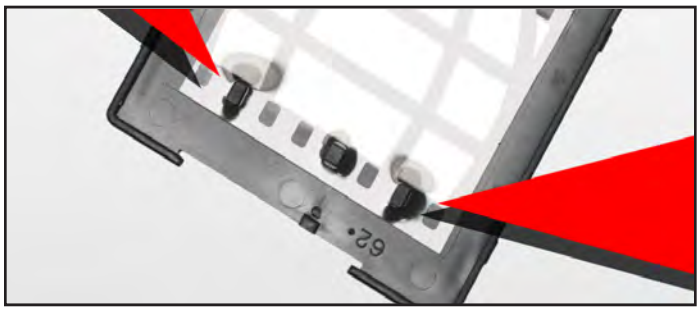
but the artwork being shot. There should be no stray light. If you are shooting a lot of the same size transparencies or negatives, tape a black-paper mask on the lowermost stage surface, under the art instead of over it.

Custom-made, open-top metal frame separates two layers of diffusion material by eight inches and provides firm support for plate-glass stage, shown here masked for a 35mm slide.

Pin registration systems can be useful for keeping things lined up, particularly when doing work involving multiple exposures. Equipment from multi-image slide show production is perfect and can be found occasionally on *eBay, Craigs List* and similar sites.

Wess mounts were made for multi-image slide shows and were first introduced in the 1970's. The design is ingenious with clips to hold film chips flat and registration pins for precise positioning of the film in the mount. There is enough space for up to four "chips" of 35mm film in each mount.

Wess *slide mounts have registration pins and full-frame apertures.*



Detail of registration pins on Wess *slide mounts. Up to three or four thickness of film can be placed on the pins making it possible to make precision copies of multi-layer slide sandwiches.*

This 35mm "compound stage" is extremely accurate with micrometer-grade X and Y movements with rotation. Equipment such as this is so much better than using tape or paper weights to hold your slides in place while copying them. Although hard to find these days, such vestiges of the multi-image slide show business can be found on the Web. Manufacturers to look for are Marron-Carrel, Forox, Double-M Industries, Sickles, Oxberry and Acme.

Protection In the Work Environment

If you wear glasses, have a separate pair that you use only for your computer. You can ask the optometrist to make you a set that focuses at your monitor viewing distance (mine is about 18 inches). Get these glasses made from glare-free glass, which is extra clear, and make sure they are always spotlessly clean. This is not just for the health of your eyes, but also because dirty glasses reduce the observed contrast, sometimes substantially. You might dial in too much contrast to compensate for that.

If you use a CRT monitor, use one that is large enough for you to sit well back. You'll still be bombarded with radiation, but it will be a little less like a sun lamp. These days I use an LCD monitor for as much work as possible but have a collection of old CRT monitors for critical color work. Once the color has been finalized using a CRT monitor, it doesn't really matter what you see on the LCD monitor as long as it is close to the original.

Platinum Printing

Platinum printing is making a comeback. You may be asked to prepare density masks for the artisans who tackle this troublesome but rewarding printing process.

Platinum and palladium prints are favored by art collectors for their wide dynamic tone range and archival qualities. It is like silver-based photographic processes but uses iron instead of silver. The process uses ferric oxalate in combination with the metallic iron salts. Red-brown "rusty" tones are developed in which "stain" watercolor-paper substrate.

After coating the paper with an emulsion of light-sensitive iron salts, the paper is contact printed with a negative and exposed to the sun (or a bright light) for several moments. The light burns a latent image into the emulsion.

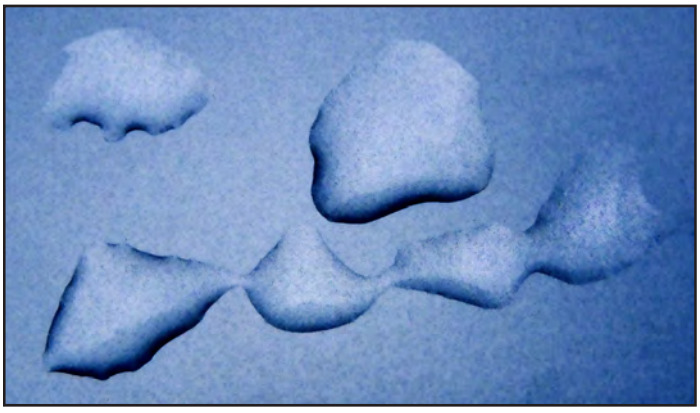
After exposure the print is developed in a solution that brings out the rusty tones in the latent image that the light burned in. Development amplifies that latent image and looks can be controlled by development time as well as exposure time.

The size of the negative limits the size of the print, as it is a contact-printing process. To print large sizes, photographers make enlarged negatives by making giclée prints on transparent or opalescent film.

Epson and others offer film products that can be used to make large negatives for platinum and palladium printing, as well as enlarged transparencies for backlit, light-box displays. Giclée on film produces the kind of large size illuminated signs you see in airports and train stations.

The key to a successful negative or positive is density. Blacks must be dense enough to resist show-through and fading. The Density of blacks is called the "*dmax*".

Low dmax is the most common problem with backlit transparencies. When light bleeds through thin blacks, they aren't black anymore, they are a shade of gray. The lack of density looks the same as moving the black point well into gray. If you did that to a picture and made a giclée on paper it would look lousy, too. Negatives for palladium and platinum printing need good dense blacks too… dense enough to face the sun!



Printing on acetate, polyester and other plastic films is a black art. Film has little or no absorbency. The surface of film is as water resistant as the hood of your car. Besides beading problems the drying time increases leaving the giclée in fragile condition for a long time.
Like water beading on a waxed car, water-based inks have nothing to "grab" and there is considerable risk of smearing before they dry. Drying can take a long time, too. The inks will likely still be wet as the giclée emerges from the printer.

Using a hair dryer can help. Try to get the ink dry before the fresh giclée passes under any rollers, risking roller marks. For a big giclée use a carpet-drying fan.

Films made specifically for giclee printing are available from Epson and others. However you may wish to use films that were not intended for printing but have no *"ground"*.

Grounds are coatings that absorb inks. Most giclée media have a ground applied to them. Some papers don't require a ground application for giclée printing, others do if they are too soft or too hard or impervious to water.

Applying grounds to film is not as far fetched as it sounds and is like spray painting. Instead of paint, you spray ground.

A certain minimum is needed to hold the inks onto the film, to give the inks something to grab onto. Added ground holds more ink, for greater density.

Although the ground itself will have a density of its own, and that density grows with the thickness of the ground, that is of no matter in the contact-printing process. However you will eventually reach a practical limit on the amount of ground that can be applied to a given type of film. If the ground and ink combination doesn't have sufficient density try making a "*density mask*".

Density Masks

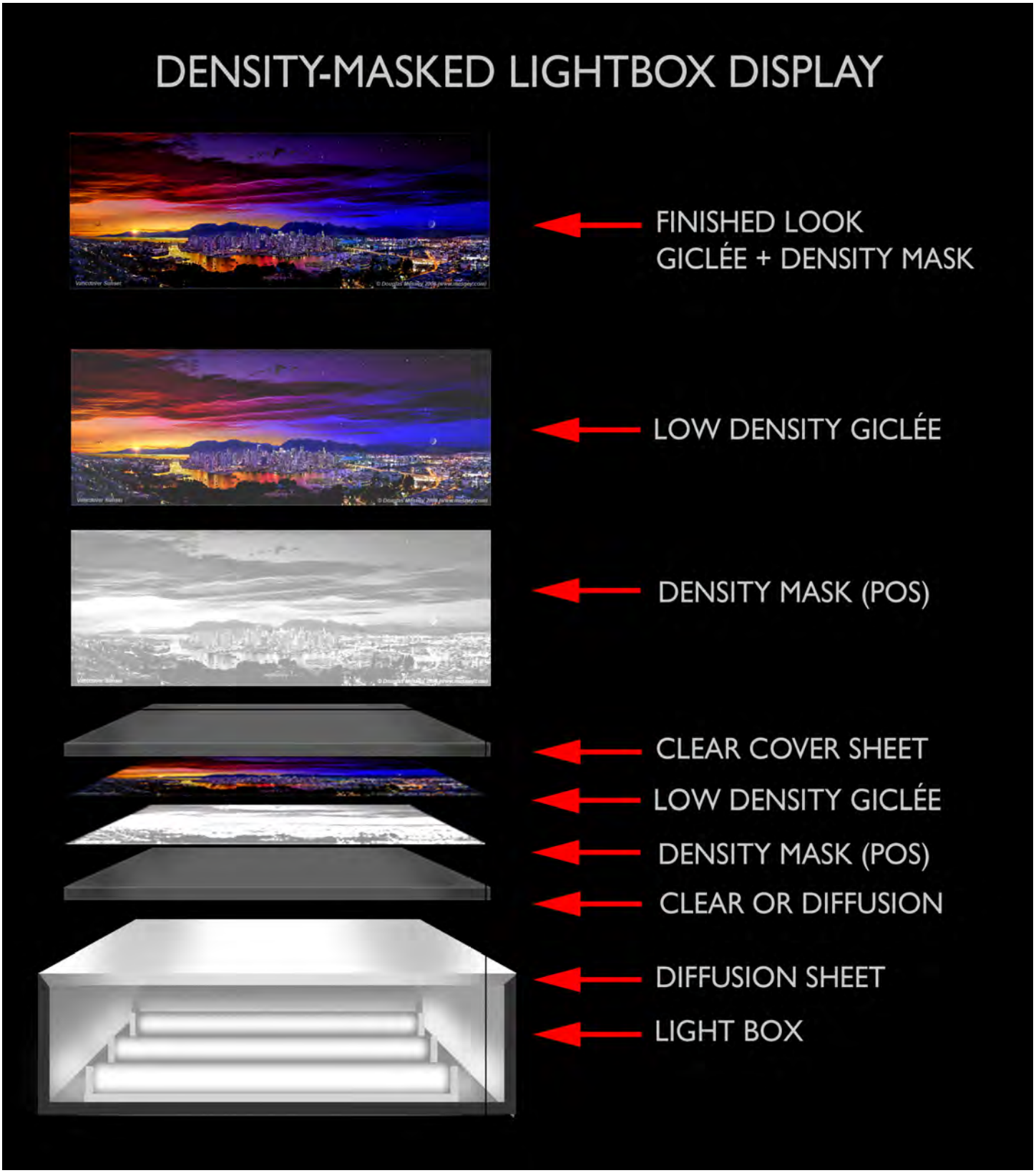
Density masks are "ghost images" of the picture. The faint black-and-white image only has any real density in the dark areas. There is very little density in the highlights. They look, well… ghostly. The name is counter intuitive. They look thin, but they add optical "thickness" (density), building blacks and dark tones.

An audiovisual production company called Image Stream developed the technique of density masking in the 1980's. Their problem was keeping blacks black when slides were projected by powerful Xenon projectors.

And earlier fix had been to make two duplicates of each slide, each slightly over-exposed. When the two were sandwiched together into pin-registered Wess slide mounts, the resulting slide sandwich had more density.

However, the polyester base layer of slide film has its own density, which although slight was objectionable when doubled up in the slide sandwich. The highlights looked dim and dirty. Not good for a slide show but unimportant for a giclée. Even though the two thicknesses of film look too dense in the highlights, that doesn't matter in the contact printing process. When you have a dense negative all you do is increase the exposure.

A better solution was found to be a sandwich using a slide duplicate made with *Kodak Fine Grain Release Positive* film, which has a virtually clear base. It is a black-and-white fine-grain film originally used to print black-and-white movies. By slightly underexposing the film, density only builds in the dark tones. Light tones remain clear. In the sandwich only dark colors get the density boost, providing a "clear" solution to the density problem.



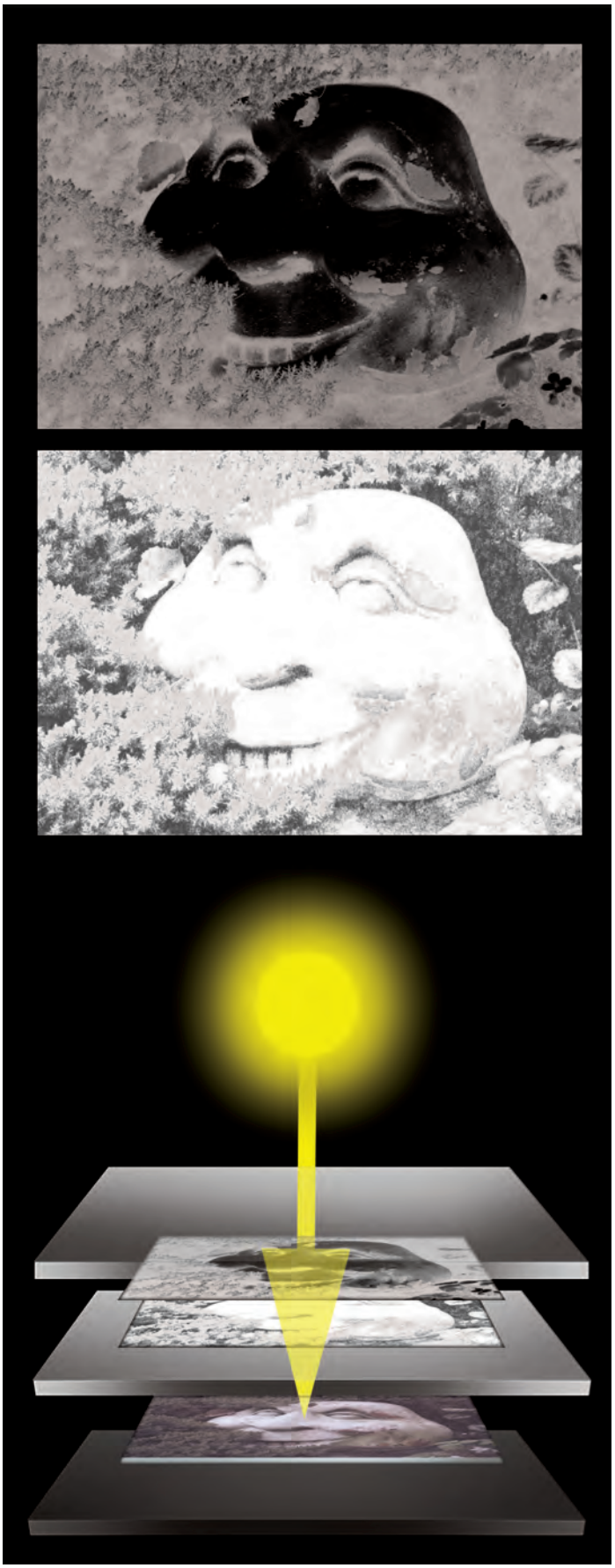
The same principle used by Image Stream for density masking slides can be used for building up dmax in a lightbox display. This can be helpful when the lightbox is so bright that the giclée looks washed out or faded.

Dmax is good for the shadows and dark tones, but not for mid tones and light ones. The mask should be clear in all except the darkest tones, and they should be pale and ghostly.

Cross-section of a density masked lightbox display for a backlit giclée or Duratrans *print. The lightbox should be built with enough space between the lights and diffusion material(s) to avoid hot-spotting or other uneven lighting conditions, like "banding". That is usually at least four inches, but it depends on the type and quality of diffusion material. Most people use milky-white* Plexiglas**,** *however a complete range of diffusion materials is available on rolls or in sheets from lighting-control materials maker* Rosco *(www.rosco.com), and pro photo stores.*

Density-Masking for Reduced Contrast

There are times when platinum printing negs and backlit transparencies benefit from reduced contrast.



There is no rule on how dense a density mask should be. The gioal is to use as little as possible to achieve the dmax and contrast necessary to make the backlit picture look better. The illustration on page 180 has exaggerated the look of the mask to make it more visible to the reader. In actuality the density mask might be much more pale. Experimentation is needed because every picture will need a slightly different amount to be as perfect as possible. Because the density mask doesn't need much ink, a thinner and more transparent ground can be used.

Density Masking to Reduce Contrast

When contrast needs to be reduced a density mask may provide a solution. This is particularly the case with overly dense photographic negatives and over-exposed transparencies (which require both pos and neg masks, discussed below).

The problem that density masks overcome is clogged-up highlights. In a photographic negative, white (clear) is black. When film is over-exposed of developed too long, too much density builds up in the blacks (highlights and light tones). When such negatives are printed, so much exposure is needed to get highlight detail that dark tones sink into blackness, creating a whole set of other problems.

Photographic printing papers come in a range of contrasts so you can normally find one that will deliver a descent print from an over-exposed, overly dense negative. However, when you are doing platinum or palladium printing there are no paper grades or variable contrast printing stocks. The contrast can only be controlled with a density mask sandwiched with the printing negative. In this case is density mask is a reversal of the negative, which is a "positive". What is a neg and what is a pos can get confusing. Bear with me as I try to explain:

- Density masks to build contrast are just like the picture they are masking, except being black-and-white and "ghostly". They add density to the *dark tones*.
- Density masks to reduce contrast are reversed (*inverted*) versions of the picture that are subsequently desaturated. They add density to the clear areas and light tones.

Adding more density to "thin" areas of the negative holds back light, balancing those areas with the amount needed to burn in the dense portions. This is exactly the same procedure used to add some ink and tone to blown out highlights when making a giclée print (as discussed in *Section Two, Step Seven - Highlight Control)*... and for the very same reason, restoring highlight detail.

To make the printing pack, refer to the illustration on the extreme left. The density mask is sandwiched with the picture negative and printing stock between two sheets of plate glass. The pack is then exposed to the sun or a bright light to "contact print" the negative onto the light-sensitized paper.

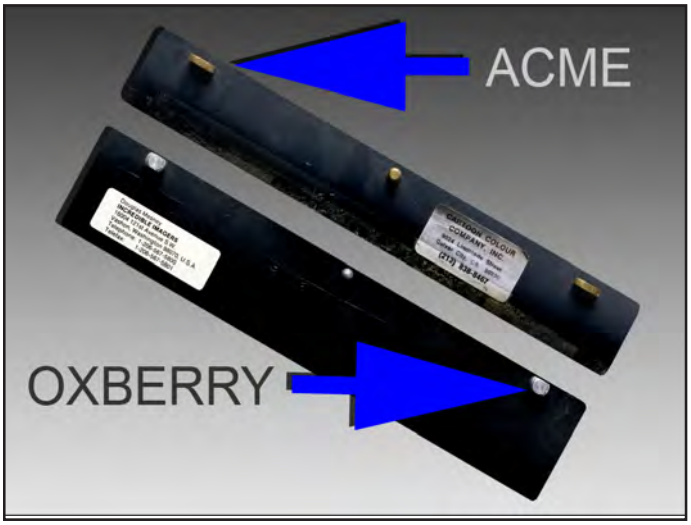
The density mask shown is a visual approximation of what you might expect yours to look like. However, the dmax of the density mask will have to be matched to the requirements of the negative being printed, which is a matter of experimentation.

A good density mask should deliver a minimum of 1% gray in the lightest portions of the print (recall that for a giclée print that amount is expressed as 2% - 3% ink in the lightest tones).

There should be no area of the print that is toneless (white) unless it is a spectral highlight or equivalent. The obvious exception to that rule is the artist who intentionally wants the media color to show through without ink or dye tones.

The result of a good density mask can be seen in the illustration to the immediate left. The yellow call-out enlargement shows a close-up of the lightest tones in the print. You can see that these areas have a little tone in them when you compare them to this book's paper color.

Registration can become an issue. If the density mask and picture negative aren't in match position the mis-registration will show in the print. (Some people use mis-registration to create effects.)



Registration can be maintained by using "peg bars". There are metal strips with registration pins. They are used by cartoon animators and title houses to keep artwork in registration during filming.

There are two types of peg bars, Oxberry and Acme. The difference is in the pins. Acme pins are flatter (top) while Oxberry pins are chubbier and rounder. Having used both I can say that the Acme system is more accurate.

Using a special punch, two acetate strips are punched to fit the peg-bar's registration pins. (You can also buy pre-punched strips and save yourself the cost of an expensive punch tool.)

The picture negative and density mask are lined-up on a light box and held in position as the peg bar with the acetate strips is placed into position the strips taped onto each.

Now the cells can be moved to the printing stage (or anywhere) and put back in registration when they are placed on the pins.

The name of this contact-printing process is *Platinotype*, meaning that your image is as large as your negative. It is because camera negatives are so small that copy negatives must be made in the size of the prints desired. The making of those copy negatives as well as density masks can be a lucrative business for the giclée prepress artist. These services are so specialized that you can charge like a heart surgeon.

Archiving & Organizing

People have their own ideas about what's organized and what's disorganized. My mom had her "everything drawer", appropriately named. For anyone else but her it contained a jumble that was useless for lack of an index and because diving in would swamp you. Picture files can get like that if you're not diligent about organization and archiving.

Organization involves search and retrieval. When things are organized, you can find the things you seek. Just because you can find them doesn't mean they're truly organized. Real organization happens when other people can find the stuff. The more people that can find it, the better the organization and labelling.

Searchable Key Word Naming Conventions

Naming conventions in the computer world are filled with code names (pardon the pun). They are often arcane and made overly complicated with acronyms and symbols. You need some sort of Rosetta Stone to figure out which file is which. Is that kind of system useful for you? Perhaps so.

Many professionals would take issue with someof the things I am about to say about file-naming conventions. However, I am undaunted because I know my system works.

They will tell you that short names are better for the computer. I will tell you that long names are better for people. You decide. But consider this first: you can't *Google* very successfully using your own code names for things.

My approach uses a file-naming convention and nomenclatures based on searchable key words. Let me explain: How would you *Google* for a picture of a pink rhododendron? The answer to that question contains key words that can be used to name the file, making it easier for other people to find it. Here is an example from my own archives:

PIX_Plant_Flower_Pink_Rhododendron_Garden_Vancouver_03.02.01 ("PIX" is a code word that is specific to my own archive. Any original photograph is put into a picture library category that I call PIX.)

Who, What, When, Where and Why

Picture names should include broader categories first, followed by related categories. They should go from universal to specific. In this case the category ranking is as follows:

- PIX (my own category name)
- Plant
- Flower
- Pink
- Rhododendron
- Garden
- Vancouver
- 03.02.01

The searchable key words in a file name should include the same kind of information you would see in the first sentence of a good newspaper article: who, what, when, where and why...the well known "*Five W's*".

As I am an illustrator, pictures (PIX) are ingredients for the collages which characterize my style. PIX that have been montaged together in an imaginary new scene are no longer photographs in the sense that most people use the word.

Photographers *take* pictures. Illustrators *make* them.

ILLUSTRATION_Mesney_Pink_Rhododendron_1.1_1024X768 _05.06.07 ("ILLUSTRATION" is another category name in my archive.)

Everybody knows that Santa's address is just "North Pole". Or that for the *Mona Lisa* you just *Google* that… *Mona Lisa*. You don't need to say "painting" or anything else. So it goes in my illustrations and artwork archive. Like other singular entities, artwork file names are unique enough to find without broad searches.

My illustration-naming convention now also uses searchable-keywords. I try to give the picture a name that says what it is in two words.

Artwork Information Ranking

- Type of Art / Illustration
- Artist's Name / Mesney
- Title of Work / Pink Rhododendron
- File / Version
- Image Size / Pixel dimensions (of file)
- Date / File origination date
-

The illustration shown at left was made a few years ago and named: "*Last Light At Lake Alta*". That name may be romantic but it is also "quaint" and won't get the picture hits on *Google* unless someone already knows the name. But suppose you didn't know the name? Instead, I would use the name "*Pink Rhododendron*" and the file name would include this information:

- ILLUSTRATION (My own category name)
- Mesney (Artist's name / keywork #1)
- Pink (Title of work / keyword #2)
- Rhododendron (Title of work / keyword #3)
- 1.1 (File version.)
- 1024 X 768 (Size of picture in pixels.)
- 05.06.07 (Date file was made.)

The new name, "Pink Rhododendron" will get hits on search engines whenever anyone looks for rhododendrons or just things that are the color pink.

Another reason I now have a fetish for short obvious names is because they are easier for people to remember, and fit better on labels, lists, etc.. Short names also enable the use of larger type. (Every little bit helps, eh?)

Some artists include copyright information in the name. Everyone's needs are unique. You may add other things to make a nomenclature scheme that work for you.

Hard Disks Are the Most Archival

Hard drives are the best and the most convenient way to store your files. CDs and DVDs are impermanent. The jury is still out on how long they will last. And nobody knows which type will last longer... gold, silver, green, blue?

I have experienced failure with 15-year-old CDs improperly stored in plastic sheets that leached oils that spoiled them. Others have failed for mysterious reasons, probably exposure to light. Whatever the cause, CD and DVD failure is a tragic event, especially because everyone once thought that these convenient media were "archival".

It turns out that they are not. In fact, the *Library of Congress* rates CDs as five-year media. Imagine that, only five years. Even if they are off by a factor of 10 that would still only be 50 years.

CDs and DVDs should be transferred onto hard drives (a.k.a. "optical drives") for more permanent archiving. "More permanent" ...? Yes, only that. The jury is out on hard drives also, as to their life-span. However, the optical disk is currently the only affordable long-term storage. As flash memory and similar types become more widely available the situation will change as storage technology morphs again. Until then, hard drives are your best bet... when they are turned off.

What will eventually fail first on a typical hard drive are its moving parts. They can be replaced, if you have spare parts (...a word to the wise). But if the parts aren't moving, they won't wear out. For that simple reason, our hard drives spend most of their time on archive shelves, asleep.

A typical hard drive sold by stores like Costco for bargain prices has an average projected life span of three years. Armed with that information you can plan your hard drive acquisitions accordingly. Hard drives in this studio are only allowed to run for a year in total. After that time their contents are transferred to a new HD and they are retired to a hard drive archive that now totals more than 50 HDs.

Fail safe systems require redundancy, therefore all files should be archived on at least two HD's, and more is better. The two hard drives should never both be on at the same time.

In years past I spent inordinate amounts of time moving files around so that they would be "organized" on each hard drive. But there is no need to do that anymore because I am using *Advanced Disk Catalogue*. This software keeps track of the content of all the hard drives, facilitating global searches through the entire archive, even though the HD's are switched off and sleeping.

With *Advanced Disk Catalogue (ADC)* I can simply fillup hard drives with whatever and park them in the archive when they are full. The indexing is taken care of by *ADC*. This system has been in place for nearly six years now and works well. The files are as safe as can be reasonably expected, at a reasonable cost and with reasonable assurance that files will be found when needed.

Wispy Edges & See-through Tones

Wispy edges like smoke, clouds and fog are challenging because of their partial transparency. Being semi-transparent, the background shows through. Edges are difficult to find at best and in many cases there may not be any edges to speak of at all.

Veils, sheer curtains and negligees present the same challenges as fog, clouds and other semi-transparent things.

The solution begins with isolating the picture area to be adjusted onto a separate layer. Include more than you need in the selection. Later, the edges of the selection will be feathered to the extent necessary to achieve successful blending.

Whatever the semi-transparent "see through" element happens to be, it is either making what is behind it lighter or darker.

By adjusting the blending options of the isolated layer to lighten or darken, you can control the difference between the tones of the background and the semi-transparent element through which it is being seen.

It is important to isolate more than you need, to be able to trim in later the parts that don't work or are not needed. You can always take away but sometimes you can't put back in; so it is better to take more than you need to begin with.

At this point, the isolated semi-transparent element is going to be adjusted to become a highlight mask or a shadow mask. The making of these masks is described in *Section Two: Steps Seven and Eight*. For now, a quick summary.

After isolating the semi-transparent element (the mask) on its own layer, make a copy of that layer to work on (and turn off the other one). The mask layer with the isolated element should be on top of the picture layer.

Expand tone differences in the mask by dodging the highlights (light tones) and burning the shadows (dark tones). While you are doing this remember that a little goes a long way. It is better to build up the effect slowly with many repetitions of small amounts.

With the mask layer over the picture, play with the blending options. For more control make a copy of the mask layer so that there are two masks, one for light tones and one for dark.

Individually developing the tones required for these separated layers will be easier than trying to work up both the highlights and shadows on the same layer.

With transparent or near transparent things like bubbles and glass it is important to remember that the reflections cannot be brighter than the source. Nor can dark tones be darker than those they reflect or which are being seen behind them.

Furthermore, having separated the light and dark parts of the semi-transparent element, the see-through effect can be more precisely recreated by individually controlling the opacities of the two mask layers.

Tone separations can be developed using Image > Adjust > Levels and/or Brightness & Contrast. But first do the work with the burning and dodging tools and go as far as you can with them. Eventually you will over lighten or over darken and the image will begin to degrade. How much degradation is acceptable is a matter of taste as well as of the individual picture and the effect desired. Sometimes going "too far" enhances the effect.

If the image is over-processed and starts to look grainy, isolate the grainy parts to another layer and apply the median filter or a surface blur. Place that as the uppermost layer, set the blending option for darken, and then lighten the layer until the graininess and other white speckles disappear.

To complete the effect, use an eraser of appropriate softness to give the mask(s) wispy edges that are as soft as needed to look natural and hide the merge of the mask(s) and picture.

At this point I normally group the picture and mask layers, make a copy of the group, and merge the copied group into a single layer.

That layer is a new sub-master for further *overall* adjustment or continued dissection, modification and reassembly.

The Making of *Glass Eye*

The model was not shot through the glass eye. Instead, thirty-three separate background and foreground picture elements were assembled on individual layers. The layers contained the pieces necessary to create natural looking distortions.

The distortions were done with Edit > Transform > Warp. In addition Edit > Transform > Scale, Skew and Rotate. Some of the pieces were blurred slightly, which is what glass distortions do from certain angles, especially planes that are almost parallel to the plane of view.

Edges were intensified with sharpening to make them appear glassy. Using excessive amounts of sharpening enhances the crystalline effect. However that was limited to the edges at the corners of the glass object by erasing away the unwanted parts. The real glass eye was studied throughout the process to determine the curves and angles for the distortion.

Finally, the color saturation, brightness and contrast of the layers was adjusted according to how much glass the piece was being seen through. The thicker the glass in that part, the less contrast, brightness and saturation. Those adjustments were absolutely minimal, because glass is clear. But no glass it totally clear so that it is important to establish differences.

The file is saved with the next sequential file-version number; for example, 1.1 becomes 1.2 and so on. The file name used to save the file is copied and pasted as the layer property for the new sub-master. Now the original group can be discarded as it has been saved, and you can continue your work on a file of a single layer. As more layers are added to become version 1.3 that is saved and reduced to a single layer; and so it goes.

Shadow & Highlight Consistency

Consistent shadows and highlights are necessary for "*trompe l'oeile*", which is a French term that means, "fool the eye".

However, the eye sees just about everything and quickly detects when something isn't as it should be, isn't 'natural'. Consistency is what they eye searches for. Shadow and highlight consistency rank high as detectable inconsistencies.

If you combine two picture elements all the shadows must appear to go the same direction. They also need to be the right size and "depth" when compared to the other around them. Highlights must match, too. Both shadows and highlights should belie *logical* light sources. For example, there are no shadows on a cloudy day.

Your's truly at age 16 fooling around with monster lighting in the living room of the family house in Douglaston, New York.

The direction of the light in all picture elements must be consistent and there must be an apparent source that explains why the light is falling on the scene in that particular way. Light can't seem to come from places it normally doesn't come from.

Shadow and highlight consistency rank high as detectable inconsistencies. Monster movies play on unusual lighting and try to stimulate fear with visual cues that are inconsistent with what people have come to expect.

For example, in old-time movies under-dashboard lights were used in night-driving scenes. They make the scene look unreal because light is not normally seen coming from underneath a face.

It is difficult to combine pictures made in sunlight to those shot on an overcast day, or indoors. The look of each is incompatible with the other. Yet sometimes we are asked to do the impossible. The only way to deal with light source and shadow inconsistency is to change the orientation of the offending element(s) or background (area). That might involve flipping various parts back and forth until everything reads right, with all shadows and highlights going the right direction.

Once shadow and highlight directional issues are resolved the rest of their adjustment involves saturation, brightness and contrast. The "look" of all the elements must match up. Not all shadows or highlights are created equal but must be made match each other's looks or else the picture will look unreal.

Like semi-transparent picture elements, the noticeable differences between opaque elements derive from differences in their colors, brightness, and contrast.

First, adjust the levels and/or brightness and contrast. The lightness and darkness of an image have an effect on saturation. However, adjustments to saturation can effect contrast, so there may be some back and forth involved getting the two balanced. These are subtle adjustment of qualities such as "softness" or "harshness" as well as "textures".

The shimmering effect of sunlit water provides an example. as does the spattering mosaic of light and shadows created by the leaves of a tree. Matching the *character* of the light all component parts is an important part of the illusion we call pictures.

Memory Allocation and Management

PhotoShop is a memory hog and rasterized graphic images are large sized files. These two facts can lead to problems if your computer's system is not tweaked for handling big graphics files. Adjustments must be made to the system's virtual memory allocation as well as its file handling and transfer protocols.

Your machine needs sufficient RAM (memory) and the amount needed is generally recommended to be twice the largest file you'll work on. If you're making a picture with a file size of one gigabyte you should have 2 gigabytes of RAM. Insufficient RAM slows down processing time for PhotoShop as well as the system.

When you run out of memory you write things down on a "scratch pad". When PhotoShop runs out of memory it writes things down on a "scratch disk".

PhotoShop has to share the RAM resources with the system and any other applications that may be running. The system also has a scratch disk called a "paging file" and uses it for the same purpose when there isn't enough RAM to go around.

You can allocate the RAM reserved for PhotoShop under Edit > Preferences > Memory & Image Cache. The more RAM you give PhotoShop the faster it will respond. However, if you give PhotoShop too much the performance of other aps may suffer.

Experiment to see how much RAM you can give PhotoShop without impingin on the system's performance. Begin by giving PhotoShop 90% of the available RAM and see if your system and aps can handle it. If they can't, back off and reduce PhotoShop's share of RAM until they can. On my machines that is generally 80%, but I don't use many other RAM intensive aps like video and music software.

The Windows operating system uses "virtual memory" when it runs out of RAM. Virtual memory functions like a PhotoShop

scratch disk in that it is a place where the system can write things down. The amount of scratch-disk space allocated for virtual memory is determined by the size of the "page file".

The page-file size defaults to a setting which is too low for PhotoShop work and it has to be (substantially) increased. Making the adjustment begings by opening the system properies box.

Right-click on My Computer and then Properties > Advanced > Settings. Here, set the performance options to "Adjust for best performance".

While in that window, set both processor allocation and memory usage to "Programs".

Next click the Advanced tab at the top of that window. In the next window click the Change button that is part of the third Advanced Performance Options, Virtual Memory. It is here that you select page file size and location.

The biggest any page file can be in Windows XP is 4,092 megabytes. Set the minimum for 4,000 and the maximum to 4,092. The partition that you choose for the location of the page file should not be the same as the partition where the system is installed. Unless you set up your machine differently, Windows installations default to the C drive; so that is *not* the place for the page file. Instead, make a separate partition for the page file. While you are at it, make a partition for PhotoShop's scratch disk, too.

Separate Partitions Maximize Performance

Partitions are like the bands on an LP record album (forgive the pun). When a hard drive is made, a "Volume" is created and given the name "Unallocated Space". Unallocated space is unusable until it is *formatted*.

Formatting creates a partition, known also as a "drive". A disk can have as many partitions as you like. However, most Windows machines come to you with a single partition which has everything in it and is labelled the "system disk" or "C drive".

Unwittingly, many people also use the system partition (C) for archiving. Although this works, if the system ever fails and needs to be re-installed, everything on that partition is lost. Since Windows will eventually need to be re-installed it is best to put your archives in their own partition.

System drives should be sized for enough space to contain the OS and the applications you will run plus a bit more for good measure. That bit more could be as much as 10GB to allow the system and aps plenty of "breathing room". There's no such thing as too much head room, but there certainly can be too little.

Separate partitions should be made for:

- Paging Files
- Scratch Disks
- Archive(s)
- System back-up file (like *Acronis*)

Page file partitions should contain at least 4 gigabytes. I have seen the page file on my PhotoShop machine hit the 2GB mark so to be on the safe side I double that. You can see the size of the current page file using Control + Atl + Delete to open Task Manager, then choose "Performance".

Scratch disk partitions for PhotoShop need to be 2.5 times larger than total of all the pictures you may have open at one time. The scratch disks on some of my machines are 30 gigabytes and the smallest one is 20 gigabytes.

An incentive to have a large PhotoShop scratch disks is that if the scratch disks ever become full, PhotoShop will not be able to save your file… your latest work will be lost. If that happens and PhotoShop reports that there is "insufficient RAM" try using Edit > Purge > Histories to free-up some RAM space, hopefully enough for a save. Also check the scratch disk and delete anything you can.

When PhotoShop closes, all the temporary files it writes on the scratch disk are normally purged leaving the scratch disk empty. But sometimes either Windows or PhotoShop closes incorrectly, leaving the Scratch Disk un-purged.

When you begin the next PhotoShop session the scratch disk may already be partially filled and you might inadvertently top out and hit the ceiling. It has happened to me, more than once. One clue that the scratch disk is near full is when PhotoShop® gets s-l-o-w.

Acronis partitions should be as big as needed to contain the *Acronis* back-up file of your machine(s) System partitions, plus another 20% for cushion space.

Archive partitions get the rest of the unallocated space, or as much as you choose to give them. However, leave at least 2% of the total available drive space unallocated. You may need it sometime for an emergency.

To summarize, a 100GB hard drive would be partitioned roughly as follows:

-
- C (System): 10 GB
- D (Paging): 4 GB
- E: (Scratch): 20 GB
- F: (Acronis): 10 GB
- G: (Archive) 54 GB
- Unallocated 2 GB

Retire a hard drive after three years of service to avoid being the victim of mechanical failure. Repair shops will tell you, off the record, that cheap HDs like the kind you get at Costco and other discount box shops are built with a three-year life expectancy. Even if yours are better than that, why take chances?

To further avoid being victimized by a crashed hard drive, back up everything on your computers HD to USB or FireWire hard drives that can spend 99% of the time off line, parked on a shelf. Files should archived on two such off-line HDs.

Driver Issues

My Computer > Properties > Hardware > Settings > Device Manager reports driver issues and provides the opportunity to update drivers from disks, the Internet, or other locations. If a device isn't working correctly this is the first place to look. Over time, new drivers are released that solve problems and/or improve the performance of devices. It is a good idea to check periodically to see if updates are available. *Driver Detective* is an

application that can keep track of new drivers that become available for the devices you use.

Windows systems occasionally "lose it" and load either no driver or the default one. When that happens, devices affected will also lose it. Device Manager is the place to start looking for the root of the problem.

Mysterious things can happen when the drivers of different machines create conflicts for one another. There have been situations in my studio when two similar printers could not be run from the same computer. Whichever was on first grabbed the driver and the other would print (very) incorrectly. The only way to solve the problem was to put each printer on its own server. And so it goes with Windows.

Avoiding Write Delay Fatalities

Write Delay Errors are the cause of more data loss than physical hard drive failures. These errors are caused when file saving is interrupted before completion. Such things as power problems, jiggling a loosely connected wire, static electricity, or a lightning storm can cause interruptions. Interruptions of only a fraction of a second can be fatal.

Data Rescue, Get Data Back and other such applications can retrieve lost data it is true. But no data-retrieval application is bullet proof. Not all data will be recovered, and the names of files may be changed leaving you clueless as to what they are without opening, identifying and re-naming them all, which can take days. That is why data retrieval can be expensive if outsourced.

Uninterruptible Power Supply units *(UPS)* can eliminate power problems from the equation. Loose wires can be avoided by keeping wires and cables neat and tidy, and possibly taping critical ones in place.

Being located on an island subject to frequent power outages and surges, I have UPS double-redundancy. Every computer and peripheral on the network is connected to at least one UPS and machines involved in printing and archiving are connected to two of them. That is because sometimes it takes a long time to save a big file, especially over a slow network.

When you are transferring a lot of files to one drive or another, it can take hours. If the power fails I want at least a half-hour to deal with it.

So that I can see what I am doing, LED Christmas lights that use only a few watts of electricity are strung nearby computer work stations. They provide low level room light for hours and even days using minimal UPS power.

High end UPS units clean and condition power and are recommended if you can afford them.

To understand how write-delay failure happens, it is useful to know how a file is transferred from one hard drive to another when it is being saved.

How Files Are Transferred and Saved

Whether between devices separated by inches or continents, all digital files are transferred the same way. People like to use a garden hose or electricity as a metaphor, but that is wrong. The process is more like sending a letter, but in a special way:

- Cut the letter into a thousand pieces.
- Mark each piece as to top and bottom orientation.
- Give each piece a sequential number.
- Make a list of all the pieces, so you can reassemble the letter.
- Put each piece in its own envelope
- Include a copy of the pieces list in each envelope.
- Mark each envelope with the number of the piece inside.
- Send the envelopes by all available carriers, including the *Post Office, FedEx, UPS,* and *DHL.*
- Get a receipt to verify each of the thousand deliveries.
- Finally, reassemble the 1000 pieces if they all arrive.

Delayed write failures are like letters gone missing. If any pieces don't arrive, the letter cannot be put back together. The letters in data transfer are called "*packets*"

Packets carry perhaps 1,000 or 1,500 bytes of the information that includes part of your email or data file as well as the packets individual ID and destination.

In the case of an email letter, the information includes the sender's IP address and the protocols that the Internet uses, Transmission Control Protocol/Internet Protocol (TCP/IP).

Each packet is sent to its destination by the best available route. The route could be a direct connection through a USB wire, a simple route through an office Intranet, or a more complicated path through the Internet where there are trillions of connections. Like river water, each streaming packet seeks the path of least resistance, the fastest route.

Depending on the type of network, packets may be referred to by another name:

- frame
- block
- cell
- segment

Most network packets are split into several parts:

The "*header*" contains instructions about the data carried by the packet. These instructions may include:

- Length of packet
- Synchronization (matches up packet to the network)
- Packet number
- Protocol (TCP/IP, e-mail, web page, streaming video, etc.)
- Destination address (where the packet is going)
- Originating address (where the packet came from)

The "*payload*" is the actual data that the packet is carrying (aka the "body" of the packet).

The "*trailer*" contains sign-off and "end of packet" data that informs the receiving device that transfer of that packet has been completed.

"*Error checking*" may be part of the packet's information. The most common error checking used in packets is a "*cyclic redundancy check*" *(CRC).*

Recall that digital data is made of 1's and 0's (ones and zeros). The cyclic redundancy check takes the sum of all the 1's in the payload and adds them together. The result is stored as a hexadecimal value in the trailer.

The CRC code is sent along with the other data. On the other end of the interface, the recipient adds up the 1's in the payload and compares the result to the value stored in the trailer.

If the values match, the packet is good. But if the values do not match, the receiving device sends a request to the originating device to re-send the packet.

If errors occur frequently, the system may drop down to a slower data flow rate (see *DMA* and *PIO*, below).

As an example, let's say that you send a 3,500 bits (3.5 kilobits) e-mail. If your network uses fixed-length packets of 1,024 bits (1 kilobit), the header of each packet is 96 bits long and the trailer is 32 bits long, leaving 896 bits for the payload. Your message will need four packets (divide 3,500 by 896). Three packets will contain 896 bits of payload and the fourth will have 812 bits.

Each packet's header will contain the proper protocols, the originating address (the IP address of your computer), the destination address (the IP address of the computer where you are sending the e-mail) and the packet number (1, 2, 3 or 4).

Routers in the network will look at the destination address in the header and compare it to their lookup table to find out where to send the packet. The destination computer strips the header and trailer off each packet and reassembles the e-mail based on the numbered sequence of the packets.

One packet may be shunted through Asian airspace while another finds passage in an underseas fiber optic cable and still another goes via a satellites in space. Millions of packets choosing millions of pathways, arriving randomly and reassembled where they have been received by the ordering date written in the "*file allocation table" (FAT*).

File allocation tables contain the packet sequencing information as well as the instructions for putting the packets back together again. Just like all the rest of the data, the FAT is sent in the packets, too. If the FAT is lost or damaged, there is no order to the data and it is as useless as the 1,000 letter pieces would be if they lost their sequence numbers.

Delayed-write errors occur when file allocation table packets are "dropped" and the FAT is lost. Without the FAT, a file's data cannot be reassembled. The name means "errors caused by delayed writing" (delayed as in unwritten).

Besides obvious glitches like power problems and loose wires, delayed write errors can occur for more subtle and hidden reasons. These can include:

- Flow rate mismatch occurs when one machine's data flow rate is different than the other's, particularly when the flow is from the fast machine to the slow one. If one machine can't keep up it puts the overflow into a "*buffer*".
- Buffers are like having a basin underneath a bottle in case you overfill it, to prevent the water from going down the drain. If the buffer gets full too, the water goes down the drain. When that happens, the FAT is lost and the whole file goes down the drain.
- Flow rates have two modes, "*programmed input output*" *(PIO)* and *"dynamic memory allocation" (DMA).* The flow rate between two devices also depends in part on the amount of memory assigned to them.

Dynamic Memory Allocation

DMA balances the total amount of memory available among all the devices using it. DMA flow rates vary according to availability, but remain as high as possible.

DMA comes in different speeds. Ultra DMA is the fastest with flow-through rates of up to 100 bits per second (a bit is a single 'on' or 'off' code bit). How fast DMA goes depends on the amount of system resources it has available. If PhotoShop is using 90% of the available RAM, for example, DMA gets only part what left and shares it with all other open aps and the system's many other services.

PIO is a fixed rate of 10 bits.

The most common fatality is DMA sending to PIO which is like connecting a fire hose to a garden hose. The thin garden hose can't accommodate the larger flow through from the fire hose and as a result a lot of water spills out and goes down the drain.

Occasionally a computer that was set for DMA will slip into PIO mode. It is another of the many Windows mysteries, but these things happen.

Modern systems that use IDE/ATA drives should be using one of the Ultra DMA modes. There are several specific requirements for running Ultra DMA:

- Hard disk support: The hard disk itself must support Ultra DMA. The hard disk must be set to operate in Ultra DMA in the operating system and the appropriate Ultra DMA mode must be enabled on the drive.
- Controller support: A controller capable of Ultra DMA transfers must be used. This can be either the interface controller built into the motherboard, or an add-in IDE/ATA interface card.
- Operating system support: The BIOS and/or operating system must support Ultra DMA.

Ultra DMA modes over 2 require an 80-conductor cable. If an 80-conductor cable is not detected by the system, 66 MB/s or 100 MB/s operation will be disabled.

On new systems there are few issues with running Ultra DMA, because the hardware is all new and designed to run in Ultra DMA mode.

With older systems, things don't always work. In theory, new drives should be backwards compatible with older controllers, and putting an Ultra DMA drive on an older PC should cause it to automatically run in a slower mode, such as PIO mode 4.

Unfortunately, certain motherboards don't function well when an Ultra DMA drive is connected, and this may result in lockups or errors. BIOS upgrades from the motherboard manufacturer are a good idea.

Utility software (available from the drive manufacturer) can be used to tell the hard disk *not* to try to run in Ultra DMA mode. The same utility can be used to enable Ultra DMA mode on a drive that is set not to use it. You should use the utility specific to whatever brand of drive you have.

Device Manager > IDE ATA/ATAPI > Properties is where to make the settings. Click on the ones for Primary IDE and Secondary IDE – Advanced Settings and there select "PIO" or "DMA If Available". Set all machines to DMA, if possible. If one is PIO, make all of them PIO.

Performance should be set to Programs as follows:

Device Manager > System Properties > Advanced > Performance > Settings. Click the Visual Fffects tab and in the window that comes up choose "Adjust for Best Performance".

There is another Advanced tab in the Settings window. Click on that and and in the window that appears select Programs. The third tab doesn't matter.

At this point you have done all you can to adjust the settings of your system for handling, transferring and saving the large-sized graphics and image files that you create doing giclee prepress and printing work. The only thing left to do is periodically check to see that the settings hold, and be sensitive to system slow downs that might indicate that they have changed.

Color Settings Set-Up In PhotoShop

PhotoShop must be tailored to your individual needs. Although the default settings may be appropriate in most cases, there are some that you will definitely want to customize to your own preferences.

The settings below are the ones that I use for the production of image files for giclée prepress and printing as well as the production of pictures for large-scale audiovisual productions.

Edit > Color Settings.

Working Spaces is a list of available Color Spaces. Adobe 1998 and sRGB are the two most frequently used. Adobe 1998 has more colors than sRGB. If you are doing print work, use the Adobe 1998 space and for film and video choose sRGB.

The difference between sRGB and Adobe 1998 gamuts affects the way a color picture will look when printed as a giclée. sRGB has fewer colors and the presents giclées that have more saturated colors and contrast. The Adobe 1998 gamut contains more pastels and therefore produce giclées that are less intense.

Dot Gain refers to how big dots get when printed. The more absorbent the media, the greater its 'Dot Gain'. Sometimes more dot gain is desirable and other times not. Substituting print profiles can control the dot gain effect by applying more or less ink to the media. For example, printing onto Epson Premier Art Water Resistant Canvas (now called Satin Canvas), I use the profile for Epson Velvet Fine Arts Paper instead. The VFAP profile delivers more ink than the PAWRC profile recommended for the media.

Gamma is a measurement of Monitor Contrast. High contrast has fewer tones than low contrast. Dialing up contrast strips away mid-tones and eventually renders a picture as black-and-white with no mid-tones at all.

This Gamma setting has to do with Monitor Contrast There are two monitor types: Apple monitors with Gamma of 1.8 and PC monitors with Gamma 2.2.

In the past, the gamma differences between Apple and PC monitors made problems for Web designers. Pictures "normalized" for one gamma look incorrect on the other. A picture that looks correct on a PC monitor will look too bright and washed-out on an Apple monitor. Pictures made using Apple monitors look too dark on PCs.

Color Management Policies concerns how to incoming files are handled when they have a profile that differs from your working color space.

For example, you are working in Adobe 1998 and the incoming file has a sRGB profile. You can choose to have PhotoShop change the picture into Adobe 1998 colors or do nothing, leaving the picture colors unaltered. When you change from one profile into another, the colors are altered because the two spaces contain different tones. They may look very similar, but they are different.

Moving from a small profile into a large one is less problematic than squeezing a large number of tones into a smaller space that won't hold them all. *Ask When Opening* alerts you to mismatches and offers the opportunity to remedy the situation or leave things as they are.

Conversion Options adjust the way PhotoShop® renders images and the choices are between sharper and crisper or softer and more film-like.

Color Engine should be set for "Adobe (ACE)".

Rendering Intent has four choices: Perceptual and Relative Colorimetric are for continuous tone work. Absolute Colorimetric and Saturation are geared for line art.

Rendering intent is how an image is adjusted to look "right" on a particular media or display. "Right" is a matter of personal opinion, of course. How the eye sees color is different than a device's perception. Eyes are more sensitive to some color tones than others, which skews the dynamic tone range people perceive. Humans also have color preferences seeing some colors more favorably than others.

Rendering Intents change the way files print or are displayed. Some are more precise and others more interpretive. They adjust borders and edges between tones, the pixels where one color changes into another.

Business graphics, like graphs generally have sharp edges and block colors. Photographs and other continuous tone art generally have soft-edged transitions between tones.

- *Perceptual* interpolates a picture to be printed the way the eyes see it.
- Relative Colorimetric is recommended when all devices are using the same color space. Source colors are mapped to destination colors together with the 'White Point'. If you are outputting onto off-white media, compensation will be made

'mathematically' instead of 'perceptually'. In other words, both 'Perceptual' and 'Relative Colorimetric' make adjustments. 'Perceptual' does it with feeling.

- *Absolute Colorimetric* has no interpolation leaving color information unaltered, no matter what it looks like. This rendering intent is mostly used for "hard proofing". Hard proofs are made to see what is in a file and they alert press operators to potential problem areas where ink might clog up or need a bit more to be seen at all. Usually, any print job goes through several proofs. Getting a picture right on the first proof is the test of a prepress artist's mettle.
- *Saturation* is for business graphics where the intent is bright bold colors using plenty of ink. Photos and illustrations may appear too saturated.

Dither is an optical trick of the eye to reduce jaggies. Dithering creates gradient tones along jagged edges where none existed before, smoothing the edges. Continuos tone artwork requires dither while business graphics may not.

Black Point Compensation 'locks' the map of a picture's dynamic tone range, if checked. No tone interpolation (alteration) permitted within the destination's space. If unchecked and turned off, the dynamic tone range of the picture is simulated by the destination space. That means new colors, which should be avoided.

Blend RGB Colors Using Gamma locks the contrast range of blends to the Gamma selected earlier, which is either a setting os 1.8 for Macintosh or 2.2 for PC. The difference between the two is that PC monitor settings show pictures darker and with more contrast than the Macintosh settings.

Desaturate Monitor Colors is something you don't want to do, so we won't even go there.

Save these color settings once they are made so they can be recalled or restored when needed.

Color Settings can be tweaked and saved in as many different configurations as you like. The one we just set-up is for RGB. Perhaps a CMYK set would be useful for you. As I am in the audiovisual business I have others for audiovisual displays and projectors.

Preferences Set-Up In PhotoShop

For general image making and giclée prepress work, many of the PhotoShop defaults are suitable. There are also many that simply appeal to one's personal work habits as opposed to having any important impact on the work being done. Unless otherwise noted here, you can use PhotoShop defaults with confidence.

Edit > Preferences > General

Color Picker – Adobe

Interpolation - Bicubic or Bicubic Smoother.

Interpolation is used when scaling or re-sizing images. It is a mathematical algorithm with variations that mostly affect the edges between pixels. Recall that Dithering creates "*faux*" pixels to make gradients along edges, smoothing jaggies through optical illusion.

This adjustment has a similar effect on edges and borders between different tones. The name of the interpolation setting called "*Nearest Neighbor*" describes well the conditions that are changed with this setting. Some people erect fences, others commingle their borders.

It takes a discerning eye to see the differences between these settings. The differences look similar to those obtained by sharpening. Sharpened images look "edgier".

Bicubic and *Bicubic Smoother* are good for giclée printing. Borders between the pixels are idealized for the giclée printing process. They are softened but not beyond recognition.

Bicubic Smoother is my setting of choice because it is intended for large sizes and offers the most softening effect. Most of my output is on canvas, and a degree of edge softening adds to the look. This is the recommended setting for enlarging images.

Bicubic Sharper has the opposite effect which can benefit architectural renderings or technical illustrations, where a more crisp look is generally sought after. This is the recommended setting for reducing pictures.

Edit > Preferences > Interface

Use defaults.

Edit > Preferences > File Handling

Use defaults.

Preferences > Performance

Memory Usage should be set to give PhotoShop everything you don't need for other applications that may be running. If there are other picture or graphics aps running, PhotoShop will be able to have less RAM than if it were operating without competition for memory. The performance levels should guide you here.

Start by giving PhotoShop 90% of RAM. Adjust downwards if necessary. Never give PhotoShop more than 90% because the system needs at least 10% for its own operation and page file(s).

Parts of PhotoShop's operation interact with the system and its page file. Cramping the system will have a negative impact on PhotoShop and all other aps that are running.

Scratch Disks should not be on the System partition. Make a separate partition for the PhotoShop scratch disk and make it twice the size of the total number of pictures you may have open in PhotoShop at one time. Scratch disk partitions on my giclée prepress machines range from 20 to 30 gigabytes.

History States keep track of what you do as you work. History States are useful to step backwards and retrace your steps. Everyone occasionally gets too far down a road and it's nice to be able to back out. The temptation is to have a lot of recall to be able to go way back. However, every recalled History State requires RAM. The more History States you recall, the slower PhotoShop will become. Actually it's the System that is slowing. History States are written to the system page file not the PhotoShop scratch disk. Consider having fewer History States and taking occasional *Snapshots.*

History > New Snapshot can be used to capture important stages in the development of an image. Snapshots are like new originals.

When you open a picture in PhotoShop, its original state appears (and stays) above the list of History States. You can always go back to the original state. However, you can't go back past the first History State.

Past history states are overwritten by recent history states. If you are set for 20 history states, your 21st step pushes the 1st step off the list; the 22nd step replaces the 2nd, and so on. If you are tracing a path of many points, the path points being plotted rapidly replace earlier History States.

If past history states are important, save them as Snapshots before embarking on adjustments that will eat up the history states list. Without a snapshot you will only have the original state to revert to. Important adjustments cannot be returned to because the (many) path points overwrote their history.

Preferences > Cursors

Use defaults or set to your liking

Preferences > Transparency and Gamut

Use defaults or set to your liking

Preferences > Units and Rulers

Use defaults or set to your liking.

Preferences > Guides, Grids & Slices

Use defaults or set to your liking.

Preferences > Plug-Ins

Use defaults or set to your liking.

Preferences > Type

Use defaults or set to your liking.

Enable Large Document Format should be checked (on). Large Document Format (.psb) is necessary for files more than 30,000 pixels in either dimension, or bigger than 2gb.

Color Casts and Tints

Casts involve red and blue shades and *Tints* involve green.

Pictures sometimes have an objectionable color cast or a tint from the nature of the light or from colors reflecting into the scene from a source outside the frame. Other times you may wish to add a cast or tint. Elimination or addition of a cast or ting can be handled dynamically or in a linear manner.

Linear change is equal throughout the picture and affects all parts equally. Dynamic change has a different affect on some tones more than others.

Linear change can be made by adding layer, filling it with a color, then adjusting the opacity of the layer to create the depth desired. The effect is made on all tones equally, but is normally seen more in light shades.

Dynamic change is made by applying blending options to the color-filled layer as well as adjusting with the layer's opacity. These changes are seen more in dark tones than in light ones.

Ink-Cartridge Changes

Change ink cartridges before printing a large giclée. Inking differences will likely show on prints made during an ink-cartridge change. The problems will show up two ways:

- Density differences especially visible in dark tones
- Surface-reflection differences where the new ink begins.

Make sure a new ink cartridge is securely in place. If it is not two things can happen that will ruin your day:

- Loss of that color in the giclée
- Leakage of the ink into the roller and transport assembly

If ink leaks into your printer from a loose cartridge it makes a hell of a mess that is difficult to clean and may require a service call from a qualified technician. Cleaning the inks isn't the hard part... it's taking the machine apart. I'm not sure I'd have the courage to take apart a $5000 printing machine; not after watching experienced technicians take one apart and put it back together.
That said, giclée inks are glycerin based and the solvents for glycerin (and glycerol, from which glycerin is made) are water and alcohol.

Cleaning Giclée Printers

Service calls are expensive if you live on an island as I do. You learn to do things for yourself. Research into the subject of cleaning giclée printers has resulted in a few suggestions worthy of note. However, the information that follows is provided with a strong caveat: users beware. If you are brave of heart and wish to take cleaning matters into their own hands, and at your own risk, read on.

Windex window cleaner is suggested for cleaning clogged print heads.

Windex ingredients are:

- Isopropanol*
- 2-Butoxyethanol
- Ethylene glycol n-hexyl ether
- Water
- Ammonia

*Isopropanol is commonly known as *Isopropyl Alcohol* and is commonly available at supermarkets and drug stores. Used as a solvent and reagent.

Windex makes sense as its ingredients have solvents for a both water and oil-based substances. Detergents share these properties.

Isopropanol alcohol and water are glycerin solvents. Another ingredient, ammonia is a mild base with a pH of 11.6 however it also acts as a weak acid. It is a *protic* substance and, like water, ammonia is *amphoteric*.
Protic solvents are polar, with both acid and base characteristics.

The molecules of such solvents can donate an H+ (proton). This quality makes them bond easily and well with either base or acid substances.

Amphoteric is another way of saying that a substance can react as an acid or a base. Whatever you call it, ammonia has dual cleaning properties... I guess that's twice as good.

2-Butoxyethanol is a de-greaser, a solvent for oil-based substances.

Ethylene glycol n-hexyl ether acts as a wetting agent to prevent streaking. Wetting agents promote "cling" and prevent "beading" when water-based products are used on impervious surfaces like glass, polished metals, painted surfaces and some plastics. In the *Windex* product it is probably there to prevent streaking.

Following are the procedures for cleaning inkjet printers as described by a UK firm, *Northlight Images*. I have not tried these procedures but include the information for your edification in the event you are more courageous than I am or or have a more pressing need.

Caution: I do not necessarily recommend these procedures. Use this information at your own risk. Realize from the start that you may destroy your printer. This information was collected www.northlight-images.co.uk: Their material is quoted verbatim below except for the subheads, which I added.

Cleaning Rollers

"Take a thickish sheet of the largest size paper your printer uses, spray it lightly with the cleaner. Form feed it through the printer a few times.

"This works well in getting any muck off the print rollers. If you've not got a thick paper, then load a sheet of paper first, lightly spray it, and then feed it through.

"Take care -- since torn wet soggy bits of paper are a pain to clean out of your printer (Yes, it has happened :-)

"If you take some kitchen roll and carefully fold it several times, you can make a strip that will fit in the foam filled gap under where the head goes on Epson printers.

"You can manually release the head (or pull the plug when it is out of its 'park' position) and gently slide it over the folded kitchen roll. Spray some cleaner in the middle section and you will see just how much dried ink your heads have built up.

"For a dried up head, you can also spray the cleaner onto the parking pads (where the head rests)

- Turn on printer - head moves across
- Pull power cord so the head is left 'unparked'
- Spray cleaner onto the parking pads
- Carefully soak up spray with kitchen roll
- Repeat if there was a lot of dried up ink on the pads
- Spray again - leave the pad soaked with the cleaner
- Turn printer on, let head return.
- Switch printer off with it's own power button
- Wait overnight :-)

"You can get cartridges full of cleaning solution but I prefer to get an old empty cartridge and add a few cc of isopropanol to it through the vent tube (this is a fiddly operation and needs a syringe). This cartridge now has very dilute ink/solvent in it."

(Isopropanol is also known as *Isopropyl Alcohol* and is commonly available at most supermarkets and drug stores.)

"Run some test prints and see if the clogs go away. The very dilute ink and solvent is much easier to see on paper than pure cleaning fluid.

"One important thing that people often forget when dealing with clogged inkjet printers is waiting. Sometimes no amount of cleaning cycles on your printer seem to work - after a few you are just wasting ink.

"Put the cleaner in place, and leave it overnight. The Epson 3000 I fixed took a week of cleaning - first thing in the morning, last thing in the afternoon. Why does it work so well for removing dried inks?

"My suspicion is that it is the isopropanol and propylene glycol ether that really go to work on the ink and make the difference between this product and the inferior versions (see later).

"If you are not in the UK, here are the ingredients, so you can look for a local equivalent. I used the (Sainsbury's) bathroom cleaner rather than the kitchen cleaner (green pack) since it does not have sodium hydroxide in it.

"Sainsbury's Bathroom Cleaner is no longer available in the formulation used in the procedures described below. The ingredients for it were:

- Water (greater than 30% by volume)
- Non-ionic surfactants (5-15%)
- Isopropanol, EDTA
- Propylene glycol ether
- Cationic surfactant
- Sodium Heptonate
- Perfume
- Preservative (less than 5%)

"This is a very powerful cleaner and solvent.

"If I wanted to run a cleaning solution through a print head I'd use something much less aggressive like isopropyl alcohol/distilled water or one of the suggested solvents in second link at the end of the article.

"Isopropanol is relatively easy to get from your local chemist (drugstore), but from various suggestions I've seen on the web, having a detergent and the glycol ether helps shift things even better.

"Once you get to the need for forcing liquids through a print head, you've got to accept that it may just be too late for that printer, although I did once remove the head from a Stylus Color 800 and put it in an ultrasonic cleaning bath with some isopropyl alcohol - it's been in regular use by someone for the last 3 years and has been fine ever since.

"Remember, cleaning inkjet printers can cause them to never work again...

"That said, the Epson 3000 I cleaned had been unused for over three years. It took a week of running the head over folded up kitchen roll soaked in the cleaner to get it printing again - it has worked perfectly ever since.

- Open the main window/door
- Press down on the cutter and move the carriage to the left
- Locate the capping pad. It should be a multi-colour fabric pad, usually orange and black.
- With an eyedropper of distilled water, soak the pad to the point of spill over.
- Allow the water to be absorbed (2-3 minutes should do the trick)
- Repeat, and return the carriage to it's home position while still wet
- Wait 3 minutes for absorption
- Run a standard clean cycle (not a power clean)

"If you still experience trouble, try the following:

"After step 2, lay down a half-folded wet paper towel (do not fold more than once as this will be too thick) in the carriage path Run the carriage over the paper towel and center it

"Grab the edges of the paper towel and "shimmy" the back of the carriage. This will wipe off some of the more stubborn dried ink chunks around the edges of the print head. *Be careful not to tear the paper towel as this can leaves hard to remove pieces of paper towel lodged in the back of the carriage.

"Continue with step 3 in the first procedure.

"'After step 5, reach in and locate the rubber wiper blade. Wipe the blade with a damp paper towel until clean. Finish the first procedure."

Hopefully you will never have to use a procedure like that. As mentioned, I have not personally used that procedure although I have had my share of ink clean-ups to deal with.

To avoid print heads drying up, simply run a test sheet every two weeks or so. Just moving a little ink through the print heads periodically will keep them unclogged.

Pictures Stuck to Glass

Un-Du by Aspen Products is a solvent that can help release pictures stuck to glass, old tape, and other hard-to-remove stuff.

(It is the studio policy at Vashon Island Imaging not to remove clients' artwork from frames, due to liability issues. However, we provide facilities and tools with which they can do it themselves. The policy same applies to the dis-assembly and re-assembly of framed work.)

Stitched panorama of Victoria B.C. required extensive dark-tone control. The 360-degree view was shot over a 12-hour period. Daylight shots provided dark-tone detail for matching night versions

Folding Made Easy

Scor-Pal by Diana Crick is useful for precision paper scoring that is made fast and easy by grooved indentations that guide the scoring tool. If you make a lot of cards and folders, this tool is a must have item. Folding never went faster.

Scor-Pal *has grooves that guide a special tool for scoring paper. There are guideing paper for folding is made easier with a* Scor-Pal.

Standard Paper and Envelope Sizes

Following now is a section containing information about the standard paper and envelope sizes for the US and many other parts of the world.

In the giclee business most of these sizes are irrelevant as we normally print on stocks that come in traditional photo-paper and film sizes, as well as media that comes in rolled form.

Nonetheless, giclees can be trimmed to any of these sizes from printed rolls or sheets. Furthermore, you may be asked to print to a size that may be included with other materials being made to a particular size.

Most useful in my opinion is the ability to quickly see the European equivalents to US sizes, and vice versa. It is astounding how many different sizes there are, especially among envelopes. Can you imagine being an envelope printer... the amount of stuff you'd have to stock to fulfil orders would require a warehouse to store it all in.

Daylight frames were converted into high-contrast highlight masks blended (lighten) with the night frames. Dark tone range in night shots was expanded using shadow control masks.

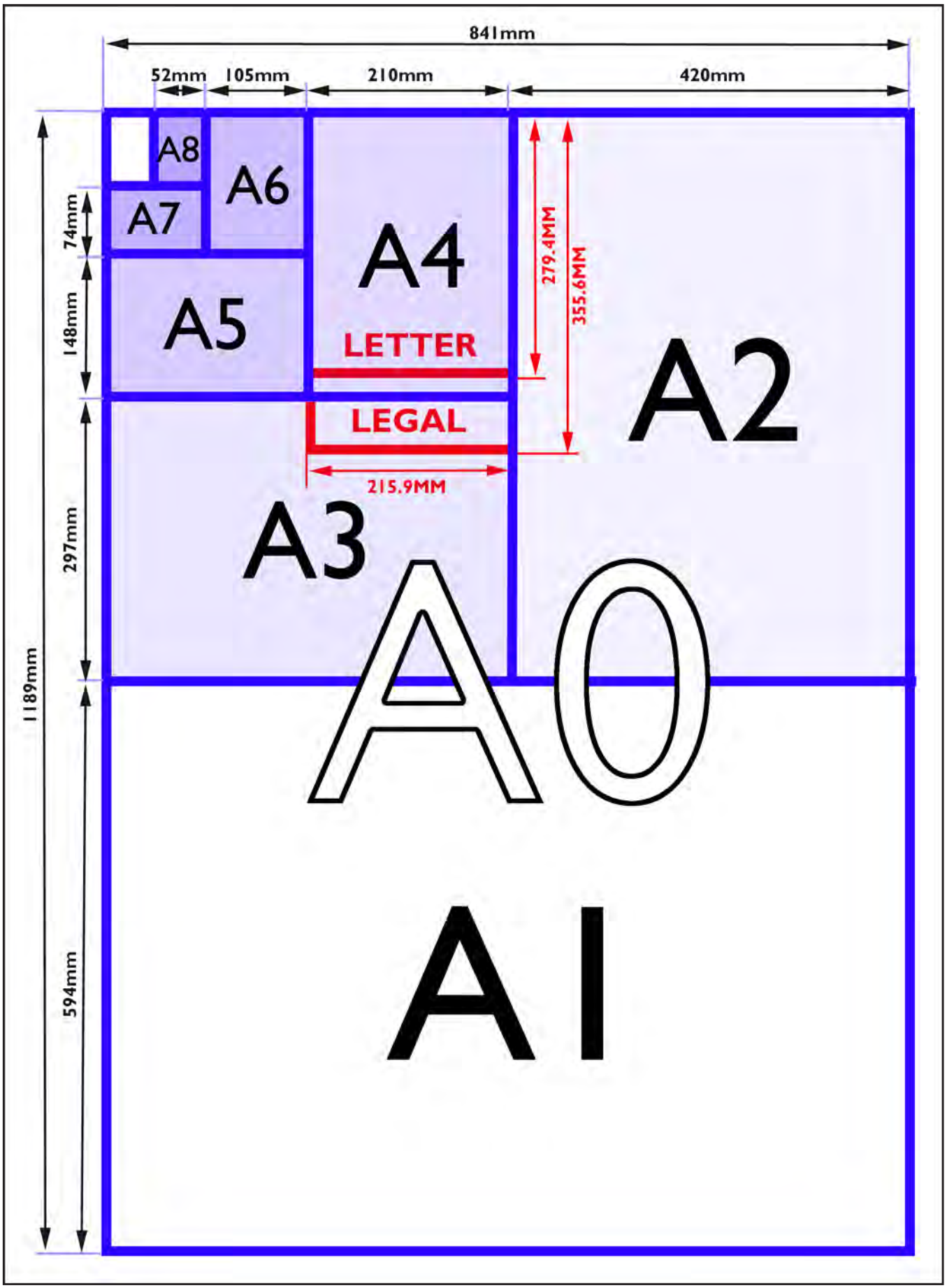
STANDARD ENVELOPE SIZES

U.S. Name	U.S. Size	Metric Equivalent
Announcement		
A2	4 3/8 X 5 3/4 inches	111 X 146 mm
A6	43/4 X 6 1/2 inches	121 X 165 mm
A7	51/4 X 7 1/4 inches	133 X 184 mm
A8	51/2 X 8 1/8 inches	140 X 206 mm
A9	5 3/4 X 8 3/4	146 X 222 mm
A10	6 X 9 1/2 inches	152 X 241 mm
Slim	3 7/8 X 8 7/8 inches	98 X 225 mm
Baronial		
2	3 3/16 X 4 1/4 inches	83 X 108 mm
4	3 5/8 X 4 5/8 inches	89 X 117 mm
5	4 1/8 X 5 1/8 inches	105 X 130 mm
5 ¼	4 1/4 X 5 1/4 inches	108 X 133 mm
5 ½	4 3/8 X 5 5/8 inches	111 X 149 mm
5 ¾	4 1/2 X 5 3/4 inches	114 X 146 mm
6	5 X 6 inches	127 X 152 mm
Booklet		
3	4 1/4 X 6 1/2 inches	108 X 165 mm
5	5 1/2 X 8 1/2 inches	140 X 216 mm
6	5 3/4 X 8 7/8 inches	146 X 225 mm
6	6 X 9 inches	152 X 229 mm
7	6 1/4 X 9 5/8 inches	159 X 244 mm
7	7 1/2 X 10 1/2 inches	190 X 266 mm
9	8 3/4 X 11 1/2 inches	218 X 292 mm
9 1/2	9 X 12 inches	229 X 305 mm
10	9 1/2 X 12 5/8 inches	241 X 320 mm
13	10 X 13 inches	254 X 330 mm
Catalogue		
1	6 X 9 inches	152 X 229 mm
1 3/4	6 1/2 X 9 1/2 inches	165 X 241 mm
2	6 1/2 X 10 inches	165 X 254 mm
3	7 X 10 inches	179 X 254 mm
6	7 1/2 X 10 1/2 inches	190 X 266 mm
7	8 X 11 inches	203 X 279 mm
8	8 1/4 X 11 1/4 inches	209 X 285 mm
9 1/2	8 1/2 X 10 1/2 inches	215 X 266 mm
9 3/4	8 3/4 X 11 3/4 inches	218 X 297 mm
10 1/2	9 X 12 inches	229 X 305 mm

U.S. Name	U.S. Size	Metric Equivalent
12 1/2	9 1/2 X 12 1/2 inches	241 X 317.5 mm
13 1/2	10 X 13 inches	254 X 330 mm
14 1/2	11 1/4 X 14 1/4 inches	285 X 362 mm
14 3/4	11 1/2 X 14 1/2 inches	292 X 368 mm
Commercial		
A2	4 3/8 X 5 3/4 inches	111 X 146 mm
A6	4 3/4 X 6 1/2 inches	120 X 165 mm
A7	5 1/4 X 7 1/4	133 X 184 mm
A8	5 1/2 X 8 1/8	140 X 206 mm
A9	5 3/4 X 8 3/4	146 X 222 mm
A10	6 X 9 1/2	152 X 241 mm
6 1/4	3.5 X 6 inches	89 X 152 mm
6 3/4	3.5/8 X 6 1/2 inches	92 X 165 mm
7 3/4 (Monarch)	3 15/16 X 7 1/2 inches	104 X 190 mm
9	3 7/8 X 8 7/8 inches	98 X 226 mm
10	4 1/8 X 9 1/2 inches	105 X 241 mm
11	4 1/2 X 10 3/8 inches	114 X 261 mm
12	4 3/4 X 11 inches	121 X 279 mm
14	5 X 11 1/2 inches	127 X 292 mm
ISO (Metric)		
C3	12 3/4 X 18 inches	324 X 458 mm
B4	9 7/8 X 13 7/8 inches	250 X 353 mm
C4	9 X 12 3/4	229 X 324 mm
B5	7 X 9 7/8 inches	176 X 250 mm
C5	6 3/8 X 9 inches	162 X 229 mm
B6	5 X 7 inches	125 X 176 mm
C6	4 1/2 X 6 3/8 inches	114 X 162 mm
DL	4 1/4 X 8 3/4 inches	220 X 110 mm
C6/C5	4.5 X 9 inches	114 X 229 mm
C7/6	3 1/4 X 6 3/8 inches	81 X 162 mm
C7	3 1/4 4 1/2 inches	81 X 114 mm
E3	11 X 15 3/4	280 X 400 mm
Other		
Japanese #3	4.7 X 9.3 inches	120 X 235 mm
Japanese #4	3.5 X 8.1 inches	90 X 205 mm
Hp	4.5 X 5.8 inches	114 X 146 mm
Hp	5.8 X 8.8 inches	146 X 222 mm

STANDARD PAPER SIZES		
U.S. Name	**U.S. Size**	**Metric Equivalent**
Index Card	3 X 5 inches	76 X 127 mm
Index Card	4 X 6 inches	102 X 152 mm
Index Card	5 X 8 inches	127 X 203 mm
Hagak	3.9 X 5.8 inches	100 X 148 mm
Monarch	3.875 X 7.5 inches	98 x 190 mm
A (letter)	8.5 x 11 inches	216 x 279 mm
Legal	8.5 x 14 inches	216 x 356 mm
B5	7.2 x 10.1 inches	182 x 257 mm
Note / Executive	7.25 X 10.5 inches	184 X 267 mm
B (Ledger/Tabloid)	11 x 17 inches	279 x 432 mm
Super B	13 x 19 inches	330 x 483 mm
C	17 x 22 inches	432 x 559 mm
D	22 x 34 inches	559 x 864 mm
E	34 x 44 inches	864 x 1118 mm
Metric Name	**Metric Size**	**U.S. Equivalent**
A5	148 x 210 mm	5.8 x 8.3 inches
A4	210 x 297 mm	8.3 x 11.7 inches
A3	297 x 420 mm	11.7 x 16.5 inches
A3+	329 x 483 mm	13 x 19 inches
A2	420 x 594 mm	16.5 x 23.4 inches
A1	594 x 841 mm	23.4 x 33.1 inches
A0	841 x 1189 mm	33.1 x 46.8 inches

EUROPEAN SERIES A PAPER SIZES



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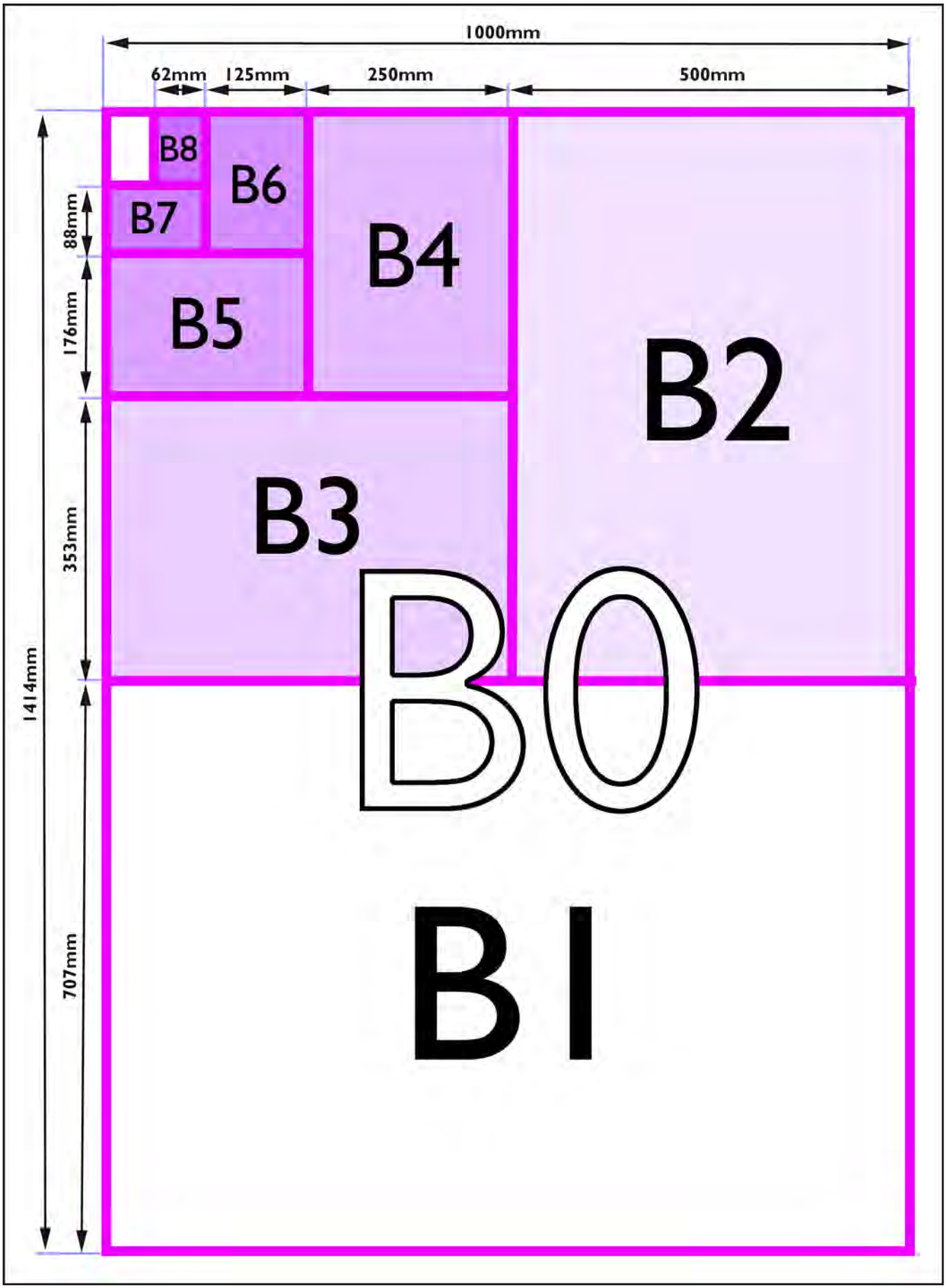

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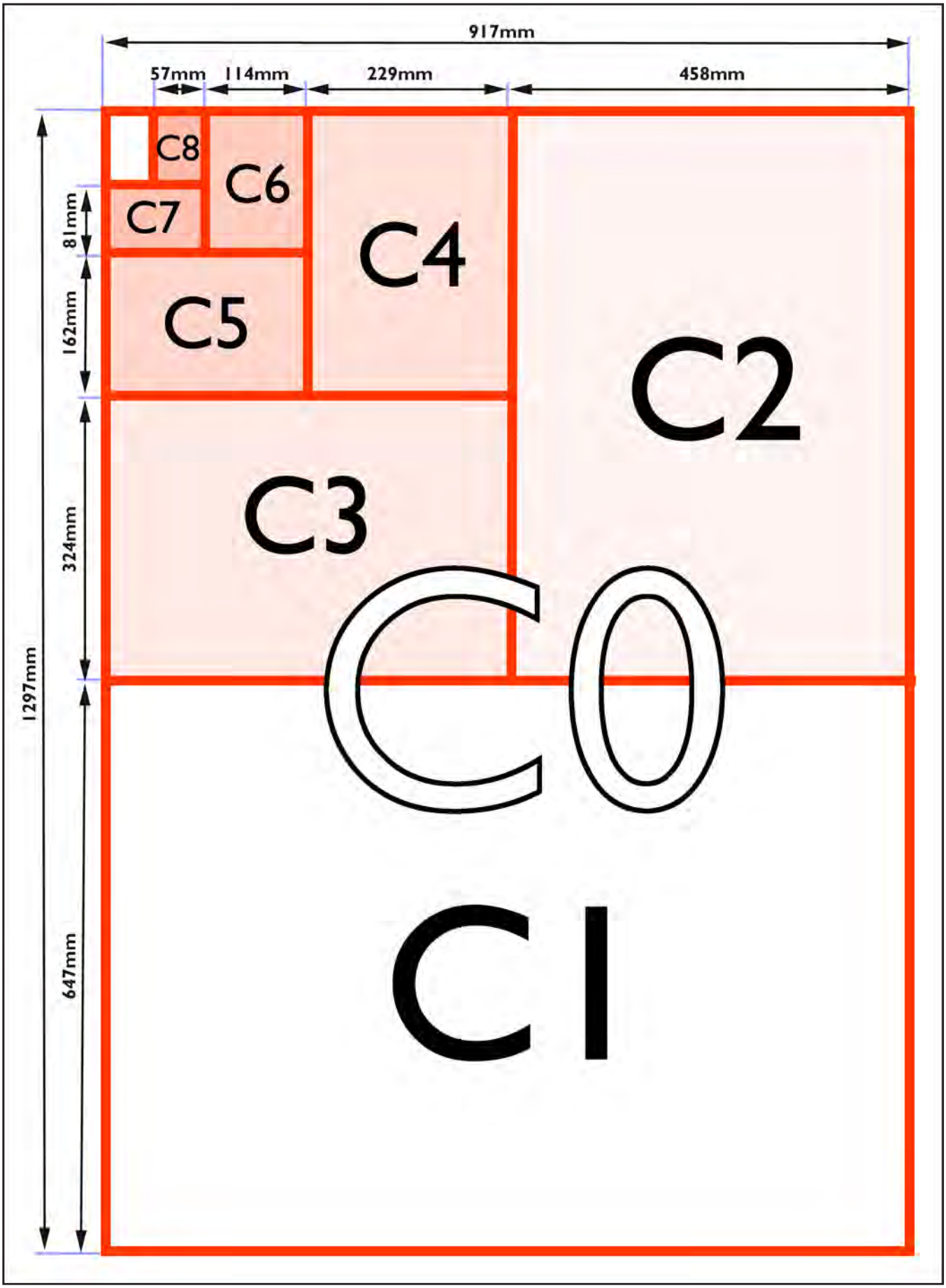
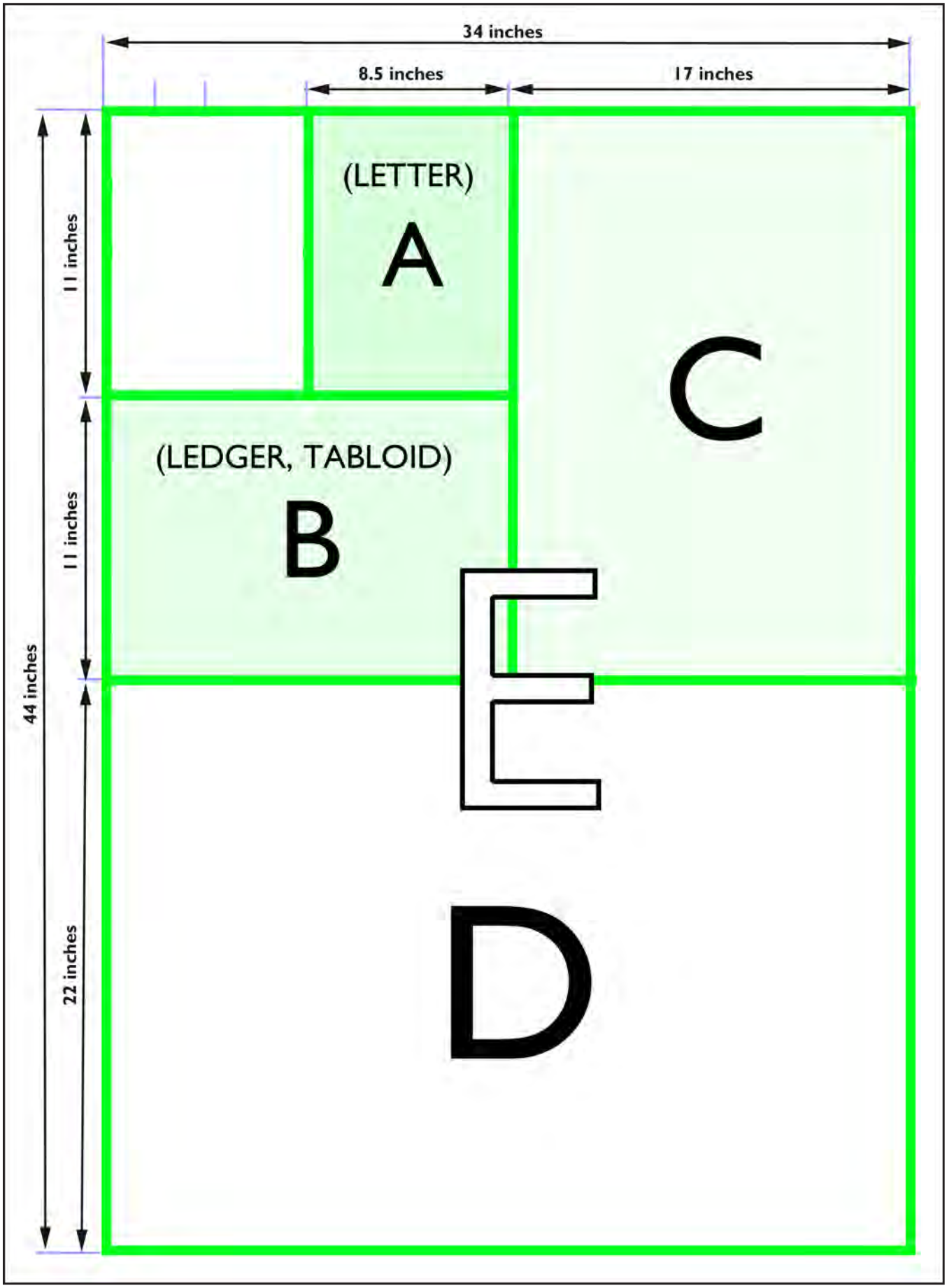


UNITED STATES PAPER SIZES



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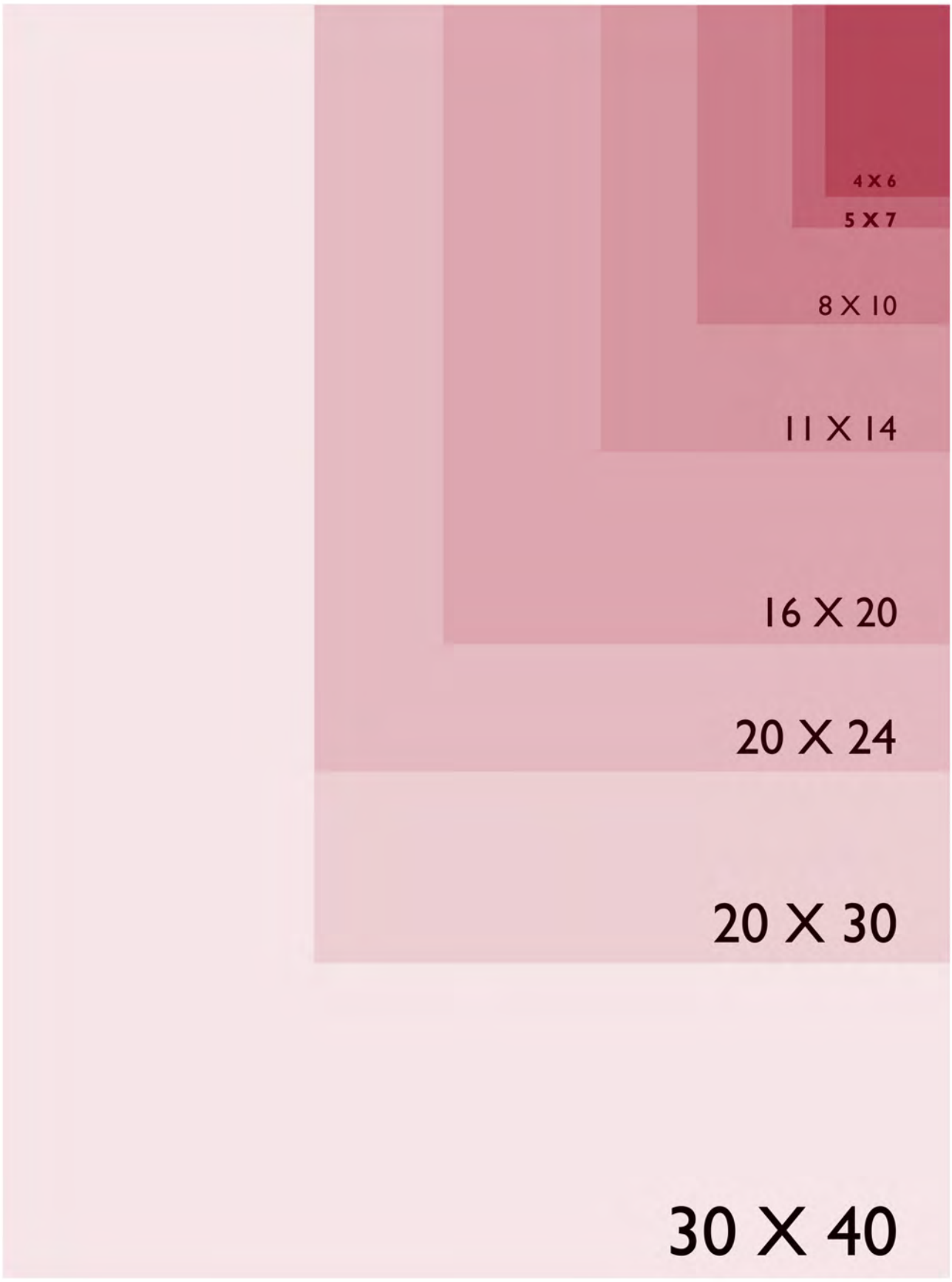


Andrea Standing No. 2 © Douglas Mesney 1968-2010

Glossary of Paper Terms

Acid Free (Neutral pH):
Papers that are without acid in the pulp. Acid free papers have a pH of 7.0. If prepared properly, papers made from any fiber can be acid free.

Archival Paper:
A paper with long-standing qualities, acid free, lignin free, usually with good color retention.

Buffering:
The neutralizing of acids in paper by adding an alkaline substance (usually calcium carbonate or magnesium carbonate) into the paper pulp. The buffer acts as a protection from the acid in the paper or from pollution in the environment.

Cold Pressed:
A paper surface with slight texture produced by pressing the finished sheet between cold cylinders.

Deckle Edge:
The feathery edge, which is the result of the natural run-off of wet pulp when making paper by hand and mould, or the result of sheets being torn when wet. The edge is simulated in machine made papers by cutting them with a stream of water when still wet.

Dimensional Stability:
The degree to which a paper will maintain its size and shape when subjected to changes in moisture content and relative humidity.

Grain:
Direction of fibers in a sheet of paper. Long grain describes fibers running parallel to the longest side of a sheet. short grain running parallel to the short side.

Grams per square meter:
The gram weight of a hypothetical square meter of a particular type of paper, and a good comparative measure because it does not vary with sheet size.

Handmade Paper:
Paper made by hand using a mould (a frame covered with a flat, rigid screen or flexible screen). In both cases the mould is covered by a flat frame called a deckle, to contain the run-off of wet pulp, dipped into a vat of wet pulp, shaken to distribute the fibers evenly and drained of its excess water. The wet mat of fibers remaining in the newly formed sheet is then dried against

blankets & may be hot pressed, cold pressed, or air dried.

Hot Pressed:
A paper surface that is smooth produced by pressing a finished sheet through hot cylinders.

Laid Papers:
Papers with a "grid" pattern in the sheet, resulting from the pulp resting against wires on the papermaking mould screen. "Laid" lines are closely spaced while "chain" lines are farther apart & run parallel with the grain direction of the sheet, important when folding papers, especially to bookbinders.

Lightfastness:
The speed at which a pigment or colored paper fades in sunlight.

Lignin:
A component of the cell walls of plants that occurs naturally, along with cellulose. Lignin is largely responsible for the strength and rigidity of plants, but its presence in paper is believed to contribute to chemical degradation. To a large extent, Lignin can be removed during manufacturing.

Nap:
A slight surface texture of some writing surfaces.

Parchment:
Animal skins or linings stretched and prepared as writing/painting surfaces. Produces a smooth, buttery surface.

Ply:
A single layer of paper. A term used when several sheets of paper are laminated together to form a board.

pH:
In chemistry, pH is a measure of the concentration of hydrogen ions in a solution, which is a measure of acidity or alkalinity. The pH scale runs from 0 to 14 and each number indicates a ten fold increase. Seven is pH neutral: numbers below 7 indicate increasing acidity, with 1 being the most acid. Numbers above 7 indicate increased alkalinity with 14 being the most alkaline. Paper with a pH below 5 is considered highly acidic. Buffered papers typically have a pH between 8.5 and 9.5.

Rag:
Formerly the principal raw material used in the making process; often meaning cotton rags. Rag content describes the amount of cotton fiber relative to the total amount of material used in the pulp. "Rag content" is not widely used (or is a misnomer) today as more and more high quality paper is made not from rag but from linters.

Rice Paper:
A common misnomer used to describe Oriental papers. There are no papers made from rice, although rice starch was traditionally used to size papers made of Kozo (mulberry plant), Gampi, or Mitsumata.

Rough:
A heavily textured paper surface produced by placing wet sheets of paper against textured blankets or air-drying (or both).

Size or Sizing:
The process by which gelatin rosin, starch or other synthetic substance is added to paper to provide resistance to the absorption of moisture or eliminating ink feathering and bleed through. Sizing added to the beater or vat of pulp is known as internal sizing. After a sheet is formed, it may be either surface sized (painted or brushed on the surface), or tub sized (immersed in a bath).

Tooth:
A very slight surface texture of paper preferred for dry media such as charcoal and pastel.

Vellum:
A paper surface that is finely textural. Vellum is also used to designate heavy weight, translucent drawing of drafting papers.

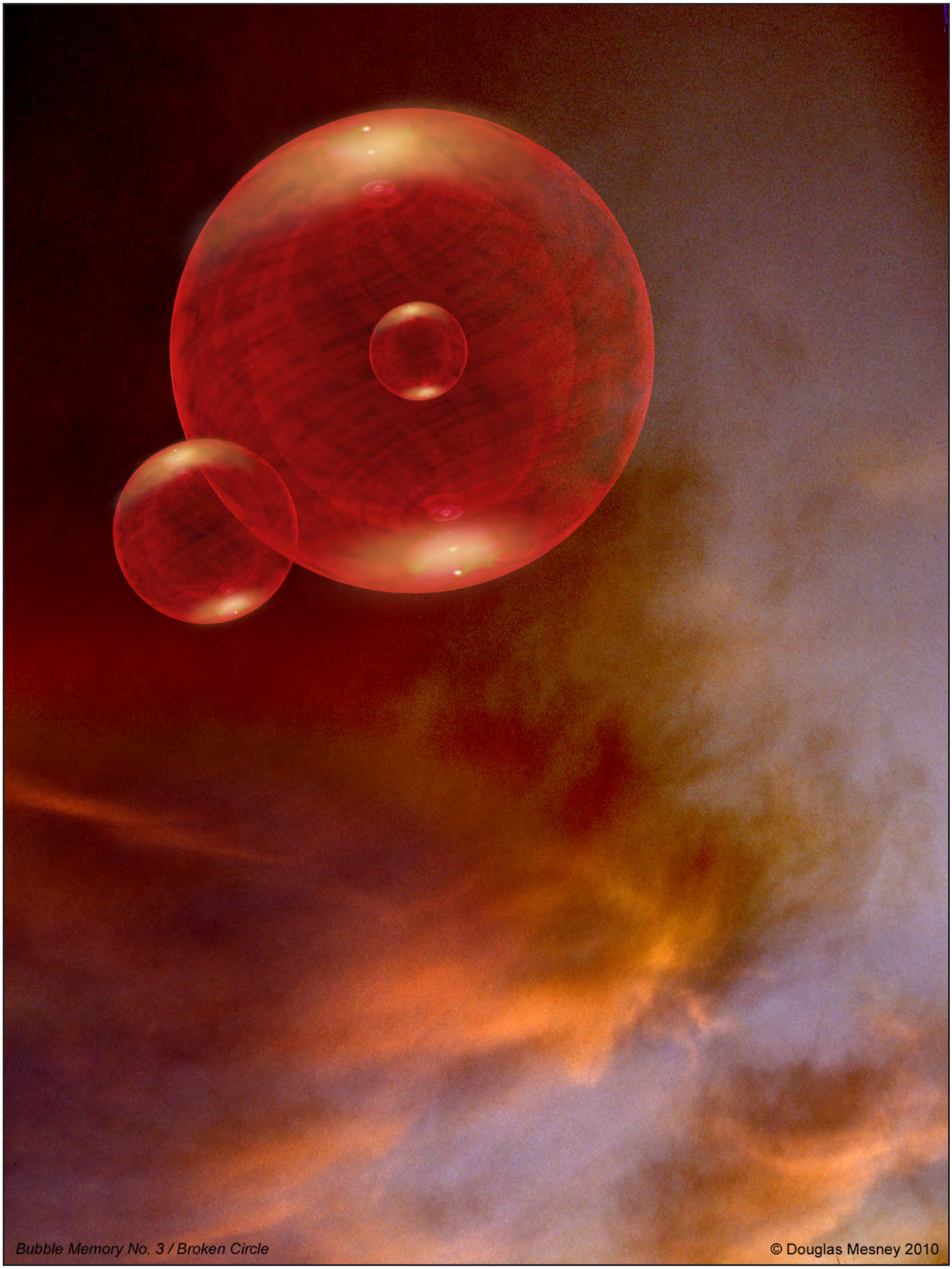
Waterleaf:
A paper with little or no sizing. Very absorbent.

Watermark:
The translucent design or name easily visible when a sheet is held to the light. A design is sewn onto the papermaking screen with raised wire. When the sheet is formed, the pulp settles in a thinner layer over the wire design.

Web:
The continuous ribbon of paper, in its full width, during any stage of its progress through the paper machine.

Wheat Paste:
A preferred archival adhesive for book arts.

Wove paper:
Papers which show no fine "laid" lines running through the sheet when held to the light.


Bubble Memory No. 3 / Broken Circle
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Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

GLOSSARY

Douglas Mesney Art Vancouver, B.C., Canada

New York Art Directors Club Graphic
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Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

GLOSSARY

"A picture is worth a thousand words." Here they are...

8-bit color
In 8-bit color, each pixel has eight bits assigned to it, providing 256 colors or shades of gray, as in a grayscale image.

24-bit color
Digital color model that uses eight bits each for the three additive colors red, green, blue. It can reproduce 256 shades of each primary color. Same as true-color image. Generally refers to 24-bit or better images. In 24 bit color, each pixel has 24 bits assigned to it, representing 16.7 million colors. 8-bits (or one byte) is assigned to each of the red, green, and blue components of a pixel.

A

A4 Paper
ISO paper size 210 x 297mm used for Letterhead.

Acetate
A transparent sheet placed over originals or artwork, allowing the designer to write instructions and\or indicate a second color for placement.

Achromatic color
Neutral white, gray, or black that has no hue.

Acid dyes
A soluble substance used for dyeing wool, silk and nylon. They are economical, react quickly, exhaust well and provide permanent results. (see also "reactive dyes")

Acid-free Paper
Paper made from pulp containing little or no acid so it resists deterioration from age. Also called alkaline paper, archival paper, neutral pH paper, permanent paper and thesis paper.

Acid Resist
An acid-proof protective coating applied to metal plates prior to etching.

Acrylic Medium
A gloss or matte extender, thinner or thickener for acrylic paint which comes in varying thicknesses. It dries to a clear, flexible non-yellowing finish and may also be used as a glue.

Additive colors
The three additive primary colors are red, green and blue. When these three colors of light are mixed in equal proportions, they will produce white light. Also known as additive primaries.

Additive Color
Color produced by light falling onto a surface, as compared to subtractive color. The additive primary colors are red, green and blue.

Addressable Resolution
The maximum resolution of any device. The finite number of pixels that any imaging device is capable of creating, manipulating or imaging.

Against the Grain (Grain Direction)
At right angles to the grain direction of the paper being used, as compared to with the grain. Also called across the grain and cross grain.

Airbrush
Pen-shaped tool that sprays a fine mist of ink or paint to retouch photos and create continuous-tone illustrations.

Algorithm
A mathematical routine that solves a problem or equation. In imaging, the term is usually used to describe the set of routines that make up a compression or color-management program and other RIP applications.

Aliasing
1.) The visual stair-stepping of edges (jagged edges) that occurs in an image when the resolution is too low. Can be caused by improper image sampling or improper image processing. (see "jaggies")
2.) In computer graphics, an undesirable effect--also known as "jaggies"--in which the edge of the image or letter is characterized by a stair-step appearance.

Alignment
A term used to refer to the proper positioning of all typefaces and size variations along an imaginary reference line.

Alpha channel
An image-editor channel used to contain a mask or partial picture element or color. Created by Alvy Ray Smith and Ed Catmull at N.Y.I.T. in 1997, the alpha channel is used to calculate the transparency of each color in an image. In a three color image, the alpha channel would be the fourth channel.

Alteration
Any change made by the customer after copy or artwork has been given to the service bureau, separator or printer. The change could be in copy, specifications or both. Also called AA, author alteration and customer alteration.

All Rights
In publishing, the purchase of all subsidiary rights to a publication, illustration, or photograph, including North American and international rights, serial rights, etc.

AM (amplitude-modulated screening)
An image screening method that uses halftones where dots vary in size but are located on a regularly-spaced grid.

Analog
Data consisting of, or systems employing, continuously variable signals or data, as opposed to discreet steps or levels of digital data.

ANSI (American National Standards Institute)
The official US standards organization, the U.S. member of the International Standards Organization (ISO), responsible for industry standards.

Anti-alias
The process of smoothing and removing of aliasing effects by electronic filtering and other techniques, such as blending of hard edges. Also, blending object-oriented art with bit-mapped art.

Anodized Plate
An offset printing plate having a treated surface in order to reduce wear for extended use.

Anti-offset Powder
Fine powder lightly sprayed over the printed surface of coated paper as sheets leave a press. Also called dust, offset powder, powder and spray powder.

Antique Paper
Roughest finish offered on offset paper.

Aqueous Coating
1.) Coating in a water base and applied like ink by a printing press to protect and enhance the printing underneath.

2.) Water-based coating applied by a printing press to protect and enhance the printed surface.

Artwork
All original copy, including type, photos and illustrations, intended for printing. Also called art.

Archival
Of or about or pertaining to archives. A term that has been used extensively in conservation literature, but that lacks an internationally accepted definition. General understanding: with characteristics of long term stability (as in: archival quality). Considered meaningless unless qualified with additional information.

Archiving
Retention of images, often on CD-ROM. Information necessary to reproduce the print is also archived, including ink, tables, sizes, and media used.

Artifact
In digital graphic applications, unwanted visual anomalies or defects generated by an input or output device, or by a software operation, that degrade image quality. (see also "aliasing" and "moiré pattern")

Artist's proof
One of a small group of prints set aside from the edition for the artist's use; a number of printer's proofs are sometimes also done for the printer's use.

ASTM International--formerly ASTM
(American Society for Testing and Materials)
One of the world's largest international voluntary standards-writing organizations. Produces Standards (Test Methods, Recommended Practices, Specifications) for products, systems, and services. Volunteers do the testing and writing; conformance to the Standards is voluntary (with a few notable exceptions, i.e., ASTM D4236).

Ascender
The part of a lowercase letter which rises above the main body, as in the letters "b", "d", "h", and "k".

Author's Alterations (AA's)
At the proofing stage, changes that the client requests to be made concerning original art provided. AA's are considered an additional cost to the client usually.

B

Back Matter
All the material that follows the main text of the book such as appendix, bibliography, and glossary.

Back Up
To print on the second side of a sheet already printed on one side. To adjust an image on one side of a sheet so that it aligns back-to-back with an image on the other side.

Banding
Patterns (stripes) on a print caused by insufficient color or gray-scale ranges within the output device's image processor, or insufficient information contained within the original scan. Creates harsh, well-defined transitions between different ranges.

Banner
In typography, any large headline, especially one that spans the width of a page.

Bar printer
Another term, English in origin, for inkjet printer.

Base Art
Copy pasted up on the mounting board of a mechanical, as compared to overlay art. Also called base mechanical.

Baseline
An invisible horizontal line on which the feet of all characters on a line of type are set, used for proper alignment of type.

Base Negative
Negative made by photographing base art.

Basic Size
The standard size of sheets of paper used to calculate basis weight in the United States and Canada.

Basis Weight
In the United States and Canada, the weight, in pounds, of a ream (500 sheets) of paper cut to the basic size. Also called ream weight and substance weight (sub weight). In countries using ISO paper sizes, the weight, in grams, of one square meter of paper.

Beziér curve
Curved-line segments created by establishing endpoints or anchor points, and at least one transient point or node. Named after French engineer Pierre Beziér.

Bind
Usually in the book arena, but not exclusively, the joining of leafs or signatures together with either wire, glue or other means.

Bindery
Usually a department within a printing company responsible for collating, folding and trimming various printing projects.

Binding and Finishing
Activities performed on printed material after printing. Binding involves fastening individual sheets together, while finishing involves additional decorative actions such as die-stamping and embossing.

BIT
Derived from Binary Digital T, the smallest unit of information in a computer. '1' or '0. 8 bits' = '1 byte'. Coined by J.W. Tileu at Bell Labs in 1948.

Bit Depth
The maximum number of bits that are used to define a pixel. A measure of the defined brightness range. The color depth or pixel values for a digital image. The number of possible colors or shades of gray that can be included in an image.

Bitmap (Bitmapped)
1.) A rasterized graphic image formed by a rectangular grid of pixels or dots.
2.) In computer graphics, the collection of individual dots--or pixels--that make up a screen image.

Black
The fourth color in process four-color printing. The "K" in CMYK. (see "Color Printing" analysis)

Black generation
The addition of black ink to the other process colors when separating an RGB color image into CMYK colors. Black generation is typically handled in one of two ways, GCR (Gray Component Replacement--replacing some of the CMY with K) or UCR (Under Color Removal-- using K only in neutral areas).

Black Point
Color that when scanned produces values of 0, 0, 0 in a scanner. Ideally, the black point is 0% neutral reflectance or transmittance. (see "white point")

Blank
Category of paperboard ranging in thickness from 15 to 48 points.

Blanket
1.) Rubber-coated pad, mounted on a cylinder of an offset press, that receives

the inked image from the plate and transfers it to the surface to be printed. 2.) A synthetic rubber mat used in offset lithography to transfer-- or "offset"--an image from a metal plate to the paper.

Bleed
1.) Printing that extends to the edge of a sheet or page after trimming. 2.) A printed image that extends beyond one or more of the finished page margins and is later trimmed so that the image "bleeds" off the edge of the sheet.

Blind Folio
A page number not printed on the page. (In the book arena, a blank page traditionally does not print a page number.)

Blind Image
Image debossed, embossed or stamped, but not printed with ink or foil.

Blocking
Sticking together of printed sheets causing damage when the surfaces are separated.

Block Text or Block Type
In typography, paragraphs set without indents.

Block Quote
A long quotation--four or more lines--within body text, that is set apart in order to clearly distinguish the author's words from the words the author is quoting.

Blow-Up
An enlargement, usually used with graphic images or photographs

Blueline
Prepress photographic proof made from stripped negatives where all colors show as blue images on white paper. Because 'blueline' is a generic term for proofs made from a variety of materials having identical purposes and similar appearances, it may also be called a blackprint, blue, blueprint, brownline, brownprint, diazo, dyeline, ozalid, position proof, silverprint, Dylux and VanDyke.

Blurb
A description or commentary of an author or book content positioned on the book jacket.

BMP file
A Windows bitmap file, with the extension ".bmp," that defines an image (such as the image of a scanned page) as a pattern of dots (pixels). From Bit mapping, the process of addressing the pixels on the screen.

Board Paper
General term for paper over 110# index, 80# cover or 200 gsm that is commonly used for products such as file folders, displays and post cards. Also called paperboard.

Body
The main text of work not including the headlines.

Body Text
The main portion of a book or other document, excluding front matter and back matter.

Boiler Plate
Blocks of repetitive type used and copied over and over again.

Bon-a-tirer or BAT (bone-ah-ti-ray)
The proof accepted by the artist that is used as the standard for comparing all subsequent prints. Some printers require a signed BAT before production printing can begin.

Bond paper
Category of paper commonly used for writing, printing and photocopying. Also called business paper, communication paper, correspondence paper and writing paper.

Book Block
Folded signatures gathered, sewn and trimmed, but not yet covered.

Book Paper
Category of paper suitable for books, magazines, catalogs, advertising and general printing needs. Book paper is divided into uncoated paper (also called offset paper), coated paper (also called art paper, enamel paper, gloss paper and slick paper) and text paper.

Book Typography
The setting and arrangement of the various parts of a book.

Border
The decorative design or rule surrounding matter on a page.

Bounce
(1) a repeating registration problem in the printing stage of production. (2) Customer unhappy with the results of a printing project and refuses to accept the project.

Brayer
A roller used for flattening, transferring or adhering together two flat surfaces.

Brightness
The overall intensity of the image. The lower the brightness value, the darker the image; the higher the value, the lighter the image will be. (see chroma)

Bristol Paper
General term referring to paper 6 points or thicker with basis weight between 90# and 200# (200-500 gsm). Used for products such as index cards, file folders and displays.

Broadside
T erm used to indicate work printed on one of a large sheet of paper.

Bromide
A photographic print created on bromide paper.

Broken Carton
Carton of paper from which some of the sheets have been sold. Also called less carton.

Bronzing
A problem with certain ink/paper combinations where darkened, or "bronzed," reflections from inked areas are juxtaposed with areas where little or no ink is present, with the resulting full reflection of the of the paper. Also called "gloss differential."2.) The effect produced by dusting wet ink after printing and using a metallic powder.

Build a Color
To overlap two or more screen tints to create a new color. Such an overlap is called a build, color build, stacked screen build or tint build.

Bulk
Thickness of paper relative to its basic weight.

Bullet
A dot or similar marking to emphasize text.

Burst Perfect Bind
To bind by forcing glue into notches along the spines of gathered signatures before affixing a paper cover. Also called burst bind, notch bind and slotted bind.

Butt Register
Register where ink colors meet precisely without overlapping or allowing space between, as compared to lap register. Also called butt fit and kiss register.

Buy Out
To subcontract for a service that is closely related to the business of the

organization. Also called farm out. Work that is bought out or farmed out is sometimes called outwork or referred to as being out of house.

Byline
In magazine and newspaper publishing, a line added to an article identifying the author (and other contributors) of the article.

C

C1S and C2S
Abbreviations for coated one side and coated two sides.

Calender
To make the surface of paper smooth by pressing it between rollers during manufacturing.

Calibration
The act of setting or adjusting the color settings of one device relative to another, such as a monitor to a printer, or a scanner to a film recorder. Or, it may be the process of adjusting the color of one device to some established standard.

Caliper
1) Thickness of paper or other substrate expressed in thousandths of an inch (mils or points), pages per inch (ppi), thousandths of a millimeter (microns) or pages per centimeter (ppc).
2) Device on a sheetfed press that detects double sheets or on a binding machine that detects missing signatures or inserts.

Callout
In typography, any of several different typographic elements that are, in essence, "called-out" of the main body text, such as text pasted onto an illustration to identify specific portions of it.

Camera-Ready
To-be-printed copy and/or artwork that requires no additional layout, positioning, redrawing, or typesetting or, in other words, is prepared to be photographed for a negative or printing plate. Synonymous terms are camera-ready copy and camera-ready art.

Camera-Ready Art
Alternate term for camera-ready. See Camera-Ready.

Camera-Ready Copy
1.) Alternate term for camera-ready. See Camera-Ready.
2.) Mechanicals, photographs and art fully prepared for reproduction according to the technical requirements of the printing process being used. Also called finished art and reproduction copy.

Camera Service
Business using a process camera to make photostats, h alftones, plates and other elements for printing. Also called prep service and trade camera service.

Cap Height
In typography, the distance from the baseline to the top of the capital letters.

Caption
In typography and page layout, any strictly descriptive text accompanying an illustration, located beneath it, alongside it, or above it.

Capture
Acquiring information, such as an image, with a scanner or digital-camera device.

Carbonless Paper
Paper coated with chemicals that enable transfer of images from one sheet to another with pressure from writing or typing.

Carload
Selling unit of paper that may weigh anywhere from 20,000 to 100,000 pounds (9,090 to 45, 454 kilos), depending on which mill or merchant uses the term. Abbreviated CL.

Carton
Selling unit of paper weighing approximately 150 pounds (60 kilos). A carton can contain anywhere from 500 to 5,000 sheets, depending on the size of sheets and their basis weight.

Cartridge
The container for inks in inkjet printers. Chipped cartridges have electronic chips on them that can prevent refilling. Unchipped they can be reused with inks other than those of the manufacturer.

Case
Covers and spine that, as a unit, enclose the pages of a casebound book.

Case Bind
To bind using glue to hold signatures to a case made of binder board covered with fabric, plastic or leather. Also called cloth bind, edition bind, hard bind and hard cover.

Cast-coated Paper
1.) High gloss, coated paper made by pressing the paper against a polished, hot, metal drum while the coating is still wet.
2.) Paper dried under pressure against a heated, polished cylinder to produce a high-gloss enamel finish.

Catalog Paper
Coated paper rated #4 or #5 with basis weight from 35# to 50# (50 to 75 gsm) commonly used for catalogs and magazines.

CCD (Charged coupled device)
Light-detection device used in many popular scanners, digital cameras, and video cameras that generates electrical current in direct proportion to how much light strikes areas of the sensor.

CD-R (CD-Recordable)
A CD format that allows the users to record data to a disc when using the proper hardware. Recorded data is not erasable.

CD-RW
A CD format that allows users to erase data.

Certificate of Authenticity
1.) A written or printed description of the multiple which is to be sold, exchanged, or consigned by an art dealer. [CALIF. CIVIL CODE] 2.) A written statement by an art merchant confirming, approving, or attesting to the authority of a work of fine art or multiple, which is capable of being used to the advantage or disadvantage of some person. [IOWA CIVIL CODE]
3.) A written statement disclosing certain key facts about a multiple print.

Chain Dot
1) Alternate term for elliptical dot, so called because midtone dots touch at two points, so look like links in a chain.
2) Generic term for any midtone dots whose corners touch.

Chain Lines
1) Widely spaced lines in laid paper.
2) Blemishes on printed images caused by tracking.

Chalking
Deterioration of a printed image caused by ink that absorbs into paper too fast or has long exposure to sun and wind making printed images look dusty. Also called crocking.

Channel
A component of a digital image that carries the data for a color component or a mask.

Character
Any letter, figure, punctuation, symbol or space.

Check Copy
1) Production copy of a publication verified by the customer as printed,

finished and bound correctly.
2) One set of gathered book signatures approved by the customer as ready for binding.

Choke
Technique of slightly reducing the size of an image to create a hairline trap or to outline. Also called shrink and skinny.

Chromaticity
Dimensions of color stimulus expressed in terms of hue and saturation, or redness-greenness, and yellowness-blueness, excluding the luminous intensity; generally expressed as a point in a plane of constant luminance.

Chine Collé
Two sheets of paper pressed (glued) together to become a single sheet.

Chop
The impression made by the artist's or the printer's seal on the paper, usually near the bottom.

Chrome
1.) Strength of a color as compared to how close it seems to neutral gray. Also called depth, intensity, purity and saturation.
2.) A measure of saturation associated with color; degree of color purity; relative brightness of a hue when compared to another.

Chromagenic Print
A color print made from a color transparency or negative in which the print material has at least three emulsion layers or silver salts. Each layer is sensitized to one of the three primary colors and records information about the color makeup in the photograph. In the initial development, a silver image is formed in each layer. With further development dye couplers are added that when united with the silver form dyes of the appropriate colors in the emulsion layers. When seen against a white print stock, the layers appear in full color.

Chromatic
Perceived as having a hue; not white, gray or black.

CIE (Commission International de l'Eclairage)
The international commission on illumination. A set of color standards based on mathematical modeling of human vision and light. CIE color spaces are used for the communication of color independent of a specific device.

CIE LAB (L*a*b*)
A color model to approximate human vision. The model consists of three variables: L* for luminosity, a* for one color axis, and b* for the other color axis.

Clip Art
Ready made artwork sold or distributed for clipping and pasting into publications. Available in hard-copy books, and in electronic form, as files on a disk.

Clipping
The grouping (usually unwanted) of all tones or colors above or below a certain value into one composite tone. The loss of visual information caused by too little contrast, in which certain gray scale values are lost or compressed either into the range of pure white or pure black.

Close Up
A mark used to indicate closing space between characters or words. Usually used in proofing stages.

CLUT (color look up table)
A set of conversion values for the display of color images in an RGB environment.

CMS
(see "color management")

CMY (Cyan, Magenta, Yellow)
Three subtractive primary colors used in color printing. In theory, the combination of pure CMY inks produces black; in reality, black must be added to produce a full color gamut.

CMYK
Cyan, Magenta, Yellow, and Black (or Key) are the four colors used in process-color printing. Also known as subtractive color, the color black is achieved by the presence of all inks.

Coarse Screen
Halftone screen with ruling of 65, 85 or 100 lines per inch (26, 34 or 40 lines centimeter).

Coating
The process of treating media or substrates to accept inkjet inks. Also, a thin covering providing protection from UV-induced fading, smudging and fingerprints, which may or may not improve the permanence of the print because most fading is due to visible light.

Coated Paper
Paper with a coating of clay and other substances that improves reflectivity and ink holdout. Mills produce coated paper in the four major categories cast, gloss, dull and matte.

Cockling
1) Describes the wavy or wrinkled appearance of paper when ink absorption limits have been exceeded.
2) A printing defect typically seen as deforming wrinkles on paper and usually caused by heavy ink loads or moisture.

Cold Press Paper
Printmaking and watercolor paper made in a mold, roughly textured.

Collage
Collage involves the creation of artworks that include elements that have previous existence as separate items. They may be found elements or transformed elements, or elements created entirely by the artist. Digital collages may be defined as digitally created artworks that involve the bringing together of separate images (which may or may not have existed in non-digital form and which may or may not have been created or altered by the artist) and digitally "pasting" them in place in order to create a new work. Digital collages may also contain digital drawing, digital painting, or other digital media. In both montage and collage, multiple sources are used to create a single image. In montage, the disparity of the sources is invisible. In collage, the disparity of the sources is visible, sometimes very much so.

Collate
To organize printed matter in a specific order as requested.

Collating Marks
Mostly in the book arena, specific marks on the back of signatures indicating exact position in the collating stage.

Colorant
Any substance that imparts color to another material or mixture. Colorants can be dyes or pigments.

Color Balance
1.) The ability to reproduce the colors of a scene to some acceptable standard.
2.) Refers to amounts of process colors that simulate the colors of the original scene or photograph.

Color Blanks
Press sheets printed with photos or illustrations, but without type. Also called shells.

Color Break
In multicolor printing, the point, line or space at which one ink color stops and another begins. Also called break for color.

Color Calibration
A system of software and/or hardware that adjusts and coordinates

colors between two or more digital devices. Color calibration systems commonly compare device color profiles and translate one color model into a device-independent language.

Color Compression
Shrinking the color gamut of the original to the color gamut a device will represent.

Color Chart
A set of color swatches, or samples of printed color that are used to accurately mix, match, choose, and communicate a particular color.

Color Cast
Unwanted color affecting an entire image or portion of an image.

Color Control Bar
Strip of small blocks of color on a proof or press sheet to help evaluate features such as density and dot gain. Also called color bar, color guide and standard offset color bar.

Color Correct
To adjust the relationship among the process colors to achieve desirable colors.

Color Curve
1.) A graphic mechanism for displaying color measurements and for making color changes to an image. User adjustments to the angle and slope of the curve implement color changes to one or all of an image's color channels.
2.) Instructions in computer software that allow users to change or correct colors. Also called HLS and HVS tables.

Color Depth
(see "bit depth")

Color Electronic Prepress System
Computer, scanner, printer and other hardware and software designed for image assembly, color correction, retouching and output onto proofing materials, film or printing plates. Abbreviated CEPS.

Color Gamut
1.) The entire range of hues possible to reproduce using a specific device, such as a computer screen, or system, such as four-color process printing.
2.) A range of colors that can be reproduced by a given system.

Colorimetric
Of, or relating to, values giving the amounts of three colored lights or receptors--red, green, and blue. Adjective used to refer to measurements converted to psychophysical terms describing color or color relationships.

Colorimeter
An instrument used for color measurement based on optical comparison with standard colors.

Colorimetry
Light measurements converted to a psychophysical description or notation which can be correlated with visual evaluations of color and color differences.

Color Key
Brand name for an overlay color proof. Sometimes used as a generic term for any overlay color proof.

Color Management (Color Management System)
An technology that uses profiles of the input and output devices to maximize color accuracy and consistency. Targets that include over 3000 colors are printed and measured with a colorimeter to create profiles for the various ink/media combinations. A combination of software and or hardware devices used to produce accurate color results throughout a digital-imaging system.

Color Matching System
A set of color charts and/or swatches--either in printed form or as computer-generated samples--used to compare, match, and specify different colors.

Color Model
1.) Way of categorizing and describing the infinite array of colors found in nature.
2.) A color measurement scale or system that numerically specifies the perceived attributes of color.

Color Profile
Also called "device profile," or simply "profile." This term refers to the relationship between the color models of the system devices.

Color Saturation
Color strength. A measure of color purity, or dilution by a neutral.

Color Space
Three-dimensional mathematical model enclosing all possible colors. The dimensions may be described in various geometries giving rise to various spacings. The parts of the visible spectrum which can be reproduced in a given medium. (i.e., RGB for computer monitors, CMYK for print, web safe index colors for the world wide web)

Color Separation
1) Technique of using a camera, scanner or computer to divide continuous-tone color images into four halftone negatives.
2) The product resulting from color separating and subsequent four-color process printing. Also called separation.
3.) A means of dividing a full-color photograph into four separate components, corresponding to the four primary colors used in process color printing - cyan, magenta, yellow, and black.
4.) The process of separating a color image into four subtractive colors, CMYK, either by photographic or electronic processes, thus producing a set of four films or a computer file.

Color Sequence
Order in which inks are printed. Also called laydown sequence and rotation.

Color Shift
Change in image color resulting from changes in register, ink densities or dot gain during four-color process printing.

Color Swatch
A sample of a specific color--either printed or stored digitally--used to describe a particular printing ink or combination of printing ink colors.

Color Temperature
The color spectrum of a "black body" radiator heated to a given temperature on the Kelvin scale. The manufacturer's method of indicating the color of a light source in degrees Kelvin (K); i.e., 2700K (yellow/white), 4100K (white), 5500K (blue/white).

Color Transparency
Film (transparent) used as art to perform color separations.

Color Wheel
Primary Colors = red, blue and yellow. (In printing; cyan, magenta, and yellow). Secondary Colors = Orange, Violet, and Green. Tertiary Colors = Colors produced by mixing two or more secondary colors, Green-Violet, Orange-Green, Violet-Orange, etc.

Complementary Colors
Two colors that, when combined, create neutral gray. On a color wheel complements are directly opposite the axis from each other; blue/yellow, red/green, and so on.

Column Gutter
The space between columns of type.

Comb Bind
To bind by inserting the teeth of a flexible plastic comb through holes punched along the edge of a stack of paper. Also called plastic bind and GBC bind (a brand name).

Commercial Printer
Printer producing a wide range of products such as announcements, brochures, posters, booklets, stationery, business forms, books and magazines. Also called job printer because each job is different.

Compression
The process of removing irrelevant information and reducing unneeded space from a file in order to make the file smaller. Compression can cause losses and distortion, depending on the method. Some types of compression can cause losses and distortion. In Run Length Encoding, rows of pixels of the same colors are stored as a number and color, reducing the file size while keeping the data intact.

Computer-generated
A misnomer that implies that no human, artistic control is required to produce artwork. In general it may mean having come through a specific kind of device, but essentially it is understood that computers do nothing without the input and control of human beings.

Complementary Colors
On a color wheel, the colors opposite of each other as in Blue and Orange, Yellow and Violet, Red and Green.

Complementary Flat(s)
The second or additional flat(s) used when making composite film or for two or more burns on one printing plate.

Composite Art
Mechanical on which copy for reproduction in all colors appears on only one surface, not separated onto overlays. Composite art has a tissue overlay with instructions that indicate color breaks.

Composite Film
Film made by combining images from two or more pieces of working film onto one film for making one plate.

Composite Proof
Proof of color separations in position with graphics and type. Also called final proof, imposition proof and stripping proof.

Composition
1) In typography, the assembly of typographic elements, such as words and paragraphs, into pages ready for printing.
2) In graphic design, the arrangement of type, graphics and other elements on the page.

Comprehensive Dummy
Simulation of a printed piece complete with type, graphics and colors. Also called color comprehensive and comp.

Comprehensive Layout
Commonly referred to as a "comp" is a stage in the page layout and design process consisting of a detailed dummy or layout of the page to be reproduced, showing the exact placement of page elements (text, illustrations, etc.) in a form comparable to that of the final print.

Condensed Font (also Condensed Type)
A font in which the set widths of the characters is narrower than in the standard typeface. Often used when large amounts of copy need to fit in a small space.

Condition
To keep paper in the pressroom for a few hours or days before printing so that its moisture level and temperature equal that in the pressroom. Also called cure, mature and season.

Contact Platemaker
Device with lights, timing mechanism and vacuum frame used to make contact prints, duplicate film, proofs and plates. Also called platemaker and vacuum frame.

Continuous Ink System (CIS)
Ink system incorporating large, bulk containers of ink, designed to enable continuous operation for much longer periods of time (than possible with original ink cartridges). Also referred to as "continuous flow system" (CFS).

Continuous Tone
1.) A photographic image containing gradient tones. For printing purposes, continuous-tone images are converted to dot patterns (halftones).
2.) Essentially, a photographic image that is not composed of halftone dots or, in other words, an image that consists of tone values ranging from some minimum density (such as white) to a maximum density (such as black).

Continuous-tone Copy
All photographs and those illustrations having a range of shades not made up of dots, as compared to line copy or halftones. Abbreviated contone.

Contrast
Tonal gradation between the highlights, midtones, and shadows in an image. High contrast implies dark black and bright white. Medium contrast implies a good spread from black to white. Low contrast implies a narrow spread of values from black to white. Also, understood in terms of "Rate of Falloff." High contrast implies a rapid transition between black and white, whereas a slow "rate of falloff" produces gradual or smooth transition between light and dark.

Converter
Business that makes products such as boxes, bags, envelopes and displays.

Contour
In typography, the setting of type in a shape in order to create the appearance of an object.

Copy
Any material that is to be typeset, be it a manuscript or typescript, or a typewritten document with handwritten changes and edits. Copy is also used to refer generally to any other page elements--including illustrations, photographs, etc--that will need to be prepared and assembled.

Copyboard
Surface or frame on a process camera that holds copy in position to be photographed.

Copyfitting
In typography, the process of estimating the point size and leading in which a particular piece of copy will need to be set to fit in a (usually) predetermined amount of space.

Copyright
Legal basis for the owner's control of the usage of his images or artworks.

Counter
In typography, the space in a letter or other character enclosed--either fully or partially--by the strokes of the character, as in the center of the letter "o".

Cover
Thick paper that protects a publication and advertises its title. Parts of covers are often described as follows: Cover 1=outside front; Cover 2=inside front; Cover 3=inside back, Cover 4=outside back.

Coverage
Extent to which ink covers the surface of a substrate. Ink coverage is usually expressed as light, medium or heavy.

Cover Paper
Category of thick paper used for products such as posters, menus, folders and covers of paperback books.

Crash
Coarse cloth embedded in the glue along the spine of a book to increase strength of binding. Also called gauze, mull and scrim.

Creep
Phenomenon of middle pages of a folded signature extending slightly

beyond outside pages. Also called feathering, outpush, push out and thrust. See also Shingling.

Crop/ Cropping.
Cutting off an undesired portion of a printed piece, photograph or other image.

Crop Marks
1.) Lines near the edges of an image indicating portions to be reproduced. Also called cut marks and tic marks.
2.) Lines drawn or printed on a photograph, overlay, or printed product to indicate the proper cropping of the image or print in question. Also spelled as one word in cropmarks.

Crossover
Type or art that continues from one page of a book or magazine across the gutter to the opposite page. Also called bridge, gutter bleed and gutter jump.

Cure
To dry inks, varnishes or other coatings after printing to ensure good adhesion and prevent setoff.

Customer Service Representative
Employee of a printer, service bureau, separator or other business who coordinates projects and keeps customers informed. Abbreviated CSR.

Cutoff
Circumference of the impression cylinder of a web press, therefore also the length of the printed sheet that the press cuts from the roll of paper.

Cut Sizes
Paper sizes used with office machines and small presses.

Cutting Machine
A machine that cuts stacks of paper to desired sizes. The machine can also be used in scoring or creasing.

Cutting Die
Usually a custom ordered item to trim specific and unusual sized printing projects.

CWT
Abbreviation for hundredweight using the Roman numeral C=100.

Cyan
1.) One of the four process colors. Also known as process blue.
2.) One of the three subtractive primary colors. (see "Color Printing" analysis)

D

DPI
Dots per inch. A measure of the detail of a print. "Apparent dpi" refers to the fact that the eye perceives a giclée as having greater detail than in does in physical reality.

D65
The CIE Standard Illuminant that represents a color temperature of 6504_K. Widely used as the standard white point for monitor calibration. (see "Kelvin")

DAM (Digital Asset Management)
Database systems used to track and manage computer files in computer graphics environments.

Database
An organized collection of data or information.

Data Compression
Technique of reducing the amount of storage required to hold a digital file to reduce the disk space the file requires and allow it to be processed or transmitted more quickly.

Deboss
To press an image into paper so it lies below the surface. Also called tool.

Deckle Edge
1.) Fine watercolor papers have natural deckles on two or four sides. Frequently the look of a print is improved by tearing the paper rather then cutting it, creating "torn deckles." After tearing, a bone knife is used to smooth the edge and create the deckled look.
2.) Edge of paper left ragged as it comes from the papermaking machine instead of being cleanly cut. Also called feather edge.

Delamination
Separation of layers in a laminate because of a cohesive failure at the material interface. May be used to describe any splitting of a material in a plane parallel to its surface.

Delta E*, Delta e*
The total color difference computed with a color difference equation. It is generally calculated as the square root of the sum of the squares of the chromaticity difference, Delta C*, and the lightness difference, Delta L*.

Densitometer
An instrument that measures the optical density of a transmitting material, or an instrument to measure the negative log of the reflectance of a reflecting material. Such instruments do not measure color. They are widely used in the graphic arts and photographic industries for process control. It will indicate, in density units or percentage dot, the percentage of a given area that is covered by halftone dots. This instrument is used to ensure consistency and process control.

Density (optical density)
The degree of opacity of an image. The ability of a material to absorb light; the darker it is, the higher the density. Density measurements of solid ink patches are used to control ink on paper.

Densitometer
Instrument used to measure density. Reflection densitometers measure light reflected from paper and other surfaces; transmission densitometers measure light transmitted through film and other materials.

Density
1) Regarding ink, the relative thickness of a layer of printed ink.
2) Regarding color, the relative ability of a color to absorb light reflected from it or block light passing through it.
3) Regarding paper, the relative tightness or looseness of fibers.

Density Range
Difference between the darkest and lightest areas of copy. Also called contrast ratio, copy range and tonal range.

Descender
In typography, the portion of lowercase letters that extends below the character's ba seline as in "g", "j", "p", "q", and "y".

Desktop Publishing
Technique of using a personal computer to design images and pages, and assemble type and graphics, then using a laser printer or imagesetter to output the assembled pages onto paper, film or printing plate. Abbreviated DTP.

Device Independent Colors
Hues identified by wavelength or by their place in systems such as developed by CIE. 'Device independent' means a color can be described and specified without regard to whether it is reproduced using ink, projected light, photographic chemistry or any other method.

Die
1.) In binding and finishing, as metal plate or block etched with a design, lettering, or other pattern.
2.) Device for cutting, scoring, stamping, embossing and debossing.

Die Cut
To cut irregular shapes in paper or paperboard using a die.

Diecutting
In binding and finishing, a finishing operation involving the use of sharp steel blades to cut a specific pattern into a substrate or to cut the substrate itself into a specific pattern.

Die-Stamping
In binding and finishing, a finishing operation similar to embossing in which hard metal dies are used to stamp or press images or patterns into a surface, such as a cloth book cover.

Digital
Type of data consisting of (or systems employing) discreet steps or levels, as opposed to continuously variable analog data.

Digital art
Art created with one or more digital processes or technologies.

Digital C-Print
Another term for digital photoprint. These are actual photographic prints that are exposed to laser or LED light then processed in traditional RA-4 wet chemistry.

Digital collage
The process of electronically simulating traditional collage techniques by pasting together disparate images into a cohesive visual whole, resulting in a new image.

Digital Fine Art Print
A fine art print made by any digital output process conforming to traditional fine art qualifications and requirements.

Digital Imaging
The process of image capture, manipulation and final image form, accomplished by digital systems.

Digital Photoprint
One of the major digital printing technologies. Produces actual photographic prints that are exposed to laser or LED light then processed in traditional RA-4 chemistry. (see "digital C-print")

Digital Printer
A non-impact printing device that is capable of translating digital data into hard copy output. Typically refers to printing with one of the digital output technologies (inkjet, electrostatic, thermal transfer, or laser photoprinting).

Digital Proofing
Page proofs produced through electronic memory transferred onto paper via laser or ink-jet.

Digitize
The process of converting analog data to digital information.

Dmax
A measure of maximum density. When talking about paper and inks in digital printing--it can apply to many things--it is the blackest black possible.

Dmin
Lowest level of density.

Diffusion Transfer
Chemical process of reproducing line copy and making halftone positives ready for paste-up.

Digital Dot
Dot created by a computer and printed out by a laser printer or imagesetter. Digital dots are uniform in size, as compared to halftone dots that vary in size.

Direct Digital Color Proof
Color proof made by a laser, ink jet printer or other computer-controlled device without needing to make separation films first. Abbreviated DDCP.

Display Type
In typography, type set in a larger point size than the text (commonly greater than 14 point), such as in headlines.

Dither
In digital imaging, to use the colors of two pixels to determine the color of a pixel lying between them. This new pixel thus has a value that is the average of the two pixels on either side of it. Dithering is often used to eliminate unwanted jaggies.

Dithering
A graphics display or printing process that uses a combination of dots or textures to simulate an original image or an output device. The purpose is to create the impression of a continuous-tone gray-scale or color image. (Diffuse dithering: method for printing continuous tone images on a laser printer, in which the grayscale information is represented by randomly located printer dots.)

Dog Ear
A letter fold at the side of one of the creases, an indentation occurs.

Dot
Dots make up an image in color separations or halftones. Halftone dots will have a fixed density but have variable size (amplitude modulation).

Dot Gain
1.) The phenomenon that occurs when ink expands its coverage during printing onto a substrate; often caused by abnormal or excessive absorption by the substrate.
2.) Phenomenon of halftone dots printing larger on paper than they are on films or plates, reducing detail and lowering contrast. Also called dot growth, dot spread and press gain.

Dot Size
Relative size of halftone dots as compared to dots of the screen ruling being used. There is no unit of measurement to express dot size. Dots are too large, too small or correct only in comparison to what the viewer finds attractive.

Dots-per-inch
Measure of resolution of input devices such as scanners, display devices such as monitors, and output devices such as laser printers, imagesetters and monitors. Abbreviated DPI. Also called dot pitch.

Dot Pitch
The distance between the dots on a computer monitor, typically 0.24 to 0.38 mm. The closer the dots the sharper the image on the monitor.

Dots Per inch (DPI)
(see "DPI")

Double Black Duotone
Duotone printed from two halftones, one shot for highlights and the other shot for midtones and shadows.

Double Bump
To print a single image twice so it has two layers of ink.

Double Burn
To expose film or a plate twice to different negatives and thus create a composite image.

Double Density
A method of recording electronically (disk, CD, floppy) using a modified frequency to allow more data storage.

Double Dot Halftone
Halftone double burned onto one plate from two halftones, one shot for shadows, the second shot for midtones and highlights.

Doubling
Printing defect appearing as blurring or shadowing of the image. Doubling

may be caused by problems with paper, cylinder alignment, blanket pressures or dirty cylinders.

Down-sampling
The process of receiving data from another computer, server or system. The reduction in resolution of an image, necessitating a loss in detail.

DPI (Dots Per Inch)
1.) Considered as "dots per square inch," a measure of output resolution in relationship to printers, imagesetters and monitors.
2.) DPI is a unit of measurement used to describe the resolution of printed output. The most common desktop laser printers output at 300 dpi. Medium-resolution printers output at 600 dpi, and Image setters output at 1270-2540 dpi.

Drawdown
Sample of inks specified for a job applied to the substrate specified for a job. Also called pulldown.

Drop-on-demand (DOD)
An inkjet system in which pressure pulses are generated directly in the printhead by piezo crystals or heated resistors to eject drops of ink only when they are needed to print a dot.

Drill
In the printing arena, to drill a whole in a printed matter.

Drop Folio
In book typography, page number, or folio, that is printed at the bottom of a page. Also known as a foot folio.

Dropout
Halftone dots or fine lines eliminated from highlights by overexposure during camera work.

Dropout Halftone
Halftone in which contrast has been increased by eliminating dots from highlights.

Drum Scanner
A type of optical scanner where the reflective or transmissive art is mounted to a rotating drum. As the drum spins, the image rotates past a fixed lens or sensor allowing the image to be recorded as a series of fine lines.

Dry Back
Phenomenon of printed ink colors becoming less dense as the ink dries.

Dry Down
The amount of time until inks are stable.

Dry Offset
Using metal plates in the printing process, which are etched to .15mm (.0006 in) creating a right reading plate, printed on the offset blanket transferring to paper without the use of water.

Dry Trap
To print over dry ink, as compared to wet trap.

Durability
A relative term used to describe the functional lifespan of a material typically compared to a control.

Dye
A colorant that does not scatter light but that absorbs [and therefore reflects] certain wavelengths [of the electromagnetic spectrum] and transmits others. Dyes are generally organic and generally soluble in water or some other solvent system; or they may exist in such a finely dispersed state that they do not scatter light and behave as though they were in solution. The dividing line between a dye and a pigment may, therefore, be indefinite and dependent on the particular total system involved.

Dye sublimation
An imaging process that vaporizes colorant with heat and pressure, and deposits it on to a substrate in order to achieve a continuous tone image.

Dynamic range
The measurable difference between the brightest highlight and the darkest value

Dual-purpose Bond Paper
Bond paper suitable for printing by either lithography (offset) or xerography (photocopy). Abbreviated DP bond paper.

Dull Finish
Flat (not glossy) finish on coated paper; slightly smoother than matte. Also called suede finish, velour finish and velvet finish.

Dummy
Simulation of the final product. Also called mockup.

Duotone
1.) Black-and-white photograph reproduced using two halftone negatives, each shot to emphasize different tonal values in the original. 2.) A two-color halftone produced by overprinting two halftone screens made from the same photograph (usually black-and-white photograph), as a means of generating a monochromatic image with a full range of tonal gradations.

Duplex Paper
Thick paper made by pasting highlights together two thinner sheets, usually of different colors. Also called double-faced paper and two-tone paper.

Duplicator
Offset press made for quick printing.

Dylux
Brand name for photographic paper used to make blue line proofs. Often used as alternate term for blueline.

E

Edition
The aggregate of identical prints produced from a single matrix. (see also "open edition," "limited edition," and "variant edition")

Effective resolution
The final appearance of a scan that has been enhanced to produce more data than the scanner can record. This is done by interpolation.

Electrostatic
A process of imaging where a "toner" is used to form an image by controlled static charges. Toner printing adheres to the charged areas.

Electronic Front End (Electronic Composition)
General term referring to a prepress system based on computers.

Electronic Image Assembly
Assembly of a composite image from portions of other images and/or other page elements using a computer.

Electronic Mechanical
Mechanical exclusively in electronic files.

Electronic Publishing
1) Publishing by printing with device, such as a photocopy machine or ink jet printer, driven by a computer that can change the image instantly from one copy to the next.
2) Publishing via output on fax, computer bulletin board or other electronic medium, as compared to output on paper.

Em
In typography, a fixed space having a height and a width equal to that of the point size.

Em Dash
In typography, a dash one em long, used to set off parenthetical text, replace missing text matter, or function in lieu of a colon.

Embossing
1.) In binding and finishing, a process in which images, patterns, or text are stamped or pressed into a substrate.
2.) To press an image into paper so it lies above the surface. Also called cameo and tool.

Em Space
In typography, a fixed space one em in length.

Emulsion
Casting of light-sensitive chemicals on papers, films, printing plates and stencils.

Emulsion Down/ Emulsion Up (ED / EU)
Film whose emulsion side faces down (away from the viewer) or up (toward the viewer) when ready to make a plate or stencil. Also called E up/down and face down/face up.

En
In typography, a unit of measurement exactly one-half as wide as, and as high as, the point size being set.

En Dash
In typography, a dash one en long, used to represent the words to or through, or function in lieu of a colon.

Encapsulated Postscript File (EPS)
1.) An Adobe graphic file format. EPS translates graphics and text into a code which the printer can read and print. EPS files hold both low-resolution "viewfiles" and high-resolution PostScript image descriptions. A vector-based, computer graphics file format developed by Adobe Systems. EPS is the preferred format for many computer illustrations because of its efficient use of memory and fine color control.
2.) Encapsulated Post Script, a known file format usually used to transfer post script information from one program to another.
3.) Computer file containing both images and PostScript commands.

End Sheet
Sheet that attaches the inside pages of a case bound book to its cover. Also called pastedown or end papers.

English Finish
Smooth finish on uncoated book paper; smoother than eggshell, rougher than smooth.

Engraving
Printing method using a plate, also called a die, with an image cut into its surface.

EP
Abbreviation for envelope.

EPS
See Encapsulated Post Script.

Equivalent Paper
Paper that is not the brand specified, but looks, prints and may cost the same. Also called comparable stock.

Estimate
Price that states what a job will probably cost. Also called bid, quotation and tender.

Estimator
The individual performing or creating the "estimate."

Etch
Use of chemicals to carve an image into metal, glass or film.

Extended Type
Typefaces that are wide horizontally--an example is Microgramma Extended.

F

Face
Edge of a bound publication opposite the spine. Also called foredge. Also, an abbreviation for typeface referring to a family of a general style.

Facing Pages
In a double-sided document, the two pages that appear as a spread when the publication is opened.

Fading
A subjective term used to describe the lightening of the hue of a colorant following exposure to the effects of light, heat, time, temperature, chemicals, and so on.

Fake Duotone
Halftone in one ink color printed over screen tint of a second ink color. Also called dummy duotone, dougraph, duplex halftone, false duotone, flat tint halftone and halftone with screen.

Fast Color Inks
Inks with colors that retain their density and resist fading as the product is used and washed.

Feathering
A technique in many image-editing programs that allows for the softening of the edge around a selection.

Feeding Unit
Component of a printing press that moves paper into the register unit.

Felt Finish
Soft woven pattern in text paper.

Felt Side
Side of the paper that was not in contact with the Fourdrinier wire during papermaking, as compared to wire side.

Fifth Color
Ink color used in addition to the four needed by four-color process.

Film Gauge
Thickness of film. The most common gauge for graphic arts film is 0.004 inch (0.1 mm).

Film Laminate
Thin sheet of plastic bonded to a printed product for protection or increased gloss.

Fine Papers
Papers made specifically for writing or commercial printing, as compared to coarse papers and industrial papers. Also called cultural papers and graphic papers.

Fine Screen
Screen with ruling of 150 lines per inch (80 lines per centimeter) or more.

Finish
1.) Surface characteristics of paper.
2) General term for trimming, folding, binding and all other post press operations.
3.) The surface properties of a material determined by its surface contour and gloss, texture, color, smoothness, or other properties affecting appearance.

Finished Size
Size of product after production is completed, as compared to flat size. Also called trimmed size.

Filters
Software or subprograms within image manipulation software that employ algorithms to control modifications to digital images by altering the values

or arrangement of entire or selected areas of an image.

Fit
Refers to ability of film to be registered during stripping and assembly. Good fit means that all images register to other film for the same job.

Fixed Costs
Costs that remain the same regardless of how many pieces are printed. Copyrighting, photography and design are fixed costs.

Fixed Space
In typography, a blank space of a fixed increment, used where a constant-width blank space is required, since typographic word spaces vary in width according to the justification needs of a line.

Flat Art
(see Reflective Art)

Flatbed Printer
Printer with an adjustable flatbed or platen that supports the substrate, which may be up to 12 inches thick and irregular in surface. The bed moves the media below the ink heads for printing, or in some cases the head moves over the stationary bed.

Flat Color
1.) Any color created by printing only one ink, as compared to a color created by printing four-color process. Also called block color and spot color.
2.) color that seems weak or lifeless.

Flat Plan (Flats)
Diagram of the flats for a publication showing imposition and indicating colors.

Flat Size
Size of product after printing and trimming, but before folding, as compared to finished size.

Flexography
Method of printing on a web press using rubber or plastic plates with raised images. Also called aniline printing because flexographic inks originally used aniline dyes. Abbreviated flexo.

Flood
To print a sheet completely with an ink or varnish. flooding with ink is also called painting the sheet.

Fluorescence
A physical process at which the material's pigments absorb light and re-radiate this light as a different color, giving the color of the material extra light or brilliance. Optical phenomenon characterized by the re-emission of absorbed radiant energy by certain chemicals or materials.

Flush Cover
Cover trimmed to the same size as inside pages, as compared to overhang cover. Also called cut flush

Flush Left
In typography, a paragraph or lines of text are aligned on the left side. Synonymous with the term Left Justified.

Flush Right
In typography, a paragraph or lines of text are aligned on the right side. Synonymous with the term Right Justified.

Flyleaf
Leaf, at the front and back of a casebound book that is the one side of the end paper not glued to the case.

FM (Frequency-Modulated Screening)
A dithering method that uses uniform dot sizes and varies the distance between them. This method is different from conventional halftone screening, which aligns dots of varying sizes on a regular grid.

Fogging Back
Used in making type more legible by lowering density of an image, while allowing the image to show through.

Foil Stamping
In binding and finishing, a finishing operation in which a design or other image is pressed onto a substrate. In foil stamping, a heated die containing a relief (raised) image presses down on a roll of foil passing above the substrate to be decorated.

Foil Emboss
To foil stamp and emboss an image. Also called heat stamp.

Foil Stamp
Method of printing that releases foil from its backing when stamped with the heated die. Also called block print, hot foil stamp and stamp.

Folder
A bindery machine dedicated to folding printed materials.

Fold Marks
With printed matter, markings indicating where a fold is to occur, usually located at the top edges.

Foldout
Gatefold sheet bound into a publication, often used for a map or chart. Also called gatefold and pullout.

Folio (page number)
1.) In typography, a page number, commonly placed outside the running head at the top of the page. Folios are also commonly set flush left on verso pages and flush right on recto pages. They can also be centered at the top of the page. A folio that appears at the bottom of a page is called a drop folio.
2.) The actual page number in a publication.

Font
In typography, a set of all characters in a typeface.

Foot-candle
The quantity of light at a point on a plane surface one foot from a standard candle and perpendicular thereto, where a "candle" [a unit of luminous intensity] refers to candle power, a measure of intensity of a source of light compared with a standard candle.

Foot Folio
In book typography, page number that appears at the bottom of a page. Also known as a drop folio.

Foot Margin
In typography, the amount of blank space allowed between the bottom of the last line of text (or other bottommost page element) and the bottom edge of the sheet.

Footnote
In typography, a reference relating to the main body of text positioned at the bottom of the page.

Form
Each side of a signature. Also spelled forme.

Format
1.) Size, style, shape, layout or organization of a layout or printed product.
2.) Characteristic identifying size of printer, media, or graphic, according to width of media roll, printer's print area, or graphic. "Medium Format" is generally between 11-24" in width; "Large Format" (Wide Format), larger than 24" in width; and "Grand Format," larger than 72" in width.

Form bond
Lightweight bond, easy to perforate, made for business forms. Also called register bond.

Form Roller(s)
Roller(s) that come in contact with the printing plate, bringing it ink or water.

For Position Only (FPO)
1.) On a mechanical, a written designation applied to a low-resolution or inferior-quality image (such as a xerox of a photograph or line art) to indicate that the image (as seen) has only been added to the mechanical to indicate its position on the layout and thus is not indicative of the appearance of the final printed image.
2.) Refers to inexpensive copies of photos or art used on mechanical to indicate placement and scaling, but not intended for reproduction.

Forwarding
In the case book arena, the binding process which involves folding, rounding, backing, headbanding and reinforcing.

Fountain
Trough or container, on a printing press, that holds fluids such as ink, varnish or water. Also called duct.

Fountain Solution
Mixture of water and chemicals that dampens a printing plate to prevent ink from adhering to the nonimage area. Also called dampener solution.

Four-color Printing
Technique of printing that uses black, magenta, cyan and yellow to simulate full-color images. Also called color process printing, full color printing and process printing.

Four-color Process
A system of printing colors by printing dots of magenta, cyan, yellow and black. (see "Digital Printing" analysis)

Four-Color Process Printing
In multi-color printing, the printing of process color by means of color separations corresponding to the four process colors: cyan, magenta, yellow and black.

Fractal
A mathematically generated pattern that is reproducible at any magnification or reduction, and repeats infinitely.

Free Sheet
Paper made from cooked wood fibers mixed with chemicals and washed free of impurities, as compared to groundwood paper. Also called woodfree paper.

French Fold
A printed sheet, printed one side only, folded with two right angle folds to form a four page uncut section.

Frisket
A paper or liquid masking device. (see also "masks")

Front Matter
In book typography and production, the pages of a book that precede the main text.

FTP (File Transfer Protocol)
The method for uploading and downloading files to/from Internet server systems.

Full-range Halftone
Halftone ranging from 0 percent coverage in its highlights to 100 percent coverage in its shadows.

Full-scale Black
Black separation made to have dots throughout the entire tonal range of the image, as compared to half-scale black and skeleton black. Also called full-range black.

G

Galley Proof
1.) Proof of type from any Source, whether metal type or photo type. Also called checker and slip proof.
2.) A printout of text used for proofreading before final page assembly.

Gamma
A mathematical curve representing both the contrast and brightness of an image. The steepness of the curve indicates greater contrast calculated as a trigonometric tangent function.

Gamut
A finite or limited range of colors provided by a specific input or output device, or by a set of colorants.

Gamut Compression
The editing of an image to reduce the color gamut so that the image can be displayed or output within the limits of a particular device.

Gamut Mapping
The plotting of an image color gamut into the CIE color space.

Gas Ghosting
The phenomenon where uncured inkjet prints form a fogged or ghost image on the inside of the glass surface when framed. Happens primarily with "barrier-type" paper such as RC papers. Can be avoided with thorough or accelerated drying of the print.

Gang
1.) To halftone or separate more than one image in only one exposure.
2.) To reproduce two or more different printed products simultaneously on one sheet of paper during one press run. Also called combination run.

Gate Fold
A sheet that folds where both sides fold toward the gutter in overlapping layers.

Gathered
Signatures assembled next to each other in the proper sequence for binding, as compared to nested. Also called stacked.

Gaussian blur
An image-softening effect used in digital imagery. Named after French Mathematician Carl Friedrich Gausse.

GCR
see Gray Component Replacement

Ghost Halftone
Normal halftone whose density has been reduced to produce a very faint image.

Ghosting
1.) Phenomenon of a faint image appearing on a printed sheet where it was not intended to appear. Chemical ghosting refers to the transfer of the faint image from the front of one sheet to the back of another sheet. Mechanical ghosting refers to the faint image appearing as a repeat of an image on the same side of the sheet.
2.) Phenomenon of printed image appearing too light because of ink starvation.

Giclée
1.) A print made by a digital process, typically inkjet.
2.) A copy (typically identical) of an original work of art (as a painting) that was created separately and then reproduced digitally, specifically by inkjet printing. First used in this context by Jack Duganne in 1991 to describe prints made on an IRIS inkjet printer. Pronounced [zhee-clay].

GIF (Graphic Interchange Format)
An image format type generated specifically for computer use. Its resolution is usually very low (72 dpi, or that of your computer screen), making it undesirable for printing purposes.

Gilding
Mostly in the book arena, gold leafing the edges of a book.

Gloss Differential
(see "bronzing")

Gloss Ink
Ink used and printed on coated stock (mostly litho and letterpress) such as the ink will dry without penetration.

Grade
General term used to distinguish between or among printing papers, but whose specific meaning depends on context. Grade can refer to the category, class, rating, finish or brand of paper.

Graduated Screen Tint
Screen tint that changes densities gradually and smoothly, not in distinct steps. Also called degrade, gradient, ramped screen and vignette.

Grain Direction
Predominant direction in which fibers in paper become aligned during manufacturing. Also called machine direction.

Grain Long Paper
Paper whose fibers run parallel to the long dimension of the sheet. Also called long grain paper and narrow web paper.

Grain Short Paper
Paper whose fibers run parallel to the short dimension of the sheet. Also called short grain paper and wide web paper.

Grammage
Basis weight of paper in grams per square meter (gsm).

Gray Balance
Printed cyan, magenta and yellow halftone dots that accurately reproduce a neutral gray image.

Gray Component Replacement
Technique of replacing gray tones in the yellow, cyan and magenta films, made while color separating, with black ink. Abbreviated GCR. Also called achromatic color removal.

Gray Levels
Number of distinct gray tones that can be reproduced by a computer.

Gray Scale
Strip of gray values ranging from white to black. Used by process camera and scanner operators to calibrate exposure times for film and plates. Also called step wedge.

Grain
The direction of the threads in cloth or the fibers in paper.

Graphic
A non-text item (illustration or photograph) or non-text component of an image.

Graphics
Visual elements that supplement type to make printed messages more clear or interesting.

Graphic Arts
The crafts, industries and professions related to designing and printing on paper and other substrates.

Graphic Arts Film
Film whose emulsion yields high contrast images suitable for reproduction by a printing press, as compared to continuous-tone film. Also called litho film and repro film.

Graphic Design
Arrangement of type and visual elements along with specifications for paper, ink colors and printing processes that, when combined, convey a visual message.

Graphics Tablet
An input device that uses a stylus or specialized mouse to write or draw on the tablet surface to communicate with the computer.

Gravure (Rotogravure)
1.) An intaglio printing process that uses engraved cylinders. Ink is retained in the engraved areas for printing. It is ideal in long-run work and prints on most substrates.
2.) Method of printing using metal cylinders etched with millions of tiny wells that hold ink.

Grayscale
An image having no color hues but containing a range of gray levels as opposed to only pure black or white.

Greeking
In computing, a means of speeding up the display redraw rate of a computer monitor by representing text characters below a certain size as gray lines, boxes, or illegible dummy type.

Grind Edge
Alternate term for binding edge when referring to perfect bound products.

Grindoff
Approximately 1/8 inch (3 mm) along the spine that is ground off gathered signatures before perfect binding.

Gripper Edge
Edge of a sheet held by grippers on a sheetfed press, thus going first through the press. Also called feeding edge and leading edge.

Groundwood Paper
Newsprint and other inexpensive paper made from pulp created when wood chips are ground mechanically rather than refined chemically.

GSM
The unit of measurement for paper weight (grams per square meter).

Gutter
1.) In the book arena, the inside margins toward the back or the binding edges.
2.) In typography, the term refers to the space between columns of type, usually determined by the number and width of columns and the overall width of the area to be filled.

H

Hairline (Rule)
Subjective term referring to very small space, thin line or close register. The meaning depends on who is using the term and in what circumstances.

Half-scale Black
Black separation made to have dots only in the shadows and midtones, as compared to full-scale black and skeleton black.

Halftone
1.) The process of reproducing a continuous tone image as a series of various sized dots within a fixed grid that can be reproduced with ink. The finer the dot grid, the higher the quality of the reproduction.
2.) To photograph or scan a continuous tone image to convert the image into halftone dots.
3.) A photograph or continuous-tone illustration that has been halftoned and appears on film, paper, printing plate or the final printed product.
4.) Any image--such as a photograph--that exists as a series of small dots of varying size and color density, which serve to simulate the appearance of continuous gradations of tone. Halftones are necessary in the reproduction of photographic images; most printing presses cannot print continuous tones, so photographic images must first be converted to a series of dots in order to be effectively printed.

Halftone Screen
Piece of film or glass containing a grid of lines that breaks light into dots. Also called contact screen and screen.

Halo Effect
Faint shadow sometimes surrounding halftone dots printed. Also called halation. The halo itself is also called a fringe.

Hanging Indent
In typography, a form of indention in which the first line or first few lines of a paragraph are set flush with the left margin, while the rest of the lines of that paragraph are indented a specified distance.

Hard Copy
Any page, document, publication, or other data that exists as some kind of output, be it on paper, film, etc., rather than as an item on a computer display or soft copy.

Hard Dots
Halftone dots with no halos or soft edges, as compared to soft dots.

Hard Hyphen
In typography, a hyphen that is always typeset, regardless of where on the line it falls. Such a hyphen would be one of those in the word "mother-in-law".

Hard Mechanical
Mechanical consisting of paper and/or acetate and made using paste-up techniques, as compared to electronic mechanical.

Head
The top of a book, page, or column. In typography, the term head is also an abbreviation for the term heading.

Head(er)
1.) At the top of a page, the margin.
2.) In typography, any text that appears at the top of a page but is not part of the body text, such as a tile, author, chapter title, etc. A header appearing on every page is called a running head.

Heading
In typography, display type used to emphasize copy, act as a book, chapter, or section title, or otherwise introduce or separate text. More commonly referred to as simply a head.

Head-to-tail
Imposition with heads (tops) of pages facing tails (bottoms) of other pages.

Heat-set Web
Web press equipped with an oven to dry ink, thus able to print coated paper.

Hickey
1.) Spot or imperfection in printing, most visible in areas of heavy ink coverage, caused by dirt on the plate or blanket. Also called bulls eye and fish eye.
2.) Any printing defect caused by a particle either of paper or other source of debris attaching itself to the printing plate..

High-fidelity Color
Color reproduced using six, eight or twelve separations, as compared to four-color process.

High-key Photo
Photo whose most important details appear in the highlights.

Highlight(s)
Lightest portions of a photograph or halftone, as compared to midtones and shadows. Also called "specular reflection."

High bit
(see "8-bit" "24-bit" etc.)

Hinged Cover
Perfect bound cover scored 1/8 inch (3mm) from the spine so it folds at the hinge instead of, along the edge of the spine.

Histogram
A graphical display that represents the distribution of tones within an image. The horizontal coordinate represents each pixel value possible from black to white. The vertical values indicate the number of pixels in the image that occur at each value level.

HLS (Hue, Luminance, Saturation)
1.) Hue, luminance and saturation: a color model based on these three coordinates of color, where Hue is the dominant color, Saturation is color purity, and Luminance is the light/dark characteristic of the color. 2.) Abbreviation for hue, lightness, saturation, one of the color-control options often found in software, for design and page assembly. Also called HVS.

Hot Spot
Printing defect caused when a piece of dirt or an air bubble caused incomplete draw-down during contact platemaking, leaving an area of weak ink coverage or visible dot gain.

Hot Press
Process for making smooth textured printmaking paper in a mold.

House Sheet
Paper kept in stock by a printer and suitable for a variety of printing jobs. Also called floor sheet.

HSB (Hue, Saturation, Brightness)
A color model that utilizes Hue, Saturation, and Brightness as the three coordinates, where Hue is the dominant color, Saturation is the purity of color, and Brightness is a neutral scale of how light or dark a color is.

Hue
1.) The attribute of color by means of which a color is perceived to be red, yellow, green, blue, purple, etc.
2.)A specific color such as yellow or green.

Hyphenation Zone
In typography, a "zone" established by a typesetting device or software toward the end of a line, within which the system can hyphenate words. A hyphenation zone is commonly used in ragged right copy. The setting of the hyphenation zone is a way of controlling the number of hyphens that will appear in the set copy.

I

Illuminant
Mathematical description of the relative spectral power distribution of a real or imaginary light source. That is, the relative energy emitted by a source at each wavelength in its emission spectrum.

Impact printing
Process of applying ink to a substrate utilizing physical contact between some part of the printing device and the substrate, (e.g., offset, lithography, and flexography). (see also "non-impact printer" and "Printing Technologies" analysis)

Indexed color
A color system that defines a palate of colors to be used in a specific image. Often this makes images small and manageable.

Infrared
Electromagnetic radiation of wavelengths between 780 to 1000 nanometers (nm).

Image Area
The actual area on the printed matter that is not restricted to ink coverage,

Imagesetter
Laser output device using photosensitive paper or film.

Imposition
Arrangement of pages on mechanicals or flats so they will appear in proper sequence after press sheets are folded and bound.

Impression
1.) Referring to an ink color, one impression equals one press sheet passing once through a printing unit.
2.) Referring to speed of a press, one impression equals one press sheet passing once through the press.

Impression Cylinder
Cylinder, on a press, that pushes paper against the plate or blanket, thus forming the image. Also called impression roller.

Imprint
To print new copy on a previously printed sheet, such as imprinting an employee's name on business cards. Also called surprint.

Ink
A fluid or viscous substance used for writing or printing. In digital printing, the substance in inkjet printing (liquid or solid) that gets sprayed onto the medium; made up of a colorant, a solvent or vehicle, and various additives.

Ink Balance
Relationship of the densities and dot gains of process inks to each other and to a standard density of neutral gray.

Ink Fountain
Reservoir, on a printing press, that holds ink.

Ink Holdout
1.) Characteristic of paper that prevents it from absorbing ink, thus allowing ink to dry on the surface of the paper. Also called holdout.
2.) The ability of paper to prevent ink from penetrating into its surface.

Inkjet
A digital printing technology that uses nozzles to spray ink onto a surface. (see "Digital Printing" analysis)

Inkjet coating
(see "coating")

Inkjet printer
A type of printer that sprays tiny spurts of ink onto coated paper. (see "Digital Printing" analysis)

Ink Jet Printing
Method of printing by spraying droplets of ink through computer-controlled nozzles. Also called jet printing.

Ink limiting
A control within a program that limits the percentage of ink applied to an area of print.

Intaglio
Form of printing in which all the elements of the image are below the surface of the plate, having been cut, scratched, engraved, or etched into the metal to form ink-retaining grooves or cups. (see "Printing Technologies" analysis)

Inner Form
A form (side of the press sheet) whose images all appear inside the folded signature, as compared to outer form.

In-Line
In typography, a style of type that has a chiseled effect, as if chipped out of stone. Although classic in appearance, their use in small doses is most effective, and they are often used in display type and are especially well-suited to dropping out from a dark background.

In-Plant Printer
Department of an agency, business or association that does printing for a parent organization. Also called captive printer and in-house printer.

Inserts
Within a publication, an additional item positioned into the publication loose (not bound in).

Intaglio Printing
Printing method whose image carriers are surfaces with two levels, having inked areas lower than noninked areas. Gravure and engraving are the most common forms of intaglio. Also called recess printing.

Integral Proof
Color proof of separations shown on one piece of proofing paper, as compared to an overlay proof. Also called composition proof, laminate proof, plastic proof and single-sheet proof.

Intensity
The amount of light reflected or transmitted by an object with black as the lowest intensity and white as the highest intensity.

Interpolation
A technique for increasing the size of a graphic file by creating pixels. Also an extrapolation algorithm. There are two types, sequential and bi-cubic. Note: increasing the size of an image by interpolation does not increase or enhance the ability to resolve the detail in that image. It only makes the details that are already present larger.

Interleaves
Printed pages loosely inserted in a publication.

IRIS or IRIS print
The branded inkjet printer that produced the early "digital fine art prints" and for which the term "giclée" was first used. Currently no longer being manufactured.

ISBN
A number assigned to a published work and usually found either on the title page or the back of the title page. Considered an International Standard Book Number.

J

Jaggies
1.) Alternate term for the results of aliasing. See Aliasing. Also known as stairsteps.
2.) The effect caused by images or lines being rendered at too low a resolution. It can easily be defined as a stair-stepped effect giving the line or image a rough appearance.

Job Lot Paper
Paper that didn't meet specifications when produced, has been discontinued, or for other reasons is no longer considered first quality.

Job Number
A number assigned to a specific printing project in a printing company for use in tracking and historical record keeping.

Job Ticket
Form used by service bureaus, separators and printers to specify production schedule of a job and the materials it needs. Also called docket, production order and work order.

Jogger
A vibration machine with a slopping platform to even-up stacks of printed materials.

JPEG (Joint Photographic Experts Group)
Standardized image compression format developed by the Joint Photographic Experts Group. Usually used for compressing full-color or gray-scale images.

JPEG 2000
Officially called ISO 15444, the "JPEG 2000: Image Coding System" is a

standardized format that will expand the ability to manage and transport continuous tone images without noticeable loss of quality.

Justification
In typography, setting lines of text so that they line up on the left and right, as opposed to ragged right, in which the lines do not line up on the right.

Justified
Type that aligns on both the left and right side. Alternate term for justified text, justified type, and justified composition.

K

K (as in CMYK)
Abbreviation for black in four-color process printing. Hence the 'K' in CMYK.

Kelvin
The name of the absolute temperature scale. Used in imaging to define the quality of a light source by referring to the absolute temperature of a black body that would radiate equivalent energy. Generally, a tungsten reading lamp is rated at 2800 degrees Kelvin, while TV or Film quartz lights are rated at 3200 degrees Kelvin, and outdoor light averages around 5600 degrees Kelvin. The higher the Kelvin temperature the more bluish the light appears.

Kerning
In typography, the reduction of letterspacing between certain character combinations in order to reduce the space between them, performed for aesthetic reasons.

Key
1.) The screw that controls ink flow from the ink fountain of a printing press.
2.) To relate loose pieces of copy to their positions on a layout or mechanical using a system of numbers or letters.
3.) Alternate term for the color black, as in 'key plate.'

Keylines
Lines on a me chanical or negative showing the exact size, shape and location of photographs or other graphic elements. Also called holding lines.

Key Negative or Plate
Negative or plate that prints the most detail, thus whose image guides the register of images from other plates. Also called key printer.

Kiss Cut
To die cut the top layer but not the backing of self-adhesive paper.

Kiss Die Cut
To die cut the top layer, but not the backing layer, of self-adhesive paper. Also called face cut.

Kiss Impression
Lightest possible impression that will transfer ink to a Substrate.

Knockout
A space left in a document for the later insertion of some form of graphic image. The term knockout is also used to refer to "white type" or, in other words, type that prints as a reverse, or, in fact, does not really print at all, allowing the color of the page to show through a background in the shape of type.

Kraft Paper
Strong paper used for wrapping and grocery bags and large envelopes.

L

Laid Finish
Finish on bond or text paper on which grids of parallel lines simulate the surface of handmade paper. Laid lines are close together and run against the grain; chain lines are farther apart and run with the grain.

Laminate
1.) To bond a plastic film by heat and pressure to a printed sheet for protection and appearance.
2.) A thin transparent plastic sheet (coating) applied to usually a thick stock (covers, post cards, etc.) providing protection against liquid and heavy use, and usually accents existing color, providing a glossy (or lens) effect.
3.) A clear coating of a variety of possible substances, usually plastic, that is applied to one or both sides of a medium after printing for reasons of durability.

Lamination
Bonding one product to another by pressure for protection or appearance.

Laminator
A device with two silicon rollers for applying controlled pressure (sometimes with heat) to a print to adhere two items together. May also be used as a press for transferring an image.

Landscape
1.) A page format in which the correct reading or viewing orientation is horizontal; the width of the page is greater than its height.
2.) Artist style in which width is greater than height. (See Portrait.)

Lap Register
Register where ink colors overlap slightly, as compared to butt register.

Large-format
A printer, media, or print 24" or greater in width.

Laser Bond
Bond paper made especially smooth and dry to run well through laser printers.

Laser-imprintable Ink
Ink that will not fade or blister as the paper on which it is printed is used in a laser printer.

Laser Printer
A laser printer uses a laser beam to write on a photoconductive revolving drum that is coated with toner, which is a fine, black powder. After the image is transferred to paper it passes through a pair of heated rollers or a fuser that melts the toner fusing it with the paper fibers.

Lay Flat Bind
Method of perfect binding that allows a publication to lie fully open. (Also known as Lay Flat Perfect Binding.)

Lay Edge
The edge of a sheet of paper feeding into a press.

Layout
A sample of the original providing (showing) position of printed work (direction, instructions) needed and desired.

Leader
In typography, dots (called dot leaders) or dashes (called dash leaders) that lead the eye from one side of a line to the other.

Lead-In
In typography, the first two or three words of a block of text set in a different, contrasting typeface or style (such as small caps or boldface).

Leading (pronounced "led-ding")
1.) In typography, an alternate and more popularly used term for line spacing.
2.) Amount of space between lines of type.

Leaf
One sheet of paper in a publication. Each side of a leaf is one page.

Ledger Paper
Strong, smooth bond paper used for keeping business records. Also called record paper.

Left Justified
Alternate term for flush left. See Flush Left.

Legend
Directions about a specific matter (illustrations) and how to use. In regard to maps and tables, an explanation of signs (symbols) used.

Lenticular
A technology to create print images that appear to encompass actual depth and/or animation, by "stripping" the image and placing the printed image behind a specially stripped lens material.

Letterpress
In letterpress printing the raised portion of a metal or hard plastic plate is inked before being pressed on the paper or other substrate resulting in type that is slightly embossed.

Letter fold
Two folds creating three panels that allow a sheet of letterhead to fit a business envelope. Also called barrel fold and wrap around fold.

Letterforms
General term referring to all typographic characters and symbols.

Letter Paper
In North America, 8 1/2' x 11' sheets. In Europe, A4 sheets.

Letterpress
1.) The oldest of the major printing processes distinguished by its use of raised metal type: using either individual characters or plates made with raised type.
2.) Method of printing from raised surfaces, either metal type or plates whose surfaces have been etched away from image areas. Also called block printing .

Letterspacing
In typography, the space between typeset letters or other characters.

Ligature
In typography, two or more characters designed as a distinct unit and commonly available as a single character. Examples are ae, ce, etc.

Lightfast
Resistant to the destructive action of light.

Lightweight Paper
Book paper with basis weight less than 40# (60 gsm).

Lignin
Substance in trees that holds cellulose fibers together. Free sheet has most lignin removed; groundwood paper contains lignin.

Limited Edition
A number of multiples or identical artworks that are produced from a single master or matrix, all of which depict the identical image, and which may bear the artist's signature and numbers indicating the unique number of the specific print as well as the stated maximum number of prints in the edition.

Line Art
1.) Single color diagrams or drawings.
2.) An image that requires sharp edges and high contrast between areas of the image that have ink and those areas that do not have ink. A drawing that consists only of black and white with no intermediate grayscale information. These images require a higher resolution to create the sharpness that is necessary.

Line Copy (also called Line Art / Line Work)
Any high-contrast image, including type, as compared to continuous-tone copy.

Line Drawing
Any illustration material that contains no halftone, continuous tone, or tinted images. Pen-and-ink drawings and mezzotints are line art.

Line Length
In typography, the width of a typeset line, usually the area between two margins.

Line Negative
Negative made from line copy.

Linearization
The process of measuring and correcting for a device's inability to see or reproduce a straight line of tones from black to white. Most commonly used to ensure that an imagesetter reproduces the same halftone dot values predicted by the imaging software. Linearization is a critical first stage in setting up any color system.

Linen Finish
Embossed finish on text paper that simulates the pattern of linen cloth.

Lithograph
The process of printing from a stone or metal plate on which the image to be printed is ink-receptive and the blank area is ink repellent. (see "Printing Technologies" analysis)

Lithography
1.) Method of printing using plates whose image areas attract ink and whose nonimage areas repel ink. Nonimage areas may be coated with water to repel the oily ink or may have a surface, such as silicon, that repels ink.
2.) A term describing a printing process in which the image area and the non-image area coexist on the same plane, in contract to letterpress (printing from raised type).

Live Area
Area on a mechanical within which images will print. Also called safe area.

Logo (Logotype)
1.) In typography, a symbol representing a company or product.
2.) A company, partnership or corporate creation (design) that denotes a unique entity. A possible combination of letters and art work to create a "sole" entity symbol of that specific unit.

Looseleaf
Binding method allowing insertion and removal of pages in a publication.

Loose Proof
Proof of a halftone or color separation that is not assembled with other elements from a page, as compared to composite proof. Also called first proof, random proof, scatter proof and show-color proof.

Loupe
Lens built into a small stand. Used to inspect copy, film, proofs, plates and printing. Also called glass and linen tester.

Low-Resolution
Descriptive of an image, either on a computer display or in printed form, that has a low number of dots or pixels per square inch.

Low Key Photo
Photo whose most important details appear in the shadows.

LPI (Lines Per Inch)
Measurement of resolution on a traditional printing press. The number of lines per inch on a halftone screen. As a general rule, the higher the lpi, the higher the printed resolution and quality.

LUX
The international unit of illumination equivilent ot the amount of light falling on a surface which is situated at all points one meter from a point souce of one international candle. (see "foot candle")

M

Machine Glazed (MG)
Paper holding a high-gloss finish only on one side.

Magenta
A term for one of the four process color inks used in multicolor printing. Also incorrectly referred to as "red" (or process red), it is the red component used in many types of color mixing.

Majuscule
An alternate term for a capital letter.

Makeready
1.) All activities required to prepare a press or other machine to function for a specific printing or bindery job, as compared to production run. Also called setup.
2.) Paper used in the makeready process at any stage in production. Makeready paper is part of waste or spoilage.

Making Order
Order for paper that a mill makes to the customer's specifications, as compared to a mill order or stock order.

Male Die
Die that applies pressure during embossing or debossing. Also called force card.

Manuscript (MS)
1.) An author's original form of work (hand written, typed or on disk) submitted for publication.
2.) Any original handwritten or typed (typescript) copy from which type will be set.

Margin
1.) Imprinted space around the edge of the printed material.
2.) Any deliberately unprinted space on a page, especially surrounding a block of text. Margins are used not only to aid in the aesthetics and the readability of a page, but also to provide allowances for trimming, binding, and other post-press operations.

Mark-Up
Instructions written usually on a "dummy."

Mask
1.) To prevent light from reaching part of an image, therefore isolating the remaining part. Also called knock out.
2.) A special effect that can modify images so that only part of the image can be seen, or so that the image blends into the background.

Master
Paper or plastic plate used on a duplicating press.

Master Proof
A galley proof containing flagged items and questions for the editor or author. Also known as a printer's proof and reader's proof.

Masthead
In newspaper and magazine publishing, the listing of the publication's staff, management, address, etc., commonly printed toward the beginning of the publication. That term masthead is often confused with the flag or logo, which is a newspaper or other publication's nameplate.

Match Print
A form of a four-color-process proofing system.

Matrix
Traditionally, the plate or surface upon which an image is inscribed in order to hold ink for the purpose of transferring the image to the substrate or paper. In digital terms the matrix becomes the electronic file located on a computer's hard drive or resident memory or stored on a disk or CD. This matrix is made up of binary encoded information that can describe how the image file should appear on the digital raster screen or print.

Matte (Finish)
1.) A low-gloss finish with very little reflective quality.
2.) Flat (not glossy) finish on photographic paper or coated printing paper.

Measure
In typography, measure is synonymous with line length.

Mechanical
1.) Camera-ready assembly of type, graphic and other copy complete with instructions to the printer. A hard mechanical consists of paper and/or acetate, is made using paste-up techniques, and may also be called an art-board, board or paste-up. A soft mechanical, also called an electronic mechanical, exists as a file of type and other images assembled using a computer.
2.) Camera-ready art consisting of typeset text, heads, line art or other illustration matter, and other page elements pasted up into the proper position and ready for the making of printing plates.

Mechanical Bind
To bind using a comb, coil, ring binder, post or any other technique not requiring gluing, sewing or stitching.

Mechanical Separation
Color breaks made on the mechanical using a separate overlay for each color to be printed.

Mechanical Tint
Lines or patterns formed with dots creating artwork for reproduction.

Media
Another term for substrate; the materials to be printed, such as watercolor papers, canvas, copper, wood veneer, cotton, or plastic. The common term used in digital printing.

Metallic Ink
Ink containing powdered metal or pigments that simulate metal.

Metallic Paper
Paper coated with a thin film of plastic or pigment whose color and gloss simulate metal.

Mezzotint
1.) An early technique in copperplate engraving, invented in the 17th century by Ludwig von Siegen, that involves etching a copper or steel printing plate with a pattern of crosshatched lines or dots to provide the illusion of continuous tone images and gray values.
2.) A tonal, rather than linear, engraving process made by first roughening the surface of the plate with a mesh of small burred dots and then producing the picture by flattening and burnishing selected areas that print as highlights. Though its traditional role of rendering copies of works of art has been supplanted by photography, it is making a comeback as a printmaking technique in its own right. Aquatint: Another tonal process where a porous ground allows acid to penetrate to form a network of small dots. Any pure whites are "stopped out" entirely before etching begins, then the palest tints are "bitten" and stopped out, and so on as in etching. This process can be repeated up to 20 to 30 times until the darkest tones (deepest recesses in the plate) are reached.

Microporous
Refers to inkjet media with a receptor coating containing voids that the ink fills, rapidly absorbing the ink within the media rather than simply applying it to the surface of the media. This rapid absorption essentially makes it instantaneously "dry" to the touch.

Midtones
1.) In a photograph or illustration, tones created by dots between 30 percent and 70 percent of coverage, as compared to highlights and shadows.
2.) Tones in an image that are in the middle of the tonal range, halfway between the lightest and the darkest. Also called "middle values."

Mil 1/1000 Inch
The thickness of plastic films as printing substrates are expressed in mils.

Miniscule
Alternate term for a lowercase letter.

Misting
Phenomenon of droplets of ink being thrown off the roller train. Also called flying ink.

Mock Up
A reproduction of the original printed matter and possibly containing instructions or direction.

Modem
Mostly used over phone lines, a device that converts electronic stored information from point a to point b.

Moiré (pronounced "Mo-Ray")
1.) An undesirable artifact or pattern that can appear in output film, or a created special effect. It appears as a regular pattern of "clumping" of colors. A moiré pattern is created by juxtapositions of two repetitive graphic structures. An often undesirable element in a digital scan, but a natural visual occurrence created when similar patterns are superimposed and a third pattern is inferred wherever the two similar patterns do not completely match.
2.) An undesirable optical effect found in halftone reproductions resulting from interference patterns caused by incorrect screen angles.
3.) Undesirable pattern resulting when halftones and screen tints are made with improperly aligned screens, or when a pattern in a photo, such as a plaid, interfaces with a halftone dot pattern.

Monarch
Paper size (7' x 10') and envelope shape often used for personal stationery.

Monochromatic
Possessing a single color.

Monochrome
An image made of a range of only one color.

Monoprint
One of a series in which each print has some differences of color, design, texture, etc. applied to an underlying common image.

Monotype
A one-of-a-kind print made by painting on a smooth metal, glass, or stone plate and then printing on paper. The pressure of printing creates a texture not possible when painting directly on paper. Sometimes called a "unique edition." (see "Printing Technologies" analysis)

Montage
The seamless combination of divergent images into a singular image.

Monospaced
In typography, descriptive of characters of a typeface all having the same width. The lowercase "i" and "m"--which would have different widths in proportional width typefaces--are identical in monospaced typefaces.

Morgue
In desktop publishing, term for a collection of reference materials, such as an encyclopedia, dictionary, thesaurus, and materials from a swipe file, such as clip art.

Mottle
1.) Spotty, uneven ink absorption. Also called sinkage. A mottled image may be called mealy.
2.) A printing defect characterized by a spotty, nonuniform appearance in solid printed areas.

Mottling
A texturing seen in the smooth or monotone areas of an image. This can be due to faulty processing and a number of improperly used digital processes, e.g., excessive unsharp masking.

Mull
A specific type of glue used for books binding and personal pads needing strength.

Multicolor Printing
Printing in more than one ink color (but not four-color process). Also called polychrome printing.

Munsell (System of Color Notation)
Identifies precise, specific colors and shows relationships among colors, relying upon three attributes: hue, value, and chroma. The system consists of over 3 million sample observations of what people perceive to be like differences in hue, chroma, and value. American Artist A.H. Munsell, circ 1905. The complete Munsell notation for a color is written as hue value / chroma or hv/c.

M Weight
Weight of 1,000 sheets of paper in any specific size.

N

Natural Color
Very light brown color of paper. May also be called antique, cream, ivory, off-white or mellow white.

Negative
Generally speaking, a reversed photographic image produced on acetate-based film or photosensitive, resin coated paper.

Negative Space
In design, the space not occupied by the text or images.

Nested
Signatures assembled inside one another in the proper sequence for binding, as compared to gathered. Also called inset.

Nested Indent
In typography, a form of indention in which each subsequent indent is set relative to the previous indent, rather than from the left (or right) margin.

Neutral Gray
Gray with no hue or cast.

News Print
Paper used in printing newspapers. Considered low quality and "a short life use."

Newton Ring
1.) Flaw in a photograph or halftone that looks like a drop of oil or water.
2.) Concentric multicolored rings that occur when film is in contact with glass; a problem in scanning from negatives or transparencies.

Nipping
In the book binding process, a stage where air is expelled from it's contents at the sewing stage.

Nonheatset Web
Web press without a drying oven, thus not able to print on coated paper. Also called cold-set web and open web.

Nonimpact Printing
1.) Printing using lasers, ions, ink jets or heat to transfer images to paper.
2.) A printing process that transfers the ink to the media (paper or other) without pressure. (see also "impact printing")

Nonreproducing Blue
Light blue that does not record on graphic arts film, therefore may be used to preprint layout grids and write instructions on mechanicals. Also called blue pencil, drop-out blue, fade-out blue and nonrepro blue.

Nozzle
In inkjet printing, the orifice in the printhead from which ink droplets are ejected.

Novelty Printing
Printing on products such as coasters, pencils, balloons, golf balls and ashtrays, known as advertising specialties or premiums.

O

Object-Oriented
Descriptive of computer graphics that are based on vectors rather than bitmaps. See Vector Graphic.

Oblique
In typography, an alternate term for italic, or a term descriptive of a right-leaning change in the posture of the characters in a particular typeface.

OD (optical density)
(See "optical density")

Offset Lithography
A term describing the most common form of lithography (a printing process in which the image area and the non-image area coexist on the same plane, rather than from raised or etched type) in which a printed image is transferred first to a rubber blanket, and the blanket then transfers (or "offsets") the image to the paper or other surface.

Offset Printing
1.) Printing technique that transfers ink from a plate to a blanket to paper instead of directly from plate to paper.
2.) Synonymous term for offset lithography. offset printing (offset lithography).
3.) Currently the most common commercial printing method, in which ink is offset from the printing plate to a rubber roller then to paper..

Opacity
(1) Characteristic of paper or other substrate that prevents printing on one side from showing through the other side.
(2) Characteristic of ink that prevents the substrate from showing through.

Onion Skin
A specific lightweight type (kind) of paper usually used in the past for air mail. Seldom used today (in the typewriter era).

Opaque
1.) Not transparent.
2.) To cover flaws in negative with tape or opaquing paint. Also called block out and spot.

Open Prepress Interface
Hardware and software that link desktop publishing systems with color electronic prepress systems.

Opacity
1.) The measure of the amount of light that can pass through a material. Also, the property of a film that prevents "show through" of dark printing or marks on a substrate (media).
2.) The degree to which a material obscures a substrate, as opposed to transparency, which is the degree to which a material does not obscure a substrate. Also "hiding power."

Open edition
An edition or set of identical prints from a single master or matrix that is not limited in number. (see also "edition" and "limited edition")

Optical Density (OD)
The print density of an inkjet hardcopy is the visually perceivable and densitometrically measurable absorption of light on the surface due to the presence of a colorant. OD only measures the surface density of a dry hardcopy, not the density of the total amount of ink that was sprayed onto the medium.

Optical Resolution
The maximum physical resolution of a device. Optical resolution provides better quality than interpolated resolution (of the same number), which uses software to create additional image information.

Orientation
The direction that the page is printed: horizontal = landscape, vertical = portrait.

Overlaminate
A protective clear film that extends an image's durability and enhances its visual quality. Most often used in commercial signage.

Orphan
In typography, the last line of a paragraph when it is less than one-third the width of the line--especially when it is the carry-over of a hyphenated word--carried to the top of a new page or column.

Outer form
Form (side of a press sheet) containing images for the first and last pages of the folded signature (its outside pages) as compared to inner form.

Outline Halftone
Halftone in which background has been removed or replaced to isolate or silhouette the main image. Also called knockout halftone and silhouette halftone.

Output
In digital printing technology, to translate information from the computer to an external device (e.g., a printer or monitor); to print. Also, the visual display of digital information, or that which is printed or displayed.

Overlay
Layer of material taped to a mechanical, photo or proof. Acetate overlays are used to separate colors by having some type or art on them instead of on the mounting board. Tissue overlays are used to carry instructions about the underlying copy and to protect the base art.

Overlay Proof
Color proof consisting of polyester sheets laid on top of each other with their image in register, as compared to integral proof. Each sheet represents the image to be printed in one color. Also called celluloid proof and layered proof.

Overprint
To print one image over a previously printed image, such as printing type over a screen tint. Also called surprint.

Over Run
Additional printed matter beyond order. Overage policy varies in the printing industry. Advance questions avoid blind knowledge.

P

Page
One side of a leaf in a publication.

Page Count
Total number of pages that a publication has. Also called extent.

Page Proof
Proof of type and graphics as they will look on the finished page complete with elements such as headings, rules and folios.

Pagination
In the book arena, the numbering of pages.

Painted Sheet
Sheet printed with ink edge to edge, as compared to spot color. The painted sheet refers to the final product, not the press sheet, and means that 100 percent coverage results from bleeds off all four sides.

Palette
1.) The number of colors a device is capable of displaying and producing. Also the tools used in paint programs.
2.) The collection of colors or shades available or used in a project, graphic system, or program.

Panel
One page of a brochure, such as one panel of a rack brochure. One panel is on one side of the paper. A letter-folded sheet has six panels, not three.

Pantone
A brand-name for a popular color matching system, or series of printed color swatches used to match, specify, identify, and display specific colors or colored ink combinations.

Paper Plate
A printing plate made of strong and durable paper in the short run offset arena (cost effective with short runs).

Parallel Fold
Method of folding. Two parallel folds to a sheet will produce 6 panels.

Parent Sheet
Any sheet larger than 11' x 17' or A3.

Pasteboard
Chipboard with another paper pasted to it.

Pasteup
1.) The composition of a page by assembling the disparate page elements, either manually or electronically, into a mechanical or other form of camera-ready copy.
2.) To paste copy to mounting boards and, if necessary, to overlays so it is assembled into a camera-ready mechanical. The mechanical produced is often called a paste-up.

PDF (Portable Document File)
A proprietary format developed by Adobe Systems for the transfer of designs across multiple computer platforms.

PE (Printer Error)
Proofreader mark meaning printer error and showing a mistake by a typesetter, prepress service or printer as compared to an error by the customer.

Perfect Bind
To bind sheets that have been ground at the spine and are held to the cover by glue. Also called adhesive bind, cut-back bind, glue bind, paper bind, patent bind, perfecting bind, soft bind and soft cover. See also Burst Perfect Bind.

Perfecting Press
Press capable of printing both sides of the paper during a single pass. Also called duplex press and perfector.

Perf Marks
On a "dummy" marking where the perforation is to occur.

Perforating
Taking place on a press or a binder machine, creating a line of small dotted wholes for the purpose of tearing-off a part of a printed matter (usually straight lines, vertical or horizontal).

Phase change printer
An inkjet printer where the ink starts as a solid but is then heated, liquefied, and then sprayed onto a substrate. (see "Digital Printing" analysis and "solid ink")

Photo CD
A proprietary format developed by Eastman Kodak for storing photographic images on a compact disc. Images can be easily accessed for use in professional printing.

Photograph
An image or picture made by photography, whether traditional or digital. (see "photography")

Photography
The art or process of capturing an image onto a recording medium (whether photographic film or image sensor/detector) by the action of light or other radiant energy with the aid of a camera or other device.

PICT
A picture file format.

Piezoelectric (or piezo)
An inkjet printing technology that uses electricity to "fire" the nozzle. (see "Digital Printing" analysis)

Photoengraving
1.) Engraving done using photochemistry.
2.) Brand name for a diffusion transfer process used to make positive paper prints of line copy and halftones. Often used as alternate term for photostat. Abbreviated PMT.

Photostat
Brand name for a diffusion transfer process used to make positive paper prints of line copy and halftones. Often used as alternate term for PMT.

Pica
A basic unit of measurement in typography. One pica equals 12 points, and 6 picas equal approximately 1 inch. There are 12 points to a pica. A pica is approximately 0.166 in.

Picking
Phenomenon of ink pulling bits of coating or fiber away from the surface of paper as it travels through the press, thus leaving unprinted spots in the image area.

Pickup Art
Artwork, used in a previous job, to be incorporated in a current job.

Pigment
Colorant consisting of particles made up of many synthetic dye molecules or carbon black. Generally more stable than dyes of the same color. Pigmented inkjet inks are credited with better longevity and may have a narrower color gamut. Finely ground insoluble dispersed particles that, when dispersed in a liquid vehicle, can be made into a paint or ink.

Pinholing
Small holes (unwanted) in printed areas because of a variety of reasons.

Pin Register
Technique of registering separations, flats and printing plates by using small holes, all of equal diameter, at the edges of both flats and plates.

Pixel
1.) Short for picture element, a dot made by a computer, scanner or other digital device. Also called pel.
2.) Term derived from pi(x)cture element. Refers to the simplest or smallest element of a digital image.

Pixel depth
The amount of data used to describe each colored dot on the computer screen. Example: monochrome is 1 bit deep, grayscale is 8 bits deep, RGB is 24 bits deep. Images to be printed as CMYK separation should be 32 bits deep. (see also "bit depth")

Pizza wheel
Serrated, edged wheels that are used to move paper through printers.

Planographic
In printmaking, a surface that has ink on its flat plane as opposed to being engraved or embossed to hold ink.

Planographic Printing
Printing method whose image carriers are level surfaces with inked areas separated from noninked areas by chemical means. Planographic printing includes lithography, offset lithography and spirit duplicating.

Plate
1.) The basic image-carrying surface in a printing process which can be made of a variety of substances such as paper, metals, rubber, or plastic.
2.) Piece of paper, metal, plastic or rubber carrying an image to be reproduced using a printing press.

Platemaker
(1) In quick printing, a process camera that makes plates automatically from mechanicals.
(2) In commercial lithography, a machine with a vacuum frame used to expose plates through film.

Plate-ready Film
Stripped negatives or positives fully prepared for platemaking.

Plotter
A term applied to a peripheral unit that, through computer control, prints data via the Cartesian (X/Y) coordinate system.

PMS
Obsolete reference to Pantone Matching System. The correct trade name of the colors in the Pantone Matching System is Pantone colors, not PMS Colors.

PMT
Abbreviation for photomechanical transfer.

Point (Point Size)
1.) Unit of measurement commonly used to specify type size. There are twelve points in a pica and 72 points in an inch.
2.) Regarding paper, a unit of thickness equating 1/1000 inch. (3) Regarding type, a unit of measure equaling 1/12 pica and .013875 inch (.351mm).

Portrait (Portrait Mode--Opposite of Landscape)
1.) An art design in which the height is greater than the width.
2.) A page format in which the correct reading or viewing orientation is vertical; the height of the page is greater than its width. See Landscape.
3.) The orientation of an image that is taller than it is wide; a setting controlling an output device to properly fit a computer document to the print medium.

PostScript
A page description programming language created by Adobe that is a device-independent. PostScript is an industry standard for outputting documents and graphics.

Position Stat
Photocopy or PMT of a photo or illustration made to size and affixed to a mechanical.

Positive (Abbreviated as Pos)
1.) A reproduction that is exactly like the original.
2.) Opposite of Negative

Positive Film
Film that prevents light from passing through images, as compared to negative film that allows light to pass through. Also called knockout film.

Post Bind
To bind using a screw and post inserted through a hole in a pile of loose sheets.

Posterization
An effect created by having a limited number of levels or gradient steps within an image. This may be a planned/desired effect, or it may be a mistake requiring correction.

Potshot
Clear material applied as a final coat to protect prints or artwork.

PPI (pixels per inch)
A measure of resolution or density of pixels in a digital image.

Prepress
Camera work, color separations, stripping, platemaking and other prepress functions performed by the printer, separator or a service bureau prior to printing. Also called preparation.

Prepress Proof
Any color proof made using ink jet, toner, dyes or overlays, as compared to a press proof printed using ink. Also called dry proof and off-press proof.

Preprint
To print portions of sheets that will be used for later imprinting.

Press Check
Event at which makeready sheets from the press are examined before authorizing full production to begin.

Press Proof
Proof made on press using the plates, ink and paper specified for the job. Also called strike off and trial proof.

Press Time
Amount of time that one printing job spends on press, including time required for makeready. Time of day at which a printing job goes on press.

Price Break
Quantity at which unit cost of paper or printing drops.

Primary Colors
Any set of colors within a particular color system that are the most basic colors for that system. All other colors can be produced from the primaries, but the primaries cannot be produced by combinations of other colors.

Print
1.) In the context of fine art, an original work of art (as a woodcut, lithograph, photograph, or digital print) where the art object or artwork does not exist until it is printed. The print is made directly from the matrix by the artist or pursuant to his/her directions. Also known as "fine print," "work on paper," and "original print."
2.) A physical image, usually on paper, produced by, but not limited to, such processes as etching, lithography, serigraphy, relief printing, photography, or digital methods. Prints are usually, but not always, produced on paper and in multiples. Traditional, photographic, and digital processes can be used to produce prints.

Print Density
(see Optical Density)

Printer Driver
Printer-specific software that allows a computer to communicate with the printer. If available, provided by the printer manufacturer. (see also "RIP")

Print Head
Part of a digital printer that is directly responsible for applying ink to a medium.

Printing
Any process that transfers to paper or another substrate an image from an original such as a film negative or positive, electronic memory, stencil, die or plate.

Printmaker
A person producing actual prints from the artist's master file, under the artist's supervision.

Print on demand
The ability of digital printing to produce prints individually or sporadically over an extended period of time, with consistency. This allows orders of a small number of prints when needed: "print on demand."

Printout
Any hard copy of computer data.

Print Permanence
The resistance of a print to physical change of any type, from any source, be it light, heat, acids, etc.

Printer Pairs
Usually in the book arena, consecutive pages as they appear on a flat or signature.

Printing Plate
Surface carrying an image to be printed. Quick printing uses paper or plastic plates; letterpress, engraving and commercial lithography use metal plates; flexography uses rubber or soft plastic plates. Gravure printing uses a cylinder. The screen printing is also called a plate.

Print Resolution
(see "resolution")

Print Service Provider (PSP)
A commercial, digital printing agency or firm that takes an artist's image file and prints it to the artist's specifications.

Printer Spreads
Mechanicals made so they are imposed for printing, as compared to reader spreads.

Printing Unit
Assembly of fountain, rollers and cylinders that will print one ink color. Also called color station, deck, ink station, printer, station and tower.

Process Camera
Camera used to photograph mechanicals and other camera-ready copy. Also called copy, camera and graphic arts camera. A small, simple process camera may be called a stat camera.

Process Color
The mechanical process of reproducing a full color image with the three primary subtractive color inks and black (CMYK: Cyan, Magenta, Yellow and Black or "K"). When viewed under a loupe, the individual color halftone dots can be seen in a process color image.

Process Color (Inks)
The colors used for four-color process printing: yellow, magenta, cyan and black.

Profile
A file of data or values. In digital printing, generally used to refer to a color profile, especially of a specific piece of equipment (monitor, printer, scanner, etc.) that enables the user to correlate color consistently on various devices.

Proof
A preliminary print used to evaluate aspects of the image (color, density, resolution, etc.) prior to final printing.

Production Run
Press run intended to manufacture products as specified, as compared to makeready.

Proofreader Marks
Standard symbols and abbreviations used to mark up manuscripts and proofs. Also called correction marks.

Process Colors
The printing of "full color" images utilizing a photographic color separation process in which each of three primary colors--cyan, magenta, and yellow, plus black--are separated from the original art and given their own printing plate.

Proportion Scale
Round device used to calculate percent that an original image must by reduced or enlarged to yield a specific reproduction size. Also called percentage wheel, proportion dial, proportion wheel and scaling wheel.

Proportional Width
In typography, individual character-width relationships based on character shape and typeface design. For example, the letter "i" has a narrow width, while the letter "m" has a wide width.

Publishing Paper
Paper made in weights, colors and surfaces suited to books, magazines, catalogs and free-standing inserts.

Pull Quote
In magazine publishing (and occasionally elsewhere), a small extract of text is pulled from a story or article and set off from the main text, often in a larger point size and/or different typeface, and may be surrounded by a border or rule. Often used for emphasis.

Q

Quadtone
A four-color halftone produced by overprinting two halftone screens made from the same photograph (usually black-and-white photograph), as a means of generating a monochromatic image with a full range of tonal gradations. Not to be confused with four-color-process printing which uses CMYK ink colors.

Quadtone Inks
Special multi-monochromatic (B&W) inksets.

Quality
Subjective term relating to expectations by the customer, printer and other professionals associated with a printing job and whether the job meets those expectations.

Quarto
1.) Sheet folded twice, making pages one-fourth the size of the original sheet. A quarto makes an 8-page signature.
2.) Book made from quarto sheets, traditionally measuring about 9' x 12'.

Quick Printing
Printing using small sheetfed presses, called duplicators, using cut sizes of bond and offset paper.

R

Rag
In the context of paper manufacturing, cotton rags are a source for high quality cellulose fibers. In fine art printmaking, refers to rag content of paper, generally high-quality paper.

Rag Paper
Stationery or other forms of stock having a strong percentage content of "cotton rag".

Ragged
In typography, lines of type that are not justified; that is, they do not align at the right margin. (Also called ragged right).

Raster
A horizontal row of pixels on a screen. The process of rendering an image or page, pixel by pixel, in a sweeping horizontal motion, one line after another.

Raster image
An image that is defined as a collection of pixels arranged in a rectangular array of lines of dots or pixels. (see "bitmap")

Rasterization
Changing vector-type image information to raster image information.

Raster Graphics
Alternate term for bitmapped graphics. See Bitmap.

Raster Image Processor
Device that translates page description commands into bitmapped information for an output device such as a laser printer or imagesetter.

RC paper (Resin coated paper)
Term used for photographic paper used in most color and some black-and-white printing applications; has a polyethylene coating on each side.

Reactive dye
Dyestuff used for coloring textiles. Reactive dyes are used for wool, silk,

cotton, but they do not dye polyester or other synthetic fibers.

Reader Spread
Mechanicals made in two page spreads as readers would see the pages, as compared to printer spread.

Ream
500 sheets of paper.

Receptor coating
Chemical layer adhered to the surface of the media that has the function of receiving and binding ink arriving from the printhead nozzle. (see "coating" and "inkjet coating")

Recto
The odd-numbered page on the right side of an open book, or the right-hand page of a two-page spread. See also Verso.

Reflectance
The fraction of the light incident on a surface that is reflected; varies according to the wavelength distribution of the light.

Reflectance, Specular
Mirror-like reflectance. The magnitude of the specular reflectance on glossy materials depends on the angle and on the scattering of the light by an uneven surface.

Reflectance, Total
Reflectance of radiant flux reflected at all angles from the surface, thus including both diffuse and specular reflectances.

Reflective Art
Artwork that is neither digital nor transparent. Refers to artwork that is viewed with the light on the same side of the image as the viewer.

Reflective Copy
Seen by light reflected from them, as compared to transparent copy. Also called reflex copy.

Registration
A process used to align an image to a particular placement on a surface before printing or transferring to that surface.

Register
1.) To place printing properly with regard to the edges of paper and other printing on the same sheet. Such printing is said to be in register.
2.) The degree to which successively printed colors (or images) are accurately positioned with respect to each other.

Register Marks
1.) Cross-hair lines on mechanicals and film that help keep flats, plates, and printing in register. Also called crossmarks and position marks.
2.) Small designs, shapes, or other patterns (most commonly a circle or oval with a cross through it) placed in non-image areas of negatives, positives, color separations, and plates to ensure correct register--or alignment--of successive colors and/or images.

Registration
The extent to which successively printed colors or images are positioned on the final print, with respect to each other or to their position on the original copy. See Register.

Relief Printing
Printing method whose image carriers are surfaces with two levels having inked areas higher than noninked areas. Relief printing includes block printing, flexography and letter press.

Relief Process
In printmaking, a process using printing plates that are incised, etched, or sand-blasted before the surface is inked. Lines or areas that have been cut away do not print. The ink is transferred from the surface of the plate to the paper either by hand-rubbing or with a press.

Rendering
Applying shading and lighting effects to a two dimensional image.

Reproduction
A copy of an original work of art. In the context of digital art, a copy of artwork that already exists in some other original form or material (painting, drawing, etc.) prior to the fixing of the image of that original work on the current printing matrix. (see also "giclée")

Repeatability
Ability of a device, such as an imagesetter, to produce film or plates that yield images in register.

Reprographics
General term for xerography, diazo and other methods of copying used by designers, engineers, architects or for general office use.

Resembling
Changing the resolution of a bitmap file without altering its physical size.

Resolution
1.) Sharpness of an image on film, paper, computer screen, disc, tape or other medium.
2.) A definition of resolution in terms of pixels per inch, or pixel density. Refers to the number of smallest discernable dots or pixels. A measurement of the "fineness" of detail reproduction given in line pairs per mm, or pixels per inch. (see "DPI" and "PPI")

Resolution Target
An image, such as the GATF Star Target, that permits evaluation of resolution on film, proofs or plates.

Retouching
Removing imperfections or unwanted portions of an image.

Reverse
1.) Essentially, the negative of an image, or the producing of the negative of an image. The term reverse also refers to type or other matter that is designed to print as white on black (or dark colored) backgrounds.
2.) Type, graphic or illustration reproduced by printing ink around its outline, thus allowing the underlying color or paper to show through and form the image. The image 'reverses out' of the ink color. Also called knockout and liftout.

RGB (Red, Green, Blue)
1.) A color model using red, green, and blue; the additive primary colors. Video display systems use RGB data to create screen images.
2.) In computer graphics, the three basic components of visible light, the various combinations of which produce all the colors of the spectrum.

RIFF (Raster Image File Format)
A storage format used with grayscale images. In Corel Painter the RIFF format is used to save color image files that retain all of the Painter capabilities such as "wet canvas" and active layers. Saving in any other format disallows further modifications and interaction with these tools.

Right Justified
Alternate term for flush right. See Flush Right.

Right Reading
1.) Copy that reads correctly in the language in which it is written.
2.) Descriptive of any film or paper image that can be read normally--i.e., from left to right and top to bottom--as opposed to wrong-reading.

RIP (Raster Image Processor)
"Bridge" software allowing the computer to give specific instructions to a printer. Often includes add-on features such as color-calibration routines and various tools.

River
In typography, an optical path of white space that can occur when word spaces in successive lines of type occur immediately below each other and

continue for several lines. This is distracting to the eye and aesthetically undesirable, and may be corrected by moving words from line to line in order to position the word spaces. Also known as a river of white.

Rotary Press
Printing press which passes the substrate between two rotating cylinders when making an impression.

Rotogravure (Gravure)
1.) An intaglio printing process that uses engraved cylinders. Ink is retained in the engraved areas for printing. It is ideal in long-run work and prints on most substrates.
2.) Method of printing using metal cylinders etched with millions of tiny wells that hold ink.

Rough
A sketch or enhanced thumbnail of a page design or layout that depicts a somewhat accurate representation of the final size and position of all page elements. Roughs are usually drawn on tracing paper by hand. A more formalized design sketch is a comprehensive layout.

Round Back Bind
To casebind with a rounded (convex) spine, as compared to flat back bind.

Ruby Window
Mask on a mechanical, made with rubylith, that creates a window on film shot from the mechanical.

Rule
1.) Line used as a graphic element to separate or organize copy.
2.) A geometric line used as a graphic enhancement in page assembly--the term is used to distinguish ruling lines from a line of type.

Ruleup
Map or drawing given by a printer to a stripper showing how a printing job must be imposed using a specific press and sheet size. Also called press layout, printer's layout and ruleout.

Runaround
In Typography, copy set so that it will create a "hole" on the page to fit an illustration, photo, or other page elements. The term runaround is also used to refer to contour type, or type that is set to form a shape.

Run-in
In typography, any copy, specifically a head, designed to be set in the same line as the text.

Running Foot
In book typography, a "heading"--such as a book title, chapter title, or author--that is located at the bottom of consecutive pages, in contrast to a running head. A running foot may also include a folio.

Running Head
In book typography, a heading--such as a book title, chapter title, or author--that is located at the top of consecutive pages, in contrast to a running foot. A running head may also include a folio.

S

Saddle Stitch
To bind by stapling sheets together where they fold at the spine, as compared to side stitch. Also called pamphlet stitch, saddle wire and stitch bind.

Sans Serif
In typography, characters (or typefaces) without serifs, which are lines crossing the free end of the stroke. "Sans serif" means "without serif".

Satin Finish
Alternate term for dull finish on coated paper.

Saturation
A measure of purity of color. Saturated colors contain pure color only, colors desaturate to gray. Saturation is a measure of the degree of pureness or movement away from gray. The amount of gray in a color. More gray means lower saturation; less gray means higher saturation. If a color has no saturation, it is a shade of gray. Saturation is also the degree to which a color is undiluted by white light. (see "chroma")

Scale
1.) The act of--or the computer function that facilitates--altering the size of an image or font proportionately.
2.) To identify the percent by which photographs or art should be enlarged or reduced to achieve, the correct size for printing.
3.) To enlarge or reduce an image by increasing or decreasing the number of scanned pixels or the sampling rate, relative to the number of samples per inch needed by the printer or other output device. (see also "interpolation")

Scan
The process of translating a picture from reflective art or transparency into digital information.

Scanner
A hardware peripheral that illuminates, reads, and then converts original text, artwork, or film into digital data. Types of scanners include flatbed, film, and drum.

Score
To compress paper along a straight line so it folds more easily and accurately. Also called crease.

Screen printing (screenprinting)
Stencil-based impact printing technology. (see "Printing Technologies" analysis)

Screen Angles
Angles at which screens intersect with the horizontal line of the press sheet. The common screen angles for separations are black 45 degree, magenta 75 degree, yellow 90 degree and cyan 105 degree.

Screen Density
Refers to the percentage of ink coverage that a screen tint allows to print. Also called screen percentage.

Screen Printing
Method of printing by using a squeegee to force ink through an assembly of mesh fabric and a stencil.

Screen Ruling
Number of rows or lines of dots per inch or centimeter in a screen for making a screen tint or halftone. Also called line count, ruling, screen frequency, screen size and screen value.

Screen Tint
Color created by dots instead of solid ink coverage. Also called Benday, fill pattern, screen tone, shading, tint and tone.

Selection
Any of several processes by which the digital artist can isolate a portion of a digital image in order to perform additional work or protect the selected area from manipulations applied to the remaining "unprotected" areas. Similar to frisket paper and masking tape in traditional painting.

Selective Binding
Placing signatures or inserts in magazines or catalogs according to demographic or geographic guidelines.

Self Cover
Usually in the book arena, a publication not having a cover stock. A publication only using text stock throughout.

Self Mailer
A printed item independent of an envelope. A printed item capable of travel in the mailing arena independently.

Separated Art
Art with elements that print in the base color on one surface and elements that print in other colors on other surfaces. Also called preseparated art.

Separations
Usually in the four-color process arena, separate film holding images of one specific color per piece of film. Black, Cyan, Magenta and Yellow. Can also separate specific PMS colors through film.

Serif
In typography, an all-inclusive term for characters that have a line crossing the free end of a stroke. The term serif refers to both that finishing line and to characters and typefaces that have them.

Serigraphic Printing
1.) Printing method whose image carriers are woven fabric, plastic or metal that allow ink to pass through some portions and block ink from passing through other portions. Serigraphic printing includes screen and mimeograph.
2.) A screen print (silk screen) is a form of printmaking utilizing stencils attached to porous screens that support delicate areas of the cut design. In the fine art world, most often issued in signed and numbered editions. (see "Printing Technologies" analysis)

Setoff
Undesirable transfer of wet ink from the top of one sheet to the underside of another as they lie in the delivery stack of a press. Also called offset.

Shade
Hue made darker by the addition of black, as compared to tint. Darkest areas of a photograph or illustration, as compared to midtones and high-lights.

Shadow detail
Subtle features in the darker part of an image.

Shadow point
The darkest tone printable in an image without being black. All tonal values below this threshold will print as black with no detail.

Sharpen edges
An image-editing technique to enhance the edges of an object.

Sharpening
1.) A picture enhancement making the image have more distinct borders, areas, lines, or tones.
2.) An option on some scanners that emphasizes detail by increasing the contrast of the boundaries between light and dark areas of an image.

Sheetfed Press
Press that prints sheets of paper, as compared to a web press.

Sheetwise
Technique of printing one side of a sheet with one set of plates, then the other side of the sheet with a set of different plates. Also called work and back.

Shingling
Allowance, made during paste-up or stripping, to compensate for creep. Creep is the problem; shingling is the solution. Also called stair stepping and progressive margins.

Show-through
Occurs when ink penetrates the paper substrate and is visible from the back; also termed "print-through."

Sidebar
In graphics and page layout, text and/or graphics set off from the primary text to impart additional or peripheral information. Sidebars may also be type set using a different font than the main text.

Side stitch
To bind by stapling through sheets along, one edge, as compared to saddle stitch. Also called cleat stitch and side wire.

Signature
Printed sheet folded at least once, possibly many times, to become part of a book, magazine or other publication.

Silhouetting
A masking or image blocking that isolates an image from the background.

Silk screen
An archaic term for screen printing, since most screen printing is now done with synthetic-fabric screens.

Signed
Carrying an original signature of the artist. In law: Autographed by the artist's own hand, and not by mechanical means of reproductions, and if a multiple, after the multiple was produced, whether or not the master was signed.

Size
Compound mixed with paper or fabric to make it stiffer and less able to absorb moisture.

Sized paper
A paper with filler added to the pulp as it is manufactured or applied to the surface after the paper is formed to facilitate better acceptance of art media.

Slip Sheets
Separate sheets (stock) independent from the original run positioned between the "printed run" for a variety of reasons.

SLR (Single Lens Reflex)
A form of small format (35mm or 6cm) camera with a reflecting mirror that retracts when the shutter is released and so allows the photographer to view the image exactly as it will be framed in the photo.

Soft Copy
Any page, document, publication, or other data that exists on a computer display, rather than as a printout, or hard copy.

Soft Dots
Halftones dots with halos.

Soft Proof
Viewing a digital image with a monitor instead of generating a hard copy proof. Can be done from a remote location via the Internet.

Solid (coverage)
Any area of the sheet receiving 100 percent ink coverage, as compared to a screen tint.

Solid ink
Also called "phase change." Solid ink technology involves the use of solid, resin-based ink. The printhead and ink supply are heated to melt the ink and bring it to very low viscosity. The ink is ejected hot and "freezes" on the surface of the medium or onto a drum from which it is transferred like an offset press, onto paper. Solid ink technology can be printed and transferred, or can be printed directly.

Soy-based Inks
Inks using vegetable oils instead of petroleum products as pigment vehicles, thus are easier on the environment.

Spatial resolution
The smallest feature of an image that can be detected as a fraction of the total image.

Specially Printer
Printer whose equipment, supplies, work flow and marketing is targeted to a particular category of products.

Specifications
Complete and precise written description of features of a printing job such as type size and leading, paper grade and quantity, printing or binding method. Abbreviated specs.

Spectrophotometer
Photometric device for the measurement of spectral transmittance, spectral reflectance, or relative spectral emittance. Spectrophotometers are normally equipped with dispersion optics (prism or grating) to give a continuous spectral curve. Commonly called "spectros."

Spectrum
Spatial arrangement of components of radiant energy in order of their wavelengths, wave number, or frequency. In this context, the full range of visible wavelengths of light energy radiation.

Specular Highlight
Highlight area with no printable dots, thus no detail, as compared to a diffuse highlight. Also called catchlight and dropout highlight.

Spine
Back or binding edge of a publication

Spiral Bind
To bind using a spiral of continuous wire or plastic looped through holes. Also called coil bind.

Split Fountain
Technique of putting ink colors next to each other in the same ink fountain and printing them off the same plate. Split fountains keep edges of colors distinct, as compared to rainbow fountains that blend edges.

Split Run
1.) Different images, such as advertisements, printed in different editions of a publication.
2.) Printing of a book that has some copies bound one way and other copies bound another way.

Spoilage
Paper that, due to mistakes or accidents, must be thrown away instead of delivered printed to the customer, as compared to waste.

Spot Color or Varnish
One ink or varnish applied to portions of a sheet, as compared to flood or painted sheet.

Spread
1.) Two pages that face each other and are designed as one visual or production unit.
2.) Technique of slightly enlarging the size of an image to accomplish a hairline trap with another image. Also called fatty. 3.) In page layout and printing, any two facing pages of a book, magazine, newspaper, or other publication.

sRGB
One of several standard RGB color working spaces. Best used for images on the Internet.

Stochastic / FM Screening
An alternative to traditional halftone dots, this random-placement dot strategy is used to render enlarged images on large-format printing devices. Unlike halftone, the dots are of a uniform size, darker areas have more dots packed closer together.

Stairstep
In digital printing, an alternate term for jaggies or the effect of aliasing.

Standard Viewing Conditions
Background of 60 percent neutral gray and light that measures 5000 degrees Kelvin the color of daylight on a bright day. Also called lighting standards.

Stat (Short for photostat)
A general term for an inexpensive photographic print of line copy or halftone.

Statistical Process Control
Method used by printers to ensure quality and delivery times specified by customers. Abbreviated SPC.

Step and Repeat
Prepress technique of exposing an image in a precise, multiple pattern to create a flat or plate. Images are said to be stepped across the film or plate.

Stocking Paper
Popular sizes, weights and colors of papers available for prompt delivery from a merchant's warehouse.

Stock Order
Order for paper that a mill or merchant sends to a printer from inventory at a warehouse, as compared to a mill order.

String Score
Score created by pressing a string against paper, as compared to scoring using a metal edge.

Strip
To assemble images on film for platemaking. Stripping involves correcting flaws in film, assembling pieces of film into flats and ensuring that film and flats register correctly. Also called film assembly and image assembly.

Substance Weight
Alternate term for basis weight, usually referring to bond papers. Also called sub weight.

Stumping (Blocking)
In the book arena, hot die, foil or other means in creating an image on a case bound book.

Stylus
A tool used on a graphic input tablet as a drawing instrument, or as a mouse.

Subhead
In typography, a secondary heading, often in a smaller point size and set below the primary head.

Subscript
In typography, characters set in a small point size and positioned below the baseline, also called inferior.

Subsampling
Scanning at a less-than-optimum sampling rate.

Substrate
1.) Any surface or material on which printing is done.
2.) Any material on which a picture is mounted.
3.) The material that receives the printed image. Sometimes called "media" in digital printing. The single or multi-layered base material of the medium, which can have a very simple or complex structure and is a carrier for the coating, if present.

Subtractive color / Reflective color
Color produced by light reflected from a surface, as compared to additive color. Subtractive color includes hues in color photos and colors created by inks on paper.

Subtractive Primary Color
Yellow, magenta and cyan. In the graphic arts, these are known as process colors because, along with black, they are the inks colors used in color-process printing.

Supercalendered Paper
Paper calendered using alternating chrome and fiber rollers to produce a smooth, thin sheet. Abbreviated SC paper.

Superscript
In typography, characters set in a smaller point size and positioned above the baseline, also called superior.

Surprint
Taking an already printed matter and re-printing again on the same.

Swash Book
A book in a variety of forms, indicating specific stock in specific colors in a specific thickness.

Swatch
Shorthand term for color swatch. See Color Swatch.

Swipe File
In graphic arts and design, a type of "scrapbook" or collection of examples of good design-- such as published advertisements, page designs, etc--from which an artist can draw for inspiration.

SWOP (Specifications for Web-Offset Publications)
A set of web standards for color proofing developed by a joint committee to ensure that colors are reproduced consistently among different publishers and publications.

T

Tabloid
1.) Using a broadsheet as a measure, one half of a broadsheet.
2.) In newspaper publishing, a page size of a newspaper corresponding to 11 1/2 x 17 inches long. As tabloid paper was often used to print so-called "scandal sheets," the term "tabloid" itself has come to refer to splashy, attention-grabbing (and, some would say, somewhat "sleazy") journalism. Not to be confused with an 11 x 17 inch spread which is made up of two letter-sized pages.
3.) Grade of dense, strong paper used for products such as badges and file folders.

Tags
In desktop publishing, a code attached to a specific piece of text that provides instructions for its formatting. Tags applied to text include its font, point size, leading, paragraph formatting (ragged or justified), and any other text attribute.

Tagged Image File Format (TIFF)
A graphic and page layout file format for desktop computers. TIFF is used to transfer documents between different applications and computer platforms. .

Target Ink Densities
Densities of the four process inks as recommended for various printing processes and grades of paper. See also Total Area Coverage.

Template
A standard layout with a background grid, image, or shape used to indicate where page elements are to be inserted. Templates are used to define the default page layout for a publication.

Text Paper
Designation for printing papers with textured surfaces such as laid or linen. Some mills also use 'text' to refer to any paper they consider top-of-the-line, whether or not its surface has a texture.

Text Wrap
See Word Wrap.

Thermal inkjet printer
Printer using inkjet print heads with a heat (thermal) system used to produce the ink drop. (see also "piezo")

Thermal transfer printer
A machine that digitally prints by transferring inks (resin or wax based) from a foil (or ribbon) onto media such as paper or vinyl.

Thermography
Method of printing using colorless resin powder that takes on the color of underlying ink. Also called raised printing.

Thumbnail
1.) A small low-resolution version of an image.
2.) A crude sketch of a proposed page layout, usually generated in bunches during the brainstorming phase of design,

TIFF
(see Tagged Image Format File)

Tiling
The process of breaking down an image or page into sections for editing or printing purposes.

Tint
1.) Screening or adding white to a solid color for results of lightening that specific color.
2.) A printed image containing "halftone" dots that are all of uniform size, as opposed to a halftone or vignette, which use variable-size dots to simulate a range of tones or shades.

Tip In
Usually in the book arena, adding an additional page(s) beyond the normal process (separate insertion).

Toner
A powder or liquid used to print onto various materials on electrostatic printers. Contains a colorant, an electrostatic thermoplastic, charge control agent, and often a magnetic material.

Tone Compression
Reduction in the tonal range from original scene to printed reproduction.

Topcoat
The coating applied to the surface of inkjet or other type media during the manufacturing process. The topcoat enhances ink adhesion and other performance characteristics; it also helps to control dot gain, drying time, and moisture resistance.

Total Area Coverage (TAC)
Total of the dot percentages of the process colors in the final film. Also called density of tone, maximum density, shadow saturation, total dot density and total ink coverage.

Touch Plate
Plate that accents or prints a color that four-color process printing cannot reproduce well enough or at all. Also called kiss plate.

Trade Shop
Service bureau, printer or bindery working primarily for other graphic arts professionals, not for the general public.

Tracking
Adjusting the letterspacing throughout a piece of typeset copy. See Letterspacing.

Transform
A color-space exchange from one system (RGB or CMYK) to the other, or changing from one hue base to another.

Translucent
Diffuse transmission of light. No clear image can be seen.

Transparent
A clear material that transmits light with minimal diffusion or scattering.

Transparency (TX)
Positive photographic image on film allowing light to pass through. Also called chrome, color transparency and tranny.

Trap
To print one ink over another or to print a coating, such as varnish, over an ink. The first liquid traps the second liquid. See Dry Traps and Wet Traps.

Trim Size
The size of the printed material in its finished stage.

Trilinear Scanner
A scanning device that uses three linear array charge-coupled devices (CCDs) utilizing red, green, and blue filters to capture color scans in a single pass.

Tristimulus
1.) Of, or consisting of, three stimuli; generally used to describe components of additive mixture required to evoke a particular color sensation.
2.) Colorimeter: An instrument that measures tristimulus values and converts them to chromaticity components of color.

Tristimulus Values, CIE
Amounts (in percent) of the three components necessary in a three-color additive mixture required for matching a color; in the CIE system, they are designated as X, Y, and Z.

Tritone
A three-color halftone produced by overprinting two halftone screens made from the same photograph (usually black-and-white photograph), as a means of generating a monochromatic image with a full range of tonal gradations.

Typeface
A specific variation within a type family, such as roman, italic, bold, etc.

Type Family
A group of typefaces created by common design characteristics. Each member may vary by weight (bold vs. regular) and width (expanded vs. condensed) and may have related italic versions.

Typescript
Any original handwritten (manuscript) or typed copy from which type will be set.

Typography
The art and process of specifying, setting, or otherwise working with print-quality type, as opposed to typewriting. Typography involves the proper placement, positioning, and specification of type to ensure not only maximum legibility but also high aesthetic appeal.

U

U&lc
Abbreviation for "upper and lower case" letters.

Uncoated Paper
Paper that has not been coated with clay. Also called offset paper.

Undercolor Addition (UCA)
Technique of making color separations that increases the amount of cyan, magenta or yellow ink in shadow areas.

Undercolor Removal (UCR)
Technique of making color separations such that the amount of cyan, magenta and yellow ink are reduced in midtone and shadow areas while the amount of black is increased.

Unit
In typography, some fraction of an em space that, due to the variation of the size of an em according to point size, varies from point size to point size.

Universal Copyright Convention (UCC)
A system to protect unique work from being reproduced without knowledge from the originator. To qualify, one must register their work and publish a © indicating registration.

Ultraviolet light (UV)
Radiant energy with wave lengths slightly shorter than the visible spectrum.

Unsharp Masking
1.) Technique of adjusting dot size to make a halftone or separation appear sharper (in better focus) than the original photo or the first proof. Also called edge enhancement and peaking.
2.) A sharpening process that first blurs the edges then subtracts the image from the blurred areas to yield an image of apparent enhanced sharpness.

Up
Term to indicate multiple copies of one image printed in one impression on a single sheet. "Two up" or "three up" means printing the identical piece twice or three times on each sheet.

UV Coating
Liquid applied to a printed sheet, then bonded and cured with ultraviolet light.

UV ink
Term used in relation to ultraviolet properties in inkjet ink:
(1) ink that is resistant to UV light degradation, or
(2) ink that is "cured" or dried by exposure to UV light.

UV protective glaze
An acrylic sheet used in framing art. It has ultraviolet light inhibitors capable of filtering out 99 percent of UV rays (one of the causes of print fading).

UV resistance
The resistance of something to change under UV light sources including daylight.

V

Value
The shade (darkness) or tint (lightness) of a color. Also called brightness, lightness, shade and tone.

Variant edition
A set of prints of the same image but varying as to size, coloration, image consistency, materials, or being otherwise differentiated.

Varnish
Liquid applied as a coating for protection and appearance.

Vector
A term given to a graphic drawing, specified as a color, start and end point, and applied to line segments, type, and tints.

Vector Graphics
Vector graphics files are usually stored in formats such as PICT or EPS. Any of a number of graphics formats including EPS(F) and DXF that describe objects on the screen not as colored pixels but as mathematically defined shapes. Vector graphics can be rescaled to any size without any effect to file size. Typically, vector graphics occupy less disk space than their bitmapped (rasterized) counterparts.

Vector image
A computer image that uses mathematical descriptions of paths and fills to define the graphic, as opposed to individual pixels.

Vehicle
In this context, a fluid or solid substance (depending on its physical state and on its desired function) that serves to either dissolve or disperse another substance or a range of substances and make them usable in a certain environment. Regarding art material coatings, the total liquid content of a paint or ink, including the binder (the adhesive portion) and any additives (driers, solvents, resins, defoamers, preservatives, and so on).

Vellum Finish
Somewhat rough, toothy finish.

Velox
Brand name for high-contrast photographic paper.

Verso
The even-numbered page on the left-hand side of an open book, or the left-hand page of a two-page spread. See also Recto.

Video Card
An add-on device that accelerates the digital screen refresh rate in order to display complex digital graphics and motion.

Viewing Booth
Small area or room that is set up for proper viewing of transparencies, color separations or press sheets. Also called color booth. See also Standard Viewing Conditions.

Vignette
An illustration in which the background color gradually decreases in strength (but not hue) as it gets closer to the edges of the image, until it gradually segues into the color of the paper. Decorative design or illustration fade to white.

Vignette Halftone
Halftone whose background gradually and smoothly fades away. Also called degrade.

Virgin Paper
Paper made exclusively of pulp from trees or cotton, as compared to recycled paper.

Vitreography
Printmaking using glass plates for either intaglio or planographic processes.

VOC (Volatile Organic Compounds)
Petroleum substances used as the vehicles for many printing inks.

W

Wash Up
To clean ink and fountain solutions from rollers, fountains, screens, and other press components.

Waste
Unusable paper or paper damage during normal makeready, printing or binding operations, as compared to spoilage.

Waterfast
Resistant to the destructive action of water.

Waterleaf paper
Papers made with little or no sizing. (see "sized papers")

Watermark
1.) Translucent logo in paper created during manufacturing by slight embossing from a dandy roll while paper is still approximately 90 percent water.
2.) A faint marking on the back of some photographic papers indicating that the picture was taken by a professional photographer.
3.) Term for a faint image superimposed on a digital image to protect rights of ownership.

Water-Resistant
A surface that can resist dampness but not a soaking of water. Generally implies a lesser degree of protection against water than the term "waterfast," but still improves the material's resistance to water damage.

Weatherability
The ability of a material to withstand the effects of exposure to weather conditions or to change in physical or chemical properties.

Web Break
Split of the paper as it travels through a web press, causing operators to rethread the press.

Web Gain
Unacceptable stretching of paper as it passes through the press.

Web Press
1.) Press that prints from rolls of paper, usually cutting it into sheets after printing. Also called reel-fed press. Web presses come in many sizes, the most common being mini, half, three quarter (also called 8-pages) and full (also called 16-pages).
2.) A high-speed printing press that prints on both sides of a continuous roll of paper. Web presses are used for high-volume printing such as newspapers and magazines.

Weight
In typography, the lightness or darkness in print of a particular typeface, based upon its design and thickness of line.

Wet Trap
To print ink or varnish over wet ink, as compared to dry trap.

White
The result of combining the additive primary colors (Red, Green, and Blue). In the subtractive color mixing system, "white" is the result of the absence of any color.

White balance
The balancing of color components to create pure white when photographing or scanning a white object. A substitute for a color temperature setting.

White point
The color and intensity of a device's brightest white. With printers, this is usually the white of the paper. With scanners, the color that when scanned produces values of 255, 255, 255 (RGB). Ideally, the white point is 100 percent neutral reflectance or transmittance. (see also "reflectance")

White Space
The total amount of non-image areas on a page, particularly gutters and margins. White space also refers to the space on either side of typographic characters, which can be reduced with tracking.

Widow
In typography, the last line of a paragraph when it is less than one-third the width of the line, especially when it is the carry-over of a hyphenated word. Widow can also refer to one word or word part standing alone in a line of a heading or a caption.

Window
(1) In a printed product, a die-cut hole revealing an image on the sheet behind it.
(2) On a mechanical, an area marked for the placement of a piece of artwork.

Wire Side
Side of the paper that rests against The Fourdrinier wire during papermaking, as compared to felt side.

With the Grain
Parallel to the grain direction of the paper being used, as compared to against the grain

Woodfree Paper
Made with chemical pulp only. Paper usually classified as calendered or supercalendered.

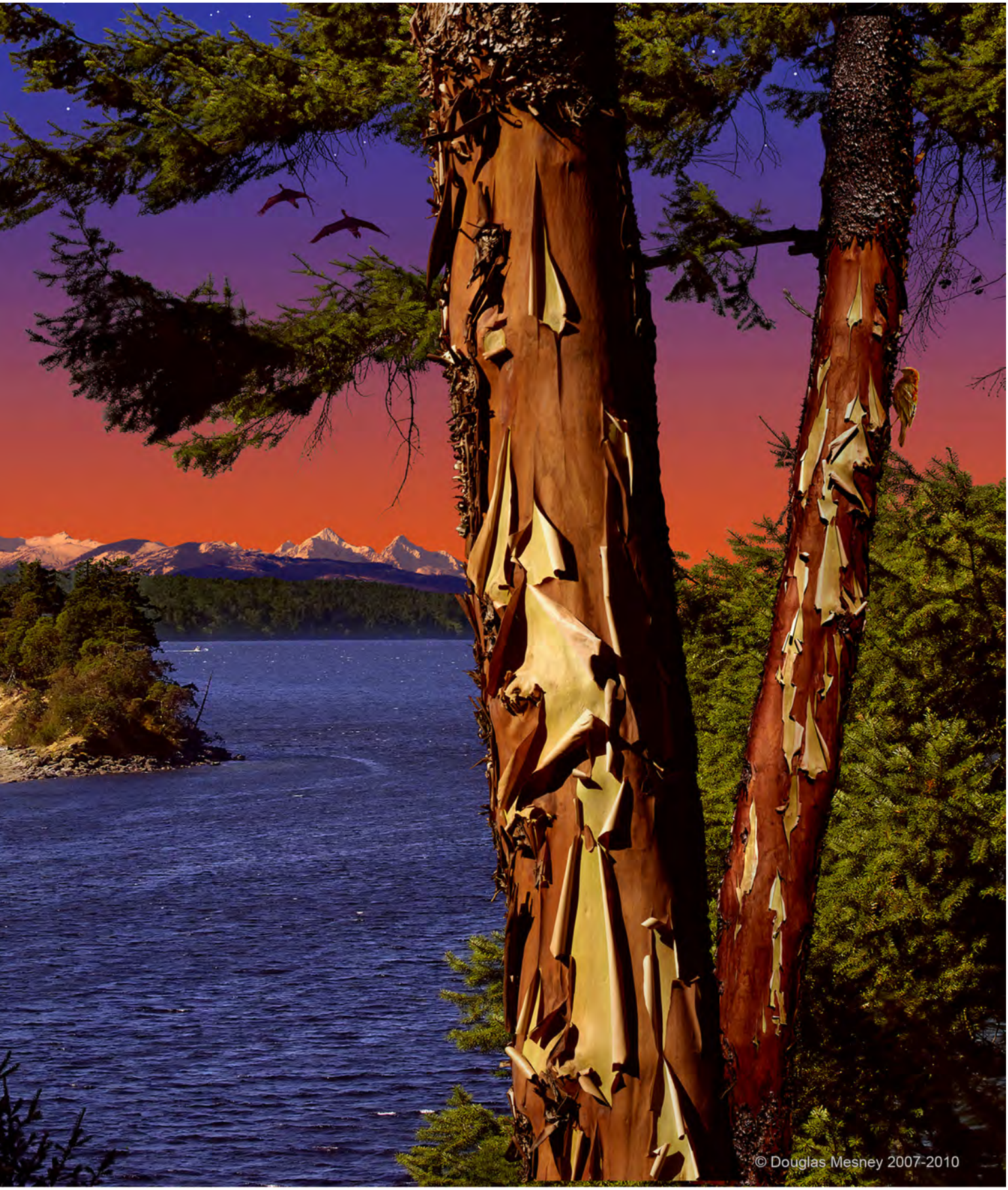
Word Wrap
In word processing / text-editing programs, a feature that automatically relocates a word to the next line when it will not fit on the current line.

Working Film
Intermediate film that will be copied to make final film after all corrections are made. Also called buildups.

Wrong-Reading
1.) Descriptive of any film or paper image that cannot be read normally--i.e., from left to right, top to bottom--or is, in other words, a mirror image, as opposed to right-reading.

Wrong Reading
2.) An image that is backwards when compared to the original. Also called flopped and reverse reading.

Wove
Paper manufactured without visible wire marks, usually a fine textured paper.



Pictures with strong colors like this one (above) look very different on our CRT or LCD monitor than they will when printed. The more primary the colors, the greater the difference between RBG and CMYK.

WYSIWYG
1.) Abbreviation for "What you see, is what you get."
2.) Refers to the ability to output data from computers exactly as it appears on the screen.

"...and we decide which is right and which is an illusion."

Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

EPILOGUE

How This Book Came To Be

Douglas Mesney Art Vancouver, B.C., Canada

Your's truly navel gazing in Vancouver summer 2007.

Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

EPILOGUE

"A picture is as good as the print delivered."

That statement is as true today as it was back in 1966 when Arthur Tcholak said it. Arthur printed for *Life Magazine* photographers, who were like gods to an aspiring teenage lens man.

When I was in junior high school one of those *Life* photographers, Ted Russell, came to shoot pictures of a play put on by our community theater group. I happened to be there because my parents were starring in the play… but my being there that evening was providential.

A year earlier, when I was 12 my Grandfather gave me a camera. It wasn't just any camera, It was a Minolta SR-2. It was also 1957, a time when Japanese and German 35mm cameras were opening a new world of photography called "*reportage*". Minolta rivaled Nikon and Canon as one of the very first 35mm single-lens reflex (SLR) cameras.

Grandfather had given grandson a truly professional tool and one much envied by my first mentor, the late Bob Banning. He was a neighbor and a photo buff who encouraged me every step of the way as I explored the new camera.

By the time of my encounter with Ted Russell, I was already deeply into photography and loving it; so the pump was primed.

Ted took me under his wing as a 'gopher' and one of those shoots foreshadowed my future.

On a bright autumn afternoon, we took a shiny new car out into the woods and I watched as Ted shot two dozen rolls of film. Two dozen rolls! He shot from every conceivable angle, which taught me that the best pictures reveal things from perspectives we don't ordinarily see.

This summer sunset was made into a dye transfer print at Peterson Color Laboratory, where I had a summer job in 1961. The money was used to build a professional-grade darkroom in the basement of the family home in Douglaston, New York. Working with professionals raised my sights and made me aware that anything is possible.

Another neighbor and mentor, the late Glen Peterson, gave me a summer job at his New York City dye-transfer studio. Peterson Color Lab wasn't just any darkroom service. They were New York's best custom lab and printed for upper echelon ad agencies and photographers. Starting as a messenger, I worked my way up to chemical mixer. It may have only been a summer job, but it was a life-altering experience. For a 14 year old like me, just going to work in the big city was like entering another world… the real world.

Being a messenger for Peterson Color Lab opened the doors of New York advertising agencies and I became energized in the presence of those who created the world's best advertising illustrations and photographs.

The money I made at Peterson Color Lab was used to build a darkroom in the basement of the family house in Douglaston. The darkroom provided a 'means of production' and soon I was hawking pictures to the entire community… pet portraits, house & garden shots. The experience of selling door-to-door like an encyclopedia salesman was invaluable because it made me into a fearless and formidable presenter. Repeated rejection built a protective coating around my ego and honed my skills at communication and more importantly, persuasion.

Mesney-Nolte Photographers was my first picture business, aside from selling door-to-door. At a wedding we shot together, I captured my partner David Nolte (left) in one picture, then myself in the mirror.

As a junior at Bayside High School, I partnered with a classmate, David Nolte, and together we photographed weddings, bar mitzvahs, portraits and anything else to make money. By the end of high school making pictures had already become my way of life and has been ever since.

College changed my career path for a while. So did the Vietnam War. To stay out of the war I needed to be in school, but I also needed to earn a living. The solution was night school at Queens College where I carried 15-18 credits each semester while working full time at a series of advertising and PR agencies in New York City. In the middle of all that I married the former Leslie Shirk, a neighborhood sweetheart. Together we managed to keep up a gruelling work & night school routine for three years.

First I worked at J. Charles David Advertising, a small three-man shop where my job involved a little of everything and a lot of making layouts and mechanicals (paste-ups) for art director Seymour Levy. Learning "board work" was fun and Seymour picked up on my photo skills, allowing me to shoot several ads for them which was a huge ego boost.

In 1963 I got a job working for a powerhouse PR lady named Louise Friscia. She employed me to take pictures and write stories about families visiting the Sinclair Dinoland pavilion at the 1964 New York World's Fair. However, that job ended abruptly when her client's son, who was also a photographer, wanted the job and for political reasons I was let go.

This may be the most photographed dinosaur of all time. It was my favorite background to photograph families visiting Sinclair Dinoland at the New York World's Fair in 1964.

However, by then my skill set was sufficient to land me a job at a big-league industrial advertising agency in New York called Basford Incorporated.

My work as an assistant account executive at Basford was called copy-contact and it involved researching and writing case-history stories about the clients' products. The stories were used to make direct-mail promotional pamphlets and brochures (lower left of collage).

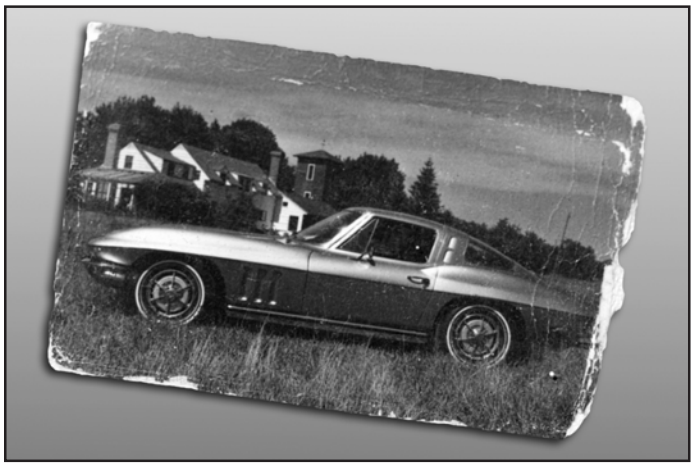
The Under Assistant West Coast Promo Man by the Rolling Stones was my theme song as I honed my skills as a cub reporter at Basford under the tutelage of Burt Holmes. Together we produced direct mail pieces for the American Iron and Steel Institute… titles like *Farm Facts, Containerization Today*, and *Highway Construction Fact Sheets.*

The television series "*Mad Men*" presents an accurate version of my life in those times. Working in the advertising business really appealed to my ego. I wore *Brooks Brothers* suits, drove a *Corvette*, smoked *Camels* and drank martinis for lunch at *Toots Shore*. Life was good but all that was about to change as agency politics turned ugly. Civil rights was a major issue back then, you'll recall.

One thing you don't see in "*Mad Men*" is black people. Prejudice was alive and well on Madison Avenue back then. Thus, when I hired the most qualified secretary I could find and it turned out to be a person of color (and also a man), he was fired by upper management for trumped up reasons.

In retrospect, seeing a black man amongst the bevy of secretarial beauties that lined the halls was odd. However, I had begun smoking more than *Camels* and my sense of outrage was overpowering in that era of the Civil Rights March and the Feminist Movement. Within hours I cleared out of my office and left.

But it wasn't just that. I had learned that what I liked most about the ad business was the picture taking part. So it was back to the future as I returned to being a photographer. Leslie's job as a systems analyst became our sole source of income as I put together a portfolio and struck out on my own. Now, my door-to-door selling experiences as a young boy came in handy as I pounded the pavement showing my book around town.



The Corvette became a favorite portfolio subject, as did my friends who pitched in as models with their own bikes and cars.

"Atomicolor" was the term I used to describe my signature style during the psychedelic Sixties and Seventies. Strong colors and contrasts built on dark foundations have always been Mesney trademark looks.

Cars and bikes filled half of my professional time at first, and the rest came from industrial work from former colleagues at Basford. Pretty soon I was pigeonholed as a "sheet metal man", a guy who shoots cars, trucks and factory stuff… and that reputation stuck.

Confidence was my middle name when I left the agency and went free-lance as a photographer. I figured the clean-cut look set me apart from all those hippy-type competitors. Above, shopping at Alkit Camera.

A Corvette Stingray is more a liability than an asset to a photographer so mine was traded in for a Land Rover *109. Leslie and I used it to explore the dunes of Fire Island in search of locations.*

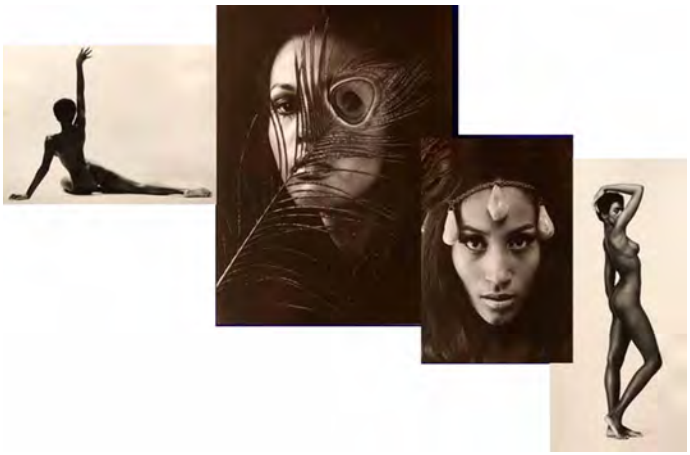
A portfolio shot of Leslie led to a cover assignment for Cycle Magazine.

Leslie stuck with me for three years as I built the first studio and made a transition from a clean-cut martini drinking "Mad Man" to a long-haired, pot-smoking, motor-cycle riding, hippie photographer. But on the night that the studio opened (at 42 East 23rd Street), she announced over the celebratory champagne that she was calling it quits and we soon divorced amicably.

Justine Reynolds operated a model consulting film. Above, a brochure cover in which she appears with a model client (right).

The first studio at 42 East 23rd Street in New York City was aptly named -- Mesney's Mad Medicine Show. There I learned the meaning of freedom and the value of persistence. The new hippy look paid off and my career was launched.

Single again I refocused on women instead of cars. With a model consultant named *Justine* for a partner, and a Park Avenue woman named Sue Keeton for a sales representative, my gears shifted and I switched from sheet metal to the fast lane of fashion.

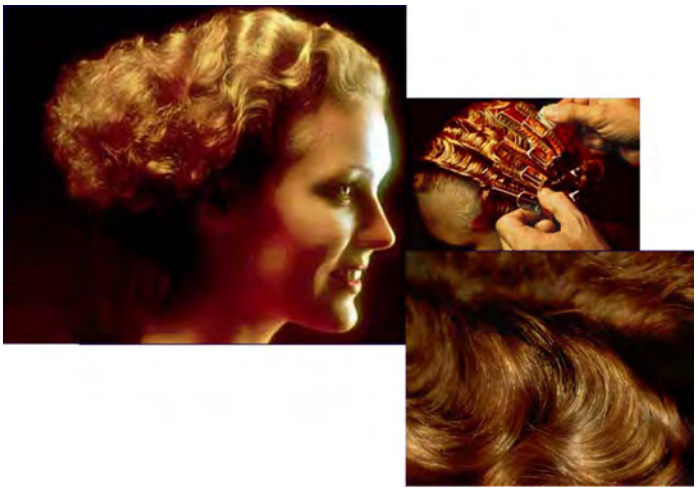


With a model agency right next door, there was no shortage of talent.

The studio at 23 East 73rd Street was the former Wanamaker mansion. During the first winter there I discovered how beautiful window frost can be... and the value of fireplaces in every room.

The front office and lounge area of the 23rd Street Studio

At the start of my studio career I dressed in suits and ties, thinking that I would set myself apart from my competitors who were mostly Hippies. However the phone didn't ring. Perturbed, I casually asked my mentor Gene Butera, Art Director at Car & Driver, what he thought could be the problem. He told me I looked like an encyclopedia salesman, not a photographer. Six-months later you would have sworn I was always a Hippie... and it worked.



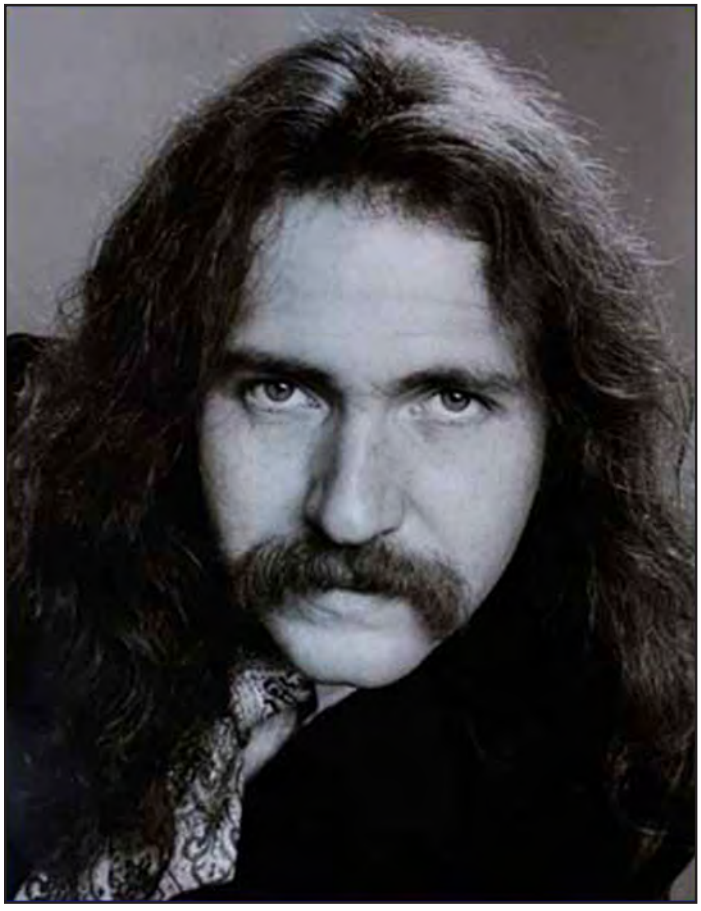
Photographing hair styles, stylists, and beauty products became the studio's dominant business. Vidal Sassoon, Clairol and Matrix Essentials and Zotos became studio regulars. It was a beautiful thing and soon the studio moved into the former Wanamaker mansion in the fashionable Upper East Side.

The late Arnold Miller (top) puts the finishing touches on a model as your's truly (on the right) scouts for shooting angles. Arnie started as a hair dresser and built an empire in the salon products business. His first product was Hennalucent *which grew into* Matrix Esstentials *which was sold to* Clairol *when Arnie passed away.*

Jack Shor, the PR director of Clairol heard about our multi-projector audiovisual work and became a client, beginning a half-decade relationship with the hair products giant for whom our projects included extravaganzas for fashion shows as well as training films and special effects graphics for packaging and promotion.

Viola Rossi, PR Director for *Intercoiffure,* ordered an *Incredible* show as the US entry in their global styling competition in Paris.

Sue Keeton was the studio rep and resident model. The shots of her became the portfolio that propelled the business into the whirlwind world of fashion and beauty.



The stylists I worked with on the set also plied their skills on yours truly. This portrait by Dona Lakin taken in 1976 captures the Hollywood me.

Cars became a smaller but spicier part of the new mix. Car & Driver *magazine work led to spreads for* Penthouse *(above) and other gentlemen's magazines like* True *and* Show.

Where the 23rd Street studio was all about photography, the 73rd street incarnation added graphic design and production. I persuaded an art director at *Car & Driver*, Tom Ridinger, to join me and together we spent the next two years building up a business producing corporate annuals, magazines and covers for paperback books and record albums.

It was the graphic design work that sparked my interest in the printing business. In those days things were done manually because there were no computers yet. You learned things the hard way... which could be a messy affair in the printing business. Details like ink control, types of papers, and the myriad other things that contribute to the look and quality of a publication became the subjects of my interest.

The studio at 23 East 73rd Street in New York City had a fireplace in every room. Shown above is the art production room. Producing magazines and book covers became a major part of the business. It was during those years that I learned about printing and prepress.

The huge volume of pages we were designing every month allowed plenty of opportunity to play with ink colors, paper stocks and finishes and learn their quirks. Life then was just as much about prepress as it was creative work. The goal became getting the visual concepts and images through the printing process in as perfect condition as possible. That is what prepress has always been about.

The studio was flying high, especially when Don O'Neill (right) brought in the Executive Jet Aviation (EJA) *account. He became our biggest client and I became an aviation photography specialist. Don also liked my graphics style and we produced advertising, brochures and annual reports for* EJA, ALIA Royal Jordanian Airline, Arab Wings, Piper Aircraft, Learjet, *and virtually every aviation trade magazine.*

Boats and boating became a big part of the studio's business largely as a result of having sailors for friends. Pictures of them and our voyages together were shown around town and many later featured in magazine covers, ads and posters.

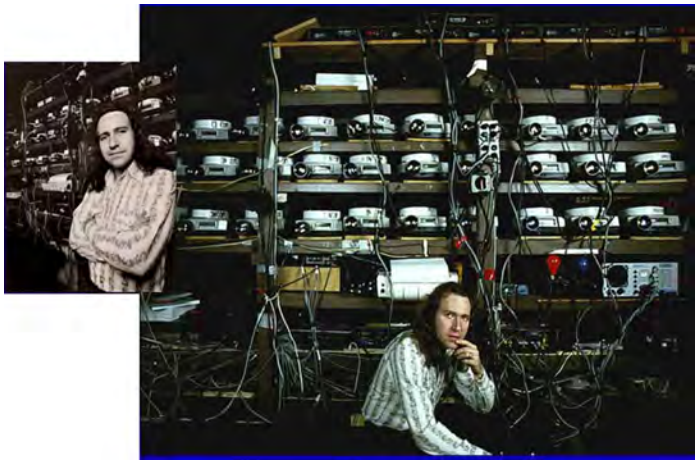
As I became known as a boating photographer my work was solicited as stock imagery by Madison Avenue. Having my work appear in ads pushed my profile still higher and led to even more editorial work. Combining fashion and yachting made for some great shooting opportunities and a hell of a life style.

Poster and theme pix for the 1972 National Boat Show both featured the strong colors that my work is known for. The look was created by using Infrared sensitive color film with cut-off filters for specific wavelengths of light. (See Section One, The Study of Light, for more on this.)

My work was selected by Nikon to illustrate an audiovisual extravaganza staged at the International Boat Show in New York. Seeing my pictures set to music altered my life.

The Nikon show (produced by Bob Schwartz at Motiva*) featured 15 self-contained rear-projection boxes stacked in a five-by-three grid. Nothing like that had been seen before because the technology for controlling multiple slide projectors was brand new.*

Within days I had a Kodak slide-show controller in my studio and was learning about screen design choreography by trial and error. The direction of the studio's business was about to change as my whim and fancy jumped off the printed page and onto the silver screen. My new interest in audiovisual production was also fueled by the gas crisis of 1973.



Within a year the studio was converted into a programming theater with a 15-projector capability. One assistant became a staff of ten.

Like recent times, recession came to the 70's and many magazines failed for lack of advertisers dollars in a business downturn that lasted half a decade. The change of focus to audiovisual production was providential because as our print clients disappeared, audiovisual clients filled the vacuum.

The first slide show was produced in 1972 for a sales meeting held by the National Association of Engine and Boat Manufacturers, for whom we also made posters and press materials. That show used 6 projectors on a single screen.

The Incredible Slidemakers *became the studio's new name in 1975. The name derived from the comments of our audiences who, seeing our animated special effects would inevitably say "That's incredible!"*

Audiovisual work rapidly replaced print work entirely and by the late 70's the studio employed nearly three dozen people. My management style was ...well, "wasn't" would be more like it. The studio functioned as a creative playpen for making your audiovisual dreams come true.

The Incredible Slidemakers swept the first International Multi-Image Festival with eleven awards. Being an organizer of the event may have helped. Those first awards boosted our reputations and egos, propelling us forward as we relentlessly pushed the limits of slide technology.

Our reputation wasn't then only thing that was growing.

The audiovisual industry was growing fast. The Vail Festival group merged with The Association for Multi-Image. Membership went from nearly zero to almost 5,000 producers in less than a decade. As a result, our reputation for cutting-edge slide shows was being challenged more and more by up-and-coming multi-image production companies.

Lasers were a developing fad in event lighting and as yet there was no way to synchronize slide shows with lasers. Undaunted, I decided that we would build our own system. The plan was to win some awards by using programmed lasers in our own shows, then market the hardware through audiovisual dealers. So the dice were rolled with the bets on lasers. A huge investment was made which never paid off financially but did keep us in focus as one of the top ten multi-image production companies in the USA.

Magic Lasers *was the name of our product. Expensive color ads and a stand at the NAVA audiovisual expo in 1978 nearly bankrupted the studio. Salvation came when one of our machines was stolen and we collected on the insurance.*

Perhaps we were ahead of our times. It didn't matter because storm clouds were brewing over the world's economy (again).

15 minutes of fame turned into two decades. Above, I am being interviewed on Philippine television by Ma'an Hontiveros. She was the wife of AVL's most successful salesman of all time, Brian King, and a television celebrity from a well-to-do family in Manila.

The early 80's brought another business collapse, which I was totally unprepared for, being an optimist by nature. With so many

employees and a five-story New York town house to support, a six-month stretch with no business led to our demise. But that wasn't the only reason for the collapse of the Incredible Slidemakers. By then I was burned out.

The eight-year run at the 73rd Street studio had transformed me from an artist to a celebrity businessman. My job became less and less creative as our success and size magnified.

By the end of the 70's things had gotten to a tipping point. One one side were fame and fortune but on the other the bald fact that I hadn't actually shot a picture in years. Celebrity and success had cost me my soul and I was beginning to realize it. Then something transformative happened.

Magic Lasers *was an attraction on the 1979* Mediatech *stand at the* London AV Expo. *At the event I befriended Peter Lloyd, (center, blow) editor of* Audiovisual Magazine*, a UK publication. That notoriety led to an event that changed my life.*

The editor of Audiovisual Magazine*, Peter Lloyd (center), here with two colleagues at the London audiovisual Expo in 1979.*

I was hired by Purchase` Point in London to shoot pictures for a slide show about Hawaii that they were producing for Rank Xerox. Initially, I tried to send one of my staff photographers but they nixed that, insisting on my shooting the job. It was that shooting trip that was to change my life in many ways.

As is my way, I hired a private guide to escort me around the Islands in order to be as time-efficient as possible. As things turned out the guide never showed up when I arrived at the airport in Honolulu. Since my flight from New York was the last one in that night, I soon found myself sitting with my baggage on the curb side of a deserted airport. But, I wasn't alone.

At a nearby gate was a woman who seemed to also be waiting for someone. After a while I decided to be sociable and learned that she was a local girl of Hawaiian ancestry named Monique Kaeo. Her car had broken down. By then it was late and we were lucky to get a passing cab to take us into town. During the ride, I decided to hire here as a guide and model for the shoot. But Monique was not the serendipity that changed my life.

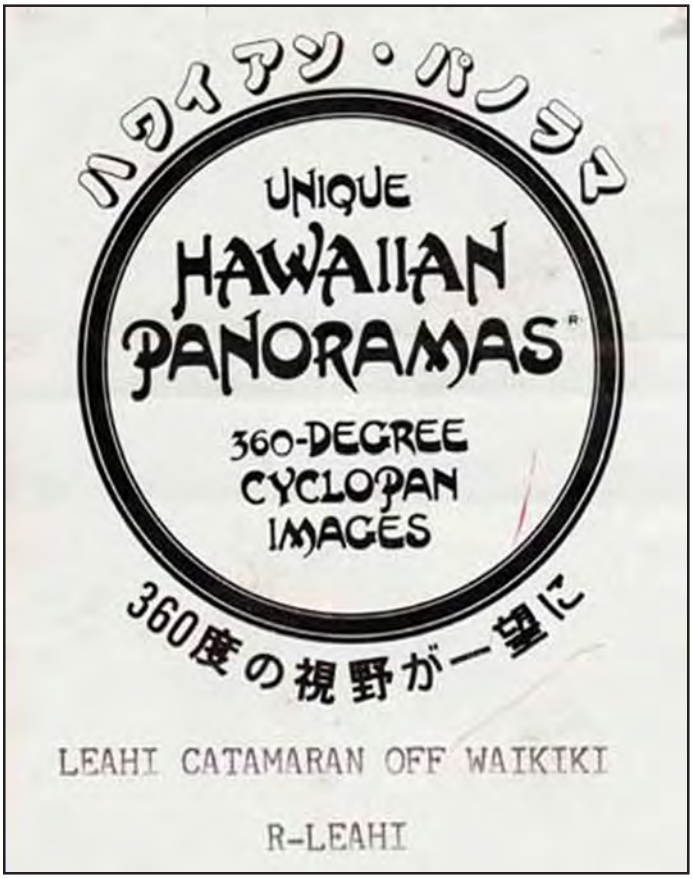
Monique Kaeo became the star of Hawaii...Xanadu *which is a 30-projector, single-screen production made to set the slide-show speed record. 30 projectors with full trays of 80 slides each present 2,400 images in three minutes, choreographed to the popular hit* Xanadu *by Olivia Newton-John. In retrospect, I should have invited the folks at the* Guiness Book of World Records *to see it, eh?*

What turned out to be the tipping point for the balance of my life occurred at sunset at the beach in Maui on the night before I was to fly back to New York after a two-week, 900-roll photographic odyssey. The hyper-creative fortnight had reminded me how much I enjoyed the craft of photography ...and working alone. The idea of returning to my role as a business boy brought tears to my eyes and I resolved that night to close Incredible Slidemakers and return to life as a freelancer.

At first, none of the staff believed me when I announced that I was going to move to Hawaii in six months. They should have suspected something was up, though. Our landlord wanted us out and raised the rent so high that staying in the Wanamaker mansion wasn't feasible.

As I looked around the city for another location absolutely nothing appealed to me. Tribeca was suggested and in retrospect would have been a good decision. But the gray streets depressed me as I recalled the blue surf off Waikiki.

Nothing convinced me to keep the company open and the staff finally understood things were coming to an end. For the most part they were unsupportive and only begrudgingly produced our swan song show, *Hawaii Xanadu.* That portfolio showpiece failed to woo any Hawaiian clients but went on to win awards in every festival it competed in. At a Photokina screening it got out of synch but still won a gold medal.



Hawaiian Panoramas *was my entry into the fine arts business. The long skinny panoramas we shot with a rotating* Cyclopan *camera.*

The New York shop was packed into a 40-foot container and moved to Hawaii… my new world HQ was the basement of my best friend Allan Seiden's house on the Pali in Honolulu. Along the way I sat next to Sandra Sande on a 15-minute inter-island Aloha Airlines flight. I talked fast enough to get her number, then went to visit her in Vancouver BC to end up persuading her to come with me to Hawaii.

Arriving in Honolulu with an "incredible" containerized studio. I was perfectly positioned for business from both East and West... or so I thought. However, people don't send work to Hawaii because they want to go there and do it themselves.

It didn't take long to go broke in Hawaii. According to my reckoning, I was perfectly positioned for audiovisual show assignments from East and West. What I hadn't factored in was that audiovisual producers want to come to Hawaii themselves, not hire me.

To make ends meet I started using a special Cyclopan camera to make 360-degree Hawaiian Panoramas and sell them to tourists. Sandra and I sold them at the art show on the fence at the Honolulu Zoo and in a couple of gift shops.

The Cyclopan camera was built by innovator Jack Rankin. There were only ten ever made. Mine was serial #3. Although quirky, it took gorgeous 360-degree panoramas on 70mm film. The negatives are giant, sometimes reaching four feet in length.

The Cyclopan *camera was originally acquired to shoot a panoramas of New York from the rooftop of* Olympic Towers. *The 360-degree pictures showed the view from the luxury skyscraper's condos. Above, the* Cyclopan *is being used to shoot a* Yankee Stadium *rally for the Korean evangelist, the Reverend Sun Myung Moon.*

Running the Hawaiian Panoramas business was my introduction to the world of galleries and fine arts publishing. It also gave me ample opportunity to hone my skills as a mat cutter and framer. The hours spent seemed endless and it all worked out to an equivalent wage of about 50¢ an hour. So we were struggling.

During that time we lived in the basement of Allan Seiden's house on the hillsides overlooking Waikiki and Honolulu. Allan is a life-long friend and has published numerous coffee-table and historical book about the Islands. His basement became a framing shop and I learned that you work hard for your money in the art biz.

Trying to make money selling Hawaiian Panoramas was like trying to fill a tire with a slow leak. We were slowly approaching zero, waiting for a big audiovisual show to bail us out. However, no amount of promoting got us into any doors. The local market just wasn't big enough to support big audiovisual productions.

Cliff Hinton and Kevin Scanlon provided me with the space and support to get *Hawaii Xanadu* up and running to demo for clients and the show was presented at in the grand ballroom of the *Hyatt Regency*.... but no takers. But life was about to be turned upside down.

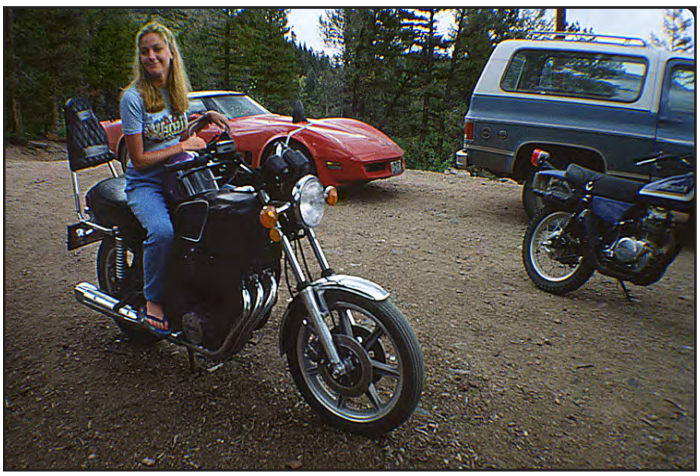
Allan Seiden (left) and your's truly emerge from the depths.

This time salvation came from the late, great Lindsay Rodda who was a prodigious producer operating a Melbourne production company called Sonar-Graphics. He hired me to teach his crew how to produce large-scale multi-image slide shows, my specialty.

Arriving at Lindsay Rodda's house in Melbourne, Sandra is let in by Bette Murray after getting a happy snap of yours truly, the writer. It was just the beginning of a global odyssey that lasted two decades.

It didn't take much to convince Sandra to come along as my assistant. For a year we lived in Melbourne and worked at Sonar-Graphics. I taught special effects and multi-screen programming while producing shows for Ford and Holden (General Mothers).

Sandra helped me produce Master Masks, another of my get-rich-quick schemes, this one involving an elaborate set of masks used to shoot "wipe" effects for multi-image slide shows and film animation. (Wipes are transitions from one scene to another. New pictures "wipe" across the screen instead of simply cutting from one to the next.)

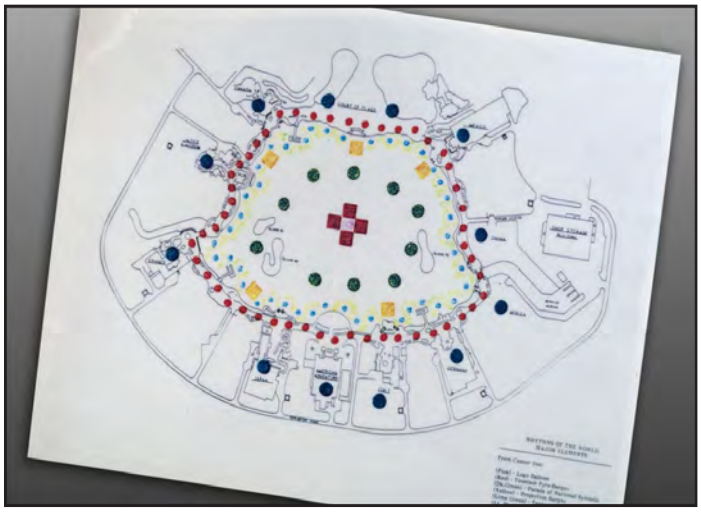


LA was the perfect place to have a bike. We picked-up this Yamaha 750 in Denver and rode it back to Vancouver, then to Los Angeles.

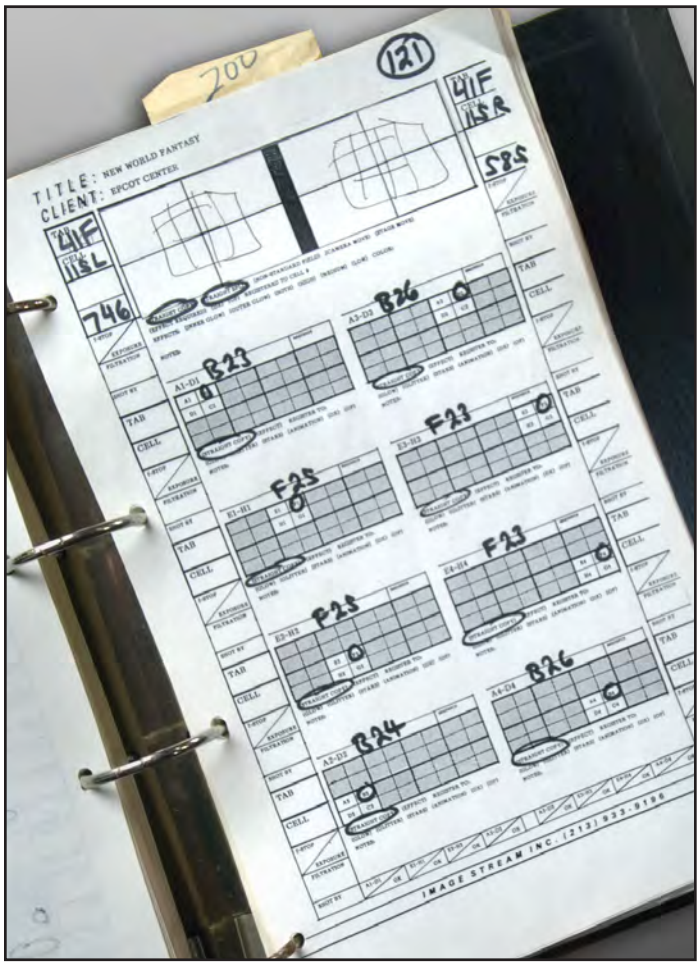
Image Stream was legendary in the multi-image industry and the "Streamers" produced the most outstanding multi-image work ever made, in my humble opinion. Such was their excellence.

Some of my best work was done at The Stream. Being located in Los Angeles, Image Stream did a lot of car and bike work as well as serving the entertainment industry.

On my suggestion, Chris Korody brought in John Emms from Australia and he ended up in charge of production. Together with Chris Ciancirillo and Ted Iserman the camera team flawlessly produced the sophisticated graphics designed by Brad Hood and Bill Aylward. The pinnacle of my time at Image Stream was the production of a floating multi-image extravaganza that played with fountains and fireworks on the Epcot Center lagoon.



While at Image Stream it was my privilege to write the core creative for an Disney extravaganza called Rhythms of The World. *The schematic (above) shows the Epcot Center lagoon and the plans for an extravagant floating musical and audiovisual pageant involving a cast of hundreds and a flotilla of sophisticated lighting and theatrical effects.*



By the mid-80's multi-image slide shows had become complex productions. The page shown is from a "technical storyboard" which details camera-shooting and image programming instructions for a 32-projector, two screen show. Each of the two screens is a quadrant of sections with four projectors aimed at each of the eight "quads". The scene wipes on from the center of each screen in 4 steps.

I would have stayed at Image Stream forever but I was seduced by an audiovisual company in Vancouver gearing up for the 1986 Expo. Offered a juicy job to produce a giant show, I quit Image Stream and we moving up the coast, back to Sandra's hometown.

Vancouver is a rainy place and sometimes when it rains it pours. The job didn't materialize and it didn't stop drizzling for 90 days during which time we became broke, yet again. And, again the phone rang just in time. This time the call was from Sweden.

Kurt Hjelt and Sven Lidbeck brought me to Stockholm to produce the show that launched the Saab 9000 Turbo *and started what turned out to be a 10-year career in Europe producing AV spectaculars.*

A week later Sandra and I were living in Stockholm and working for Kurt Hjelt and Sven Lidbeck at Audio Visual Centrum (AVC) to produce a 30-projector show for the Saab 9000 launch in '85.

Lars Einar, the advertising manager at Saab, was the one who had insisted that I design the show for the 9000 launch. He had visited the NAVA show where Incredible Slidemakers demonstrated Magic Lasers and after that visited the studio on 73rd Street where he saw our highly-animated slide techniques first hand. Now, he wanted the Mesney look and asked AVC to partner with me for the launch show.

Working as a freelancer spoils you. Clients go out of their way to make sure your are comfortable and have everything you need. Complicated ideas with demanding requirements are more likely to be seriously considered. As a result, my recommendation to produce an 30-projector launch show were eagerly accepted. Subsequently I discovered the quality of Swedish workmanship which is the highest I have ever encountered. They get it right.

Saab shooting crew for the 9000 CD launch show. Your's truly is wearing blue. Our favorite locations were the fjords of Norway.

Thomas Lagerqvist started as Lars Einar's right hand man and ended up in charge of audiovisual show production for Saab. He was dating Lena when this picture was made on a shoot at a Swedish castle. They are now married with grown children and he is in real estate.

American producer Rick Pedolsky was also working at AVC while we were there. He married a Swedish gal and never came back. It's not hard to do that there.

Filip Jarnehag was my primary student at AVC and subsequently opened his own company, Slidecom AB*, and continues to produce stills and* Watchout *shows.*

Elisabeth Ivarsson was AVC's Kodak sales rep. She swept me off my feet and became an integral part of my life in Sweden. At the time I still hadn't learned that it is a bad idea to work with your wife. Ultimately, office politics split us up.

The launch of the Saab 9000 CD was held at the Acropolis *in Nice, France. An 80-projector audiovisual show was accompanied by a cast of fifty singers and dancers and a symphony orchestra. The screen (top right) was custom made by* D&D *in Brussels and was composed of 40 rigid-plastic rear-screen panels. Each panel was serviced by two projectors. The 80 projectors were controlled by 4 AVL* Eagle *computers.*

AVC lived up to its name "Audio Visual *Centrum*" (emphasis mine). Kurt and Sven didn't hesitate to bring in top talent from the USA and Europe to work with their Swedish crew and teach them the latest techniques and technologies. The results were shows that were light years ahead of the local competition.

Volvo heard about the work we were doing for Saab and asked to have a Mesney production but we were already at work on another Saab show. To avoid a conflict of interest situation, I brought in Bill Ayward, Karl & Susan Shield, and Tim Geier from Los Angeles to work on Volvo, as well as Jim Casey from New York to assist me on Saab.

The productions made for the two Swedish auto giants were state of the art and swept top awards at every film festival they were entered in. AVC's reputation turned golden and soon IKEA and Ericsson offered more opportunities. Things were going great but unbeknownst to us, AVC was having financial difficulties and ultimately defaulted on their payments to us.

Without enough money to get back to the States, there was no was no alternative except to open my own company in order to earn enough to get back to Vancouver. So in 1986 Incredible Imagers AB was launched and the new studio opened for business right across the street from AVC at Hornsgatan 100.

Incredible Imagers AB set up shop on the 1st floor of Hornsgatan 100 in Stockholm, right across the street from AVC. The studio first occupied the right half of the floor. Elisabeth Ivarsson bought the other half and the two units were connected by a tiny tunnel of dubious legality.

The studio darkroom at Hornsgatan 100 featured a crystal chandelier rigged with orthochromatic (red) photographic "safe" lights.

My image library contains a few hundred thousand pictures and has circled the globe with me from New York to Hawaii, Sweden, Belgium Canada and now Vashon Island.

The 30-projector programming suite at the Hornsgatan studio was driven by twin AVL Eagles and a 24-track Teac *tape system.*

Incredible Imagers AB (AB means "Aktiebolog" which translates as "stock company") became like a little version of the old New York studio. It was *déjà vu* all over again. I started empire building again as one-by-one the big AVC clients moved across the street to our studio.

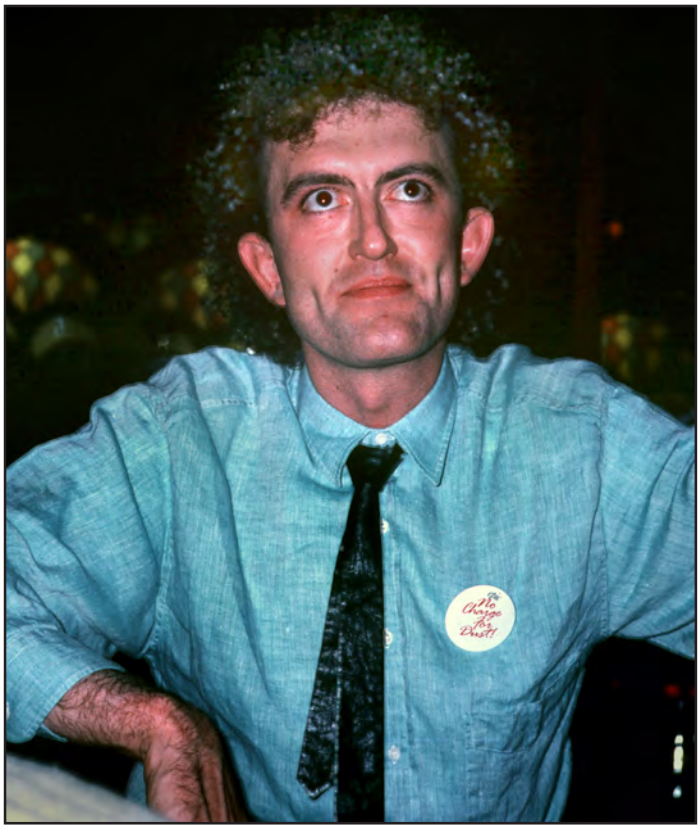
Receiving the "Best of Show" award at the New York International Film and TV Festival, for the third year in a row, made my Mom proud. The first was for an IKEA show, the second and third for Saab productions.

Cooking became a hobby first, then an obsession. The kitchen at the Hornsgatan studio started as a Spartan Swedish affair and ended up spilling over into the former rostrum camera room.

To learn patisserie I befriended Stefan Peterson at a local bakery and apprenticed from 4:00 am to the start of the business day for a few months. He went on to head the bakery at fashionable NK *in central Stockholm, where I worked by his side as part of a staff of 30.*

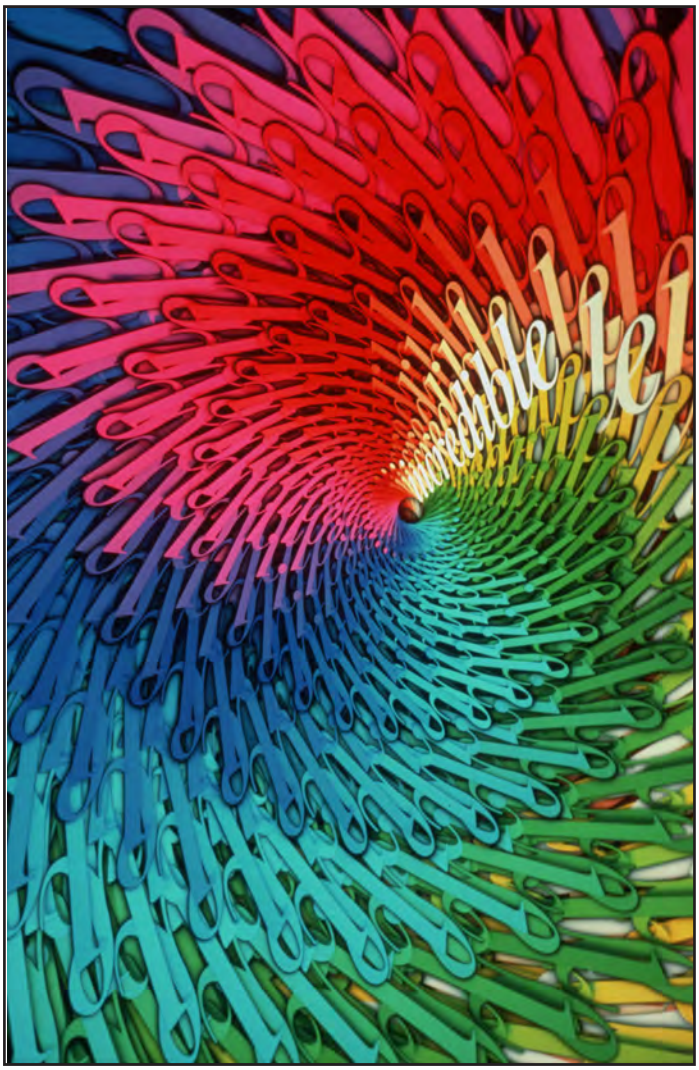
A cake by your's truly, baked at the Vashon Island studio. The entire kitchen from the Hornsgatan studio was shipped to Vashon. The kitchen features specialty cooking tools from many nations.

This time I ran a tight ship. John Emms came to Stockholm from Los Angeles where Image Stream's demise in 1985 had left him without a job. He did all the slide production and I did everything else. Simultaneously, Elisabeth Ivarsson left Kodak and we became "*sam bo*" (living together) after a serious indiscretion on my part turned out to be more than Sandra could bear and she left me. As I said, it's not hard to do that in Sweden.



There is not one advanced technical feat that I can think of that John Emms has not done. He's stopped bullets, frozen water droplets splashing, and done microscopy of crystals with polarized light... among others. We met in Melbourne where he joined Sonar-Graphics as lead cameraman. We worked again at Image Stream in Los Angeles.

By the mid-Eighties the name Mesney was legendary in the little universe of multi-image slide shows... at least I was a legend in my own mind. I made myself the star of a Kodak show called Got To Be SAV *that toured the world and won an inordinate number of awards.*



Spiral logo treatment for Incredible Imagers AB by John Emms. The graphic was shot on a souped-up Marron Carrel rostrum camera from 10-field artwork. Each individual color is laid in using "sandwiches" of pos and neg masks, drop-shadow masks, diffusion material, and thin layers of glass. Such was the kind of stuff John Emms likes to sink his teeth into. One of his early computer graphics took 3 days to render.

Incredible Imagers was an overnight success. More and more awards led to bigger and bigger jobs. Much of our business was by then coming from Stuttgart and Brussels.

Kodak employed us to endorse and promote their SAV projectors. Mercedes Benz gave us an RFP for a remake of their Visitors Center in Stuttgart. Colgate Pamolive in Brussels hired us for a corporate video. And at every festival we entered we returned with a sack of awards. You could say we were on a roll.

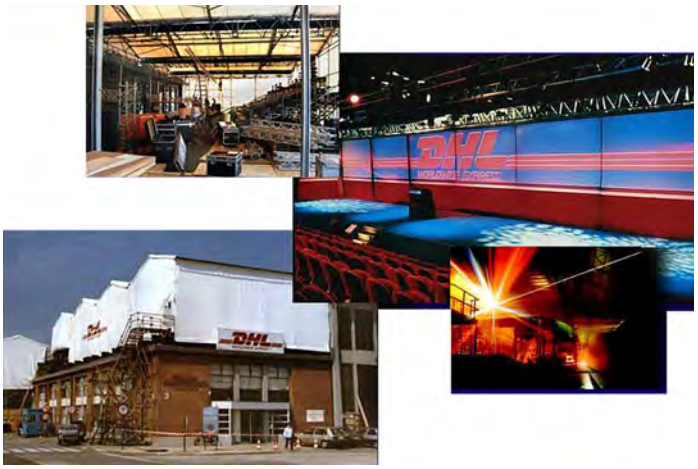
I began commuting between Stockholm and Brussels during production of the Saab 9000 CD show. A special screen needed to be built and the company that got the job was D&D in Brussels.

Now, Eric returned the favor and brought us a 24-projector show to make for *Gemeentekrediet,* a major Belgian financial institution. It began a collaboration that would have continued if the Gulf War hadn't so abruptly ended things for Incredible Imagers.

The Gemeentekrediet *stand featured a "house of mirrors" to reflect the image wall. It was designed and built by D&D in Brussels.*

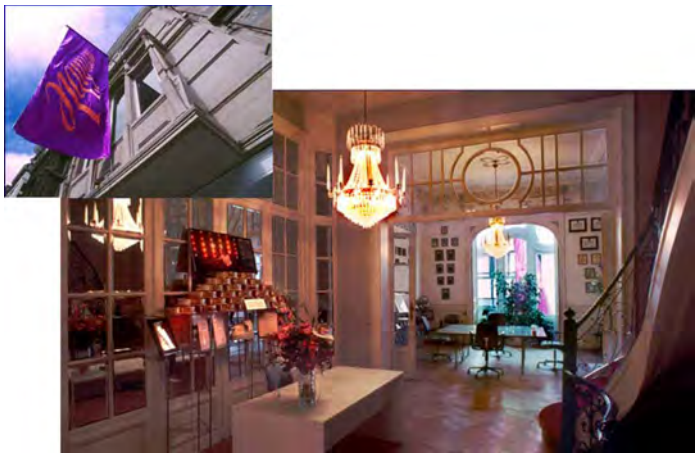
Jan Robberechts, CEO of Burson-Marsteller Brussels, became a close colleague as we shared in common many war stories involving other colleagues at Burson Marsteller in New York, like Don O'Neill. When Jan learned of the many shows I had done for his company's head office, I had a shoe in the door at BMB.

The first production for Jan was the launch of the DHL Brussels Hub. Together with Mediatech, we made a show that was projected on walls that opened to reveal the new hub. It was an ingenious solution for cramped quarters. The show was a success and more work from Burson Marsteller followed. During this Jan and I became close. Rick's Cafe was our evening office.



The challenge of the Brussels Hub launch show was where to put the audience. Nobody was allowed in the Hub itself for security reasons. The problem was solved by building a theater on the roof and using skylights to create an "observatory" into the building. The windows were covered with six screens (above, right) which slid apart for the big reveal of the Hub, which was lit by lasers and a light show.

When Burson Marsteller Brussels made us their official audiovisual supplier in 1989 I decided to move Incredible to Brussels and there I built an opulent palace for audiovisual production... *Xanadu.*



The studio in Brussels was even more ornate than the Wanamaker mansion in New York had been and made even more so with the installation of imported Swedish crystal chandeliers throughout.

The programming suite in the Brussels studio featured an 80-projector projection grid controlled by four AVL Eagle computers.

Incredible's new headquarters was located at 38 Rue de Magistrat, just off the famed Avenue Louise in the heart of downtown Brussels, and right around the corner from Burson Marsteller. The building was a classic ornate townhouse that had been completely modernized and most importantly, had a garage for my Saab.

My favorite car, the Saab 900 Turbo., replete with vanity plates.

Entry hall to the "awards room" at the Brussels studio. What do you do with 150 trophies and plaques?

Jan Robberechts graciously arranged for the agency to host a week-long series of press events and customer receptions. With contracts in hand and the assurance of ongoing business from BMB things were looking up.

Then the first Gulf War broke out and *all* our contracts were cancelled. We were left with no work… and no money. Having just spent our cash reserves to move the business, we only had enough reserves to last six months. As the 180 days played out more and more of the studio's gear went on the block.

In the end I was bailed out by Wolfgang Lenz at Comm-Tec who paid us 10¢ on the dollar for our entire projection grid. Our souped-up *Marron Carrel* rostrum camera ended up in Taiwan.

After dismantling the Brussels studio and bidding farewell to John Emms and his assistant Connie Bergqvist I headed back to Sweden with my tail between my legs. Although circumstances beyond anyone's control caused our demise, I still felt like a failure. Back in Sweden I was on my own. Elisabeth had left me when I chose not to bring her to Brussels in favor of John Emms.

Saab saved me by offering a 60-projector show that played the European motor-show circuit in the Spring of 1991. With the assistance of Filip Jarnehag that show was produced so economically that I was able to pay my way back to the States.

My swan song production for Saab was a 60-projector image-wall that formed a 180° arc around an ingenious turntable featuring a Saab that would split into pieces and reassemble itself while rotating.

Before returning to America I made a foray into Eastern Europe where opportunities were beginning to develop after of the collapse of the Soviet Union and the Berlin Wall. At the beginning of my European odyssey Sandra and I had visited Finland and Leningrad (St. Petersburg, now). It was an intriguing experience and I wished to see a bit more before leaving the Continent.

My goal was to build a Visitors Center in Tallinn, Estonia, the gateway to St. Petersburg and a tourism magnet in its own right. Tallinn is one of four well-preserved mediaeval fortress towns, like Gdansk, Poland and Rothenburg, Germany.

I hired a rep and formed a company called Incredible Imagers Estonia. However, in the end I couldn't raise the capital and that is when I retreated to Vashon Island.

The studio on Vashon Island is another world compared to the city life I was accustomed to. But by the time I reached Vashon Island, I was burned out and wanted a change.

Why Vashon Island? My sister lives here and as a result I had visited and fallen in love with the Island in the mid eighties. In 1989 I bought a house there, which she managed as a rental until I finally returned in 1992. Vashon is a lot like Sweden and the Island has a thriving arts community.

By the time I got to Vashon I was ready for a major change. My eye was on being a restaurateur, as I was burned out on audiovisual. The new studio also housed a brand new 600-foot kitchen that I had a burning desire to work in. But that would have to wait because once again, the phone rang and my fate changed.

I needed a car and suddenly, there was an Isuzu thanks to Rick Sorgel.

On the very first day I was in the house, before anything had been moved in, I rigged the basic phone system. As I plugged in the phone, it rang. When I answered it, Rick Sorgel was on the other end of the line.

A decade ago Rick had run a multi-image production company in Milwaukee called Sorgel-Lee and we were friends from slide show festivals and trade association events. Living overseas, I hadn't spoken to him in years. But here he was on the phone offering me a month-long, 14-state photo assignment for Isuzu. I ended up bartering part of the shoot for the car they gave me for the trip, which I still drive today.

Thomas Leung in Kuala Lumpur hired me to partner with him in the production of a big slide show for Malaysia Airlines. That resulted in a three-year commute between Kuala Lumpur and Vashon and the production of audiovisual shows and an International Photo Library resource for the airline and Malaysian Tourist Promotion Board (MTPB).

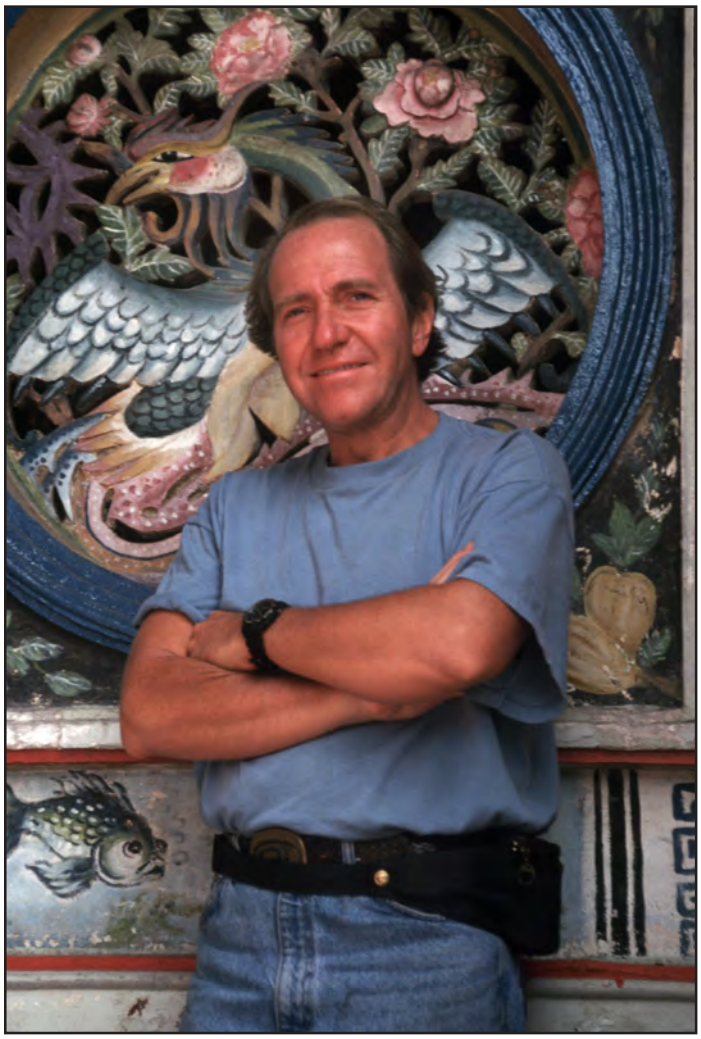
Here I am (back row, right) with some of my Malaysian friends at dinner, planning a 6-week trip to Rajasthan, India. Bob Vines (upper left) and Lye-Kin Fong (lower right) of BSB Malaysia became colleagues with whom I collaborated on audiovisual productions for Malaysia Airlines and the Malaysian Tourist Promotion Board (MTPB).

The production work for the Malaysia Airlines work was done in collaboration with Doug Ethridge and Monte Cline at Ethridge's shop in Seattle, called *Avcon Communications*. We were introduced by Craig Martin of Boeing for whom I had produced a corporate show in partnership with photographer Bob Peterson.

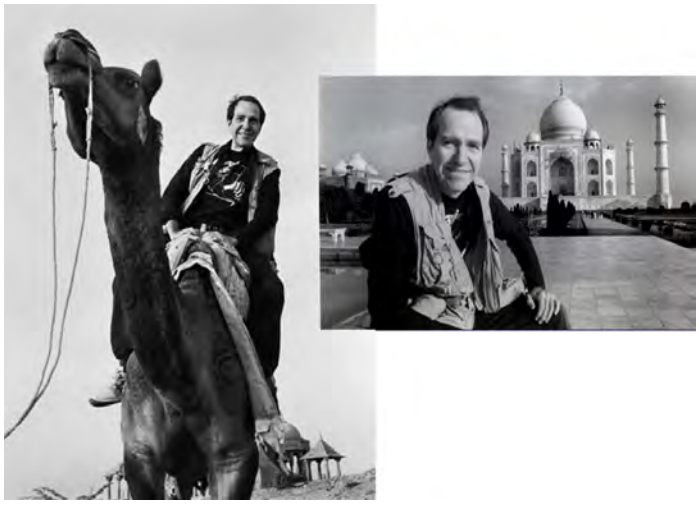
Saadah Shaikh Mahmood was the advertising manager at Malaysia Airlines with whom I collaborated on a half dozen projects.

Malaysia was the opportunity of a lifetime to learn some exotic cooking. The country is 30% Malay, 30% Indian and 30% Chinese and the food is a melange of all those flavors. I immediately befriended Thompson Hon at the local noodle stand, Soo Kee Mei *(above) from whom I leaned some Chinese tricks of the trade.*

At the Indian restaurant Bangles *the crew was happy to oblige my thirst for knowledge. To win them over, I shot a portfolio of pictures about the restaurant. They let me hang out and watch and I picked up more in a week than from a dozen books.*



The Malaysian chapter of my life ended when the airline was privatized and the new owner brought in new people and suppliers. But at the same time an opportunity was opening up on Vashon Island to fulfill my dream of a running a restaurant.



Before returning to Vashon I accompanied some Malaysian friends and colleagues on a six-week trip to India. We toured through Rajasthan with the obligatory trip to the Taj where I spent an hour trying to vertically align the towers until I learned they leaned outward on purpose.

Narbdeshwar Pandey (above) was hired to be our guide and chauffeur for the overland trip across Rajasthan. He and I remained in contact and in 2008 I was invited to attend the wedding of his daughter. Her picture, Indian Bride, is an example *in Section Two, Step Twelve.*

Lewellyn Price hired me as a consultant to critique a visitors center show made for the family's hotel in Quebec City, Auberge Saint-Antoine. Visiting the French-Canadian city I was flabbergasted to discover that they boast more swimming pools per capita than any other city. Maybe they ice-skate on them. My grandmother was from Quebec and I felt oddly at home there. But after Sweden, no more snow please.

In 1995 I spent everything I earned in Malaysia and opened a restaurant on Vashon Island called Fork Inn the Road. It crash-landed with few survivors in just a half a year. Once again I should have looked before I leapt. Vashon Island wasn't ready for an international cafe. There isn't one retaurant-business mistake I didn't make there.

My partner in the restaurant venture was Hita Von Mende shown here with me lighting the signs on opening day, May 5, 1995.

Although I thought I knew everything about the restaurant business it turned out I didn't know much at all. My biggest error was a menu that had so many items it was unsustainable. I had to go back to AV work to pay restaurant bills. You know what they say about absentee owners, right?

On top of one world and the bottom of another, that was my lot in life in 1995. On top of Mount St. Helens but soon to bottom out in the restaurant business.

When the restaurant ran into economic difficulties Hita persuaded me not to close but rather hand it over to her in exchange for indemnification. I chose liberty and walked away from restaurant and back into near bankruptcy.

Filip Jarnehag heard of my predicament and brought me back to Sweden in 1996 to help him produce a slide show for Nokia and later that year we produced the Scania *Omni-City* launch show together. Suddenly I was back in the AV business, a place I never thought I would be again.

During the trip to Sweden to assist Filip Jarnehag, I made a side trip to Gdansk, Poland to photograph that famous Medieval seaport. On the ferry I met Anna Raus, who lived in Ravicz and went to school in Poznan. Eventually I went to visit her and we started dating long distance after she sent me a Christmas card and invitation.

John Whitcomb brought me an AV project for AT&T that was so big that I ended up partnering with Bruce Silverstein and Charlie Watts at their Seattle production company, *Watts-Silverstein.*

Before resigning from Watts-Silverstein I joined the film crew for the Asian leg or the assignment, while Doug Ethridge of Avcon shot in Europe and Scandinavia. Dave Oglevie was the video shooter. His sound assistant, Libby, is shown above with your's truly and Steve Miccicci, my gaffer, departing Shanghai airport.

During my tenure at Watts-Silverstein a former Incredible Slide-makers "client of the year", Allan Hilberg, reappeared. We hadn't seen each other since he worked at Burson Marsteller in New York. Now he brought me a project of international scope for Swedish Match, which I brought into W-S.

The job entailed documenting the company's tobacco products business which includes the manufacturing of cigars, lighters and matches. Their operations are spread around the world. Our shooting list included Brazil, Shanghai, Indonesia, and a dozen European and Scandinavian countries. Both video and stills were shot in order to put together a global employee motivation program themed on a famous sailing race in which Swedish Match was sponsoring a yacht.

The job proved my undoing at Watts-Silverstein. Money was squandered on large meetings with everyone on billable time. When it came tome to produce, there was not enough money left to deliver the quality expected by the client. I resigned in protest.

The work for Swedish Match at Watts-Silverstein had been supervised by their Swedish agency, Lexivision. At the time it seemed bothersome to have another agency looking over our shoulders. However it turned out to be providential for me.

You see, I knew Lexivision's CEO, Jan-Erik Ander, from my days in Sweden. When he heard that I was off the account in Seattle he asked me to join Lexivision in Stockholm and help him build-up their multi-image business.

Returning to Sweden felt like coming home... from the wars. For so long my fate was in my employers hands and as a result my own were often "tied". Now at last I was going to be my own boss again. I have never really been a team player. I am the kind of person who stays behind the curtain, in the dark, unseen.

I returned to Sweden and began working with Lexivision as a Creative Director. Anna came with me. The immigration authorities were already suspicious about Anna's frequent visits to the States. To avoid more hassles with them we married before leaving Vashon for Sweden.

To everyone's great surprise, Lexivision went bust a year later and I was dismissed. However before we could even pack our bags Scania Bus Company decided to move forward with an idea I had given them five years earlier to produce an up-to-date photo library of their operations across Europe.

Max Bjurhem was Scania's ad manager and I had produced several shows for him during the 80's. Despite being unswervingly cautious and a master of office politics, he gave me total creative freedom and I gave him back award-winning shows.

This launch show for Scania's Omni-City *bus model was produced with Filip Jarnehag to earn money for paying Fork Inn the Road's bills, back on Vashon Island. The show featured a "floating bus" that used industrial-strength compressed air "pads" under each wheel. After floating into position on stage, two dozen singer-dancers got off the bus and began a musical journey across Europe accompanied by slides (which you can barely see through the bus windows on the left).*

Max Bjurhem and I go back a long way. Along that way we produced three launch shows and a company song "*The Power of Scania*" made with the help of Jeff Levin in Los Angeles.

All companies benefit from having consistent branding. International companies often have difficulty achieving branding consistency because quality levels in media production vary from country to country, as do styles and trends. Scania Bus was just such a company.

Anna and I stuffed ourselves in a car and crisscrossed 22 countries in Europe shooting 33,000 pictures to create the Scania Bus International Photo Library and the company's prestigious Year 2000 calendar.

For years I tried to convince advertising manager Max Bjurhem that an image library with consistent quality was worth the admittedly large sum of money it would cost to produce.

Now, at precisely the right moment in my life, the project was green lighted. Anna and I packed out of our Stockholm flat and moved to Katrinaholm where Scania Bus had its headquarters. There we set up a digital-imaging operation in a conference room and began a six-month odyssey.

First we shot 33,000 frames of color negative in 22 countries. Then 3,300 were scanned, retouched and archived on CDs. A pictorial index for the color negatives was made from 3X5 prints (top). On the left is an example of the pictures in the collection. This scene illustrates the driver's environment as the bus enters a tunnel.

It was the just beginning of digital photography. Being wary of the new digital imaging technology I hedged my bet and shot the job on color negative film, then digitally scanned the negs. Now with almost two decades of digital imaging under my belt, I still think that is a good idea. Film negatives have a known lifespan and they deliver a great look when properly scanned. But for me the biggest benefit is that they are *film,* stuff that I can hold in my hands.

The digital post production turned out to be an intensive crash course in PhotoShop and color management. During four intense months 3,300 negatives were scanned, retouched and "processed" into high-, medium- and low-res digital-image files.

Some examples from the Scania International Picture Library. Left, a collage of fish-eye-lens shots made in factory settings. Upper right is set on a rainy night in the town square of Krakow, Poland. The third is of a Swedish traffic light for busses. Pictures like these were used in Scania's millennium calendar and in a series of posters that accompanied copies of the digital-image library that were sent to the Scania Bus partners and agents around the world.

The result of our efforts was an archive of 3,000 digital pictures 256 CD-ROMs. The best of the best were selected to become the year 2000 calendar, which I was asked to design and produce. That was my introduction to color management, or rather the lack of it, in this case.

The RGB pictures I made in PhotoShop looked *terrible* when converted to CMYK because color management didn't really exist. My monitor wasn't profiled and neither were those at the printing company.

In the end I had to remake all the files in CMYK and work through endless proofs. But the result was a beautiful calendar resulted and in the process I learned a lot about color management and prepress for both analog and digital printing.

While in Sweden I renewed friendship and collaboration with Dataton, a Swedish maker of world-renowned audiovisual control equipment. We all recognized that the day of color slides was coming to an end and that slide-show producers would need a way to make their shows digitally. I challenged Mike Falh and Bjorn Sandlund to create digital slide-show tools before the end of the century... and they met the challenge.

The Dataton solution is a software product called *Watchout* that facilitates the choreography of digital video and still pictures on a timeline. The software outputs the results to as many displays or projectors as you want. It is muti-image on digital steroids.

Dataton asked me to present the keynote address at the launch of *Watchout* in Stockholm in December 1999 and again in London a few months later. That address, which pokes fun at AV with a mock slide show, can be seen on my website. (*Quicktime* movies of a selection of Watchout shows can also be seen there.)

Mike Fahl, Dataton's software creator had met my challenge of producing a digital multi-image show by the turn of the century. Here it was at last, true digital multi-image.

Dataton asked me to write an introduction for the user's Forum on the Watchout *website. Still a poster boy in my own mind, who else but myself would I choose to star in the theme picture? Humility was still unknown to me... but soon would be learned.*

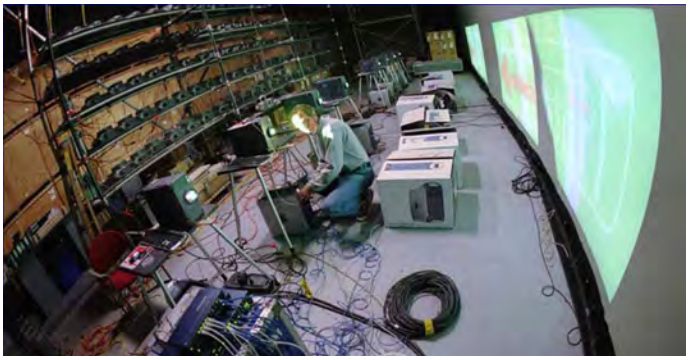
Watchout revived the sagging AV business. Big slide shows had succumbed to video and *PowerPoint* 10 years earlier. After a decade of watching video and computer screens people's eyes were square and they were ready to see w-i-d-e shows again.

I invested heavily in Dataton's new digital slide-show software and became an early pioneer in *Watchout,* just as I had been one of the pioneers of multi-image shows and effects three decades earlier in the slide-show days.

My goal was to re-invent myself as an AV producer. However, this time I wanted no part of having my own production company. Instead I chose to work for others as a freelancer. However, there was a flaw in my plan.

Just as digital technology made it possible for anyone to make great pictures, publications and/or music by themselves, Dataton's Watchout wipes out the need for professional programmers. So much for my new sales concept.

The programming studio at Vashon Island in 2003 during production of a five screen event show for IBM. The programming rig included 20 image servers feeding images to as many confidence monitors (top, center). The programming is done on the right-side workstation while images are made in graphics workstation on the left.



This picture is taken at Sound Images original studio in Portland is worth a thousand words. It shows an audiovisual world in the throes of change. In the foreground I can be seen setting up 8 video projectors and Watchout *image servers. In the background is a rack of 100 slide projectors made redundant by the Watchout system.*

Dave Frey at Sound Images in Portland was one of my first clients. He hired me to work with his team producing a variety of Shows for Nike and other clients.

Dave Frey (upper left) became more a mentor than a client. His production company, Sound Images, had made a science out of large-show production. 100-projector Nike extravaganzas were made at Sound Images on a regular basis. That made my qualifications appropriate.

This projection grid at Sound Images was so long that I used roller blades to speed from one end to the other loading slides.

Your's truly on the right, stage directing a Nike production at Portland Convention Center.

Crews at Sound Images were largely made up of a small group of freelancers of which I was privileged to be one. Above left, Derek Jackman and Steve Ferris in the warehouse. Top center, Chris Fowler at the rostrum camera.. Bottom center, Dan Root aka "Rooter the Shooter." Right, Phillip Augustine, world's most fastidious slide mounter.

Scene from a "typical" Nike extravaganza involving large screen projections as backdrops for fashion shows by athletic dancers.

In 2002 Anna left. For the next year I found myself sinking into depression. Yet another marriage had failed, and for the same reason. Ultimately, anyone in my life discovers that my work comes first. Wives don't take kindly to being second in line. But that didn't matter as much as the conundrum I found myself facing. Did success in one part of your life require failure in others?

Living alone on an island wasn't helping. I considered moving to back Stockholm, or to Portland or Denver. Finally I chose Vancouver BC because it has a has the most international *zeitgeist.*

In the autumn of 2003 I winterized the Vashon Studio and moved into Vancouver's West End, setting up shop at 1435 Nelson Street in a split-level condo.

Alone in Vancouver I faced my depression. Why despite so much professional success was I inwardly empty and unhappy. After time I realized that I had been repeating the same behavior pattern over and over, hoping for different results. That had to change. But how?

Many years earlier in similar circumstances my sister Barbara had given me a copy of Lao Tzu's *Tao Te Ching*, to help me over the loss of the Brussels studio and Elisabeth, which I had taken hard. But at that time I put the book aside, considering myself too pragmatic for "mystical" stuff and swamis. Now, in the shuffle of stuff called moving, the Tao ended up on my desk. This time I opened it realizing that if nothing else it would take me down a different path, and that I knew of no better one.

The Tao is not an easy read. The poems are obscure, to say the least. I decided to take it in bite-sized pieces. Every day I read one and worked on understanding what it could mean. After a while a pattern emerged and I realized that I was seeing things differently.

I started seeing the world around us as a total system. It sounds overly simplistic, I know. Nature is a system, of course. The lesson's value took on value as I looked at my own life in terms of its "sustainability" and interplay with Nature. Many things changed as a result, the most important being my diet and compass settings.

My life had been about pleasing others. When that is your aim, you cannot be yourself. If you can't be yourself you can't be happy. That sounds overly simplistic, too... but it is that simple. Like the song says, "You can't please everyone, you gotta please yourself."

On further analysis I came to realize that I had strayed from my own "nature". Business and its fame and fortune are the wrong path for me. What makes me happy is making pictures.

As if by magic a huge Watchout show fell into my lap from Quantum Audiovisual in Reno, Nevada. There are few things I like doing more than choreographing pictures and music, which was exactly what the new show called for.

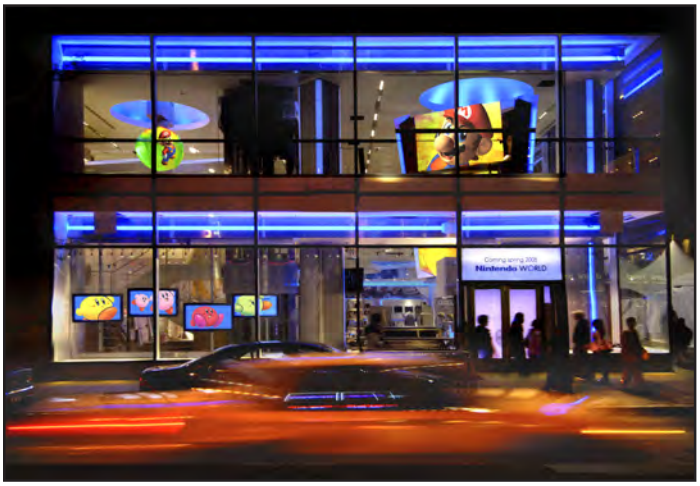
The red area in the above picture is the 60-foot-wide projection screen that arcs around the bar in the "chill lounge" at the Oceano Restaurant *in Reno's* Peppermill Casino.

The Peppermill Casino was one of Quantum's clients. A new restaurant and lounge there were to feature ambient music and visuals, and I was hired to produce the content.

Quantum owners Dean Rossi and Joe Ness both have a passion for the art of AV, a refreshing change from crasser clients. They introduced me to Burning Man. That turned out a life altering experience that played right in to my metamorphosis.

Dean Rossi and I took the Oceano show to Burning Man in 2005. It was a "trip" in every sense of the word. We loaded everything we needed on an old truck that Dean had gotten especially for Burning Man. The truck became the platform for the screen and projectors and the screen was one wall of our encampment in the Blackrock desert. Behind the truck is my Ford Van which served as the AV control room.

The red picture is the 20-foot-wide AV screen bolted to the truck. The illuminated seating and sign were custom made by Dean and rigged with programmed LED lighting. The fireworks in the background are compliments of a neighboring camp.



Nintendo contracted me to produce Watchout *content for their flagship store in* Rockefeller Center *in New York. Four plasma screens can be seen in the windows (lower left) An image globe hangs from the ceiling (second floor above the plasmas) and a two-story-high column of projections extends from the main entrance on the right, up through the ceiling to the second floor.*

Backstage at a New York Life sales meeting. The 60-foot screen appears in the right background. In the foreground is my Watchout rig sending images to primary and back sets of four projectors each. The little screens on my desk are called "confidence monitors" which give me a preview of what is going out. The back-up set is also used to rehearse speakers between shows.

Giving up being a businessman meant retiring from commercial art, which I have done for the most part. The only commercial work I now accept involves "art".

An important step into my expanding awareness was a symbolic trek to the summit of Mount Kilimanjaro for my 60th birthday in 2005.

In 2006 I was brought in to program the Watchout content of a 19-screen audiovisual spectacular at the CDC (Centers for Disease Control and Prevention) Museum in Atlanta, Georgia. The show was produced by Batwin & Robin with AV consolidation by Communications Electronic Design (CED) in Louisville. Viewers watch the show from a promontory lit by programmed LED lighting effects.

Your's truly at the programming computer at the CDC in Atlanta. Some of the 19 hanging screens can be seen behind me (left). The viewing promontory's LED lighting dome can be seen above my right shoulder.
Fine arts work has become my passion again and my primary focus. It is another case of "*back* to the future". As soon as I made the transition to self-satisfaction in 2005 and 2006, things started going my way. My luck started to change.

My lessons from the Tao had taught me to go with the flow. That is not a passive condition, as it turns out. Actually, it involves acute attention to the things that flow into your life, as a result of your thoughts. Instead of trying to shape the reality around me, I now prefer to follow its contours and see where they lead.

Now, I allow things to happen rather than trying to make them happen. As a result, my headlights are always on and my antenna is always up. Perhaps for that reason I noticed Pamela Swanson in a busy shop. What caught my eye was her's. Unlike most other people, she did not glance away when our eyes met. I couldn't get that out of my mind and returned to the shop to ask her out for coffee. She accepted my invitation. That was the 7th day of July, 2007... 7-7-7.

Pamela is a poet. We quickly discovered a mutual interest in things metaphysical and existential. She introduced me to "*The Law of Attraction*" by Esther and Jerry Hicks. Their philosophy contends that you get what you think about.

Pamela and I began sharing more than philosophies and on 9-9-9 we tied the knot in a simple ceremony on the English Bay beach in Vancouver, where we had coffee on our first date.

It is a mistake to make art for money. You may make money from your art, but money can't be the intent… it skews your thinking.

Commercial art offers opportunities to do some extraordinary work, and get paid too. The problem is that "purity" and perfection are compromised by consensus mentality and committee decision making in the name of "collaboration".

Compromise is a path *away* from satisfaction and happiness for the artist, or anyone. To the extent that compromises can be eliminated or at least mitigated, that degree of happiness can be achieved. If it is true that you get what you think about, why compromise the future with anything less than perfection? Spending time making things perfect keeps your mind focused on perfection. Thoughts about perfection beget perfection. If you think you can do it, you can do it.

Having read *Giclée Prepress* you have just about everything you need to know about pixel-perfect printing. All you need is experience. Practice makes perfect, as you know.

Reflecting on half a century's work, I realize that Arthur Tcholak was right. No matter whether the pictures you are making are for a movie or a magazine, a poster or a postcard, a Web site or a wedding, each is only as good as the 'print' delivered, what people see.

Digital imaging and giclée printing techniques are so precise and allow so much control that there is no excuse for a bad picture anymore. Not when perfection is possible. Like your life, every giclée that you prepress can be whatever you want it to be.

It is my hope that you find the procedures and information in this book *useful* above all else. Giclée prepress is as much an art as a craft. The craft is not difficult and involves just a few basic tools and techniques, as you have discovered. The art of giclée involves the achievement of perfection, or as near to perfection as you can get.

Thank you for reading *Giclée Prepress.* I leave you with the wish that your efforts be rewarded with the satisfaction of knowing that you are making the best giclée prints in town.

To be continued....

To and Fro
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Giclée Prepress
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SECTION FOUR

1978 | AVL Equipment Manuals

The following pages contain AVL equipment and software manuals for:

- Acuetone 12-tone tone programmer
- Mark IV 2-projector dissolve
- Mark VII 3-projector dissolve
- Accessories:
    - Exhibit Master 40-channel playback programmer
    - Electric Punch for ShowPro I and II punched-tape programmers
    - 40A Encoder for 40-channel expansion of ShowPro I and II
    - 20A Encoder for 20-channel expansion of ShowPro I and II
    - Power control box – programmable switch with 110-volt, AC outlet
- ShowPro VB digital, memory programmer
- ShowPro V Memory Test
- PD-3 programmable dissolve
- QD2 & QD3 computerized playback modules (dissolvers)
- Enhanced Procall
- Pocket Procall – cue guide for Procall Version 5
- Reliance Audiovisual (New York) rental catalogue

As mentioned in the Backstory, Steve Michelson has additional AVL manuals and product descriptions at his website. [http://www.stevenmichelsen.com/]

For audiovisual aficionados, Reliance Audiovisual's rental catalogue is perhaps even more interesting than AVL's manuals because it provides an overview of the AV universe in the mid-1970s. Reliance was the mainstay, go-to equipment resource and had been for at least a decade before multi-image took off. They had an enormous inventory of traditional presentation aids and hardware—including communications systems, display aids (flip charts, strip-film projectors, microfilm gear, lecterns and even furniture.

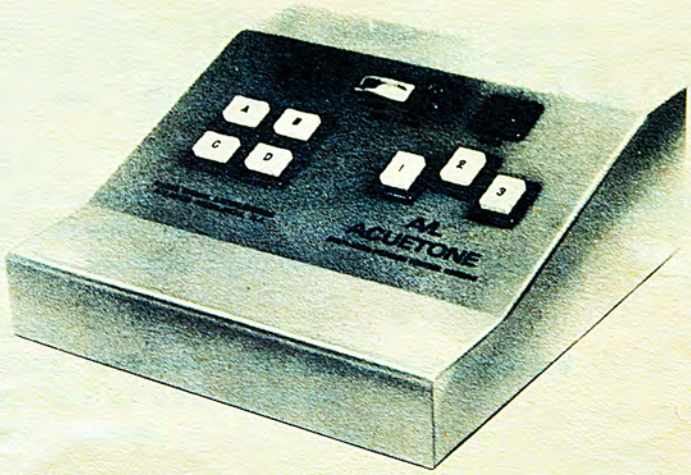
That range of gack wasn't offered by the new guys on the block, who started-up after 1970. Iin New York that included AVPA (Audio Visual Presentation Aids), run by Charlie Brotman; and Charlie Spataro's AV Workshop.

Charlie was a natural born schmoozer and deal maker. He managed to work a sweetheart deal with AVL's co-founder and sales manager, Ed McTigue, by which he got gear at lower wholesale prices than anyone else on the East Coast. He was therefore able to undercut all nearby competitors and for years and years was AVL's number-one dealer.

During the 70s, as multi-image dynamically expanded, becoming an industry unto itself, specialty companies emerged to stage shows. AVL's regional sales reps extended dealer pricing to them, further diffracting the hardware market. Producers, however, got no such preferential treatment. The deal(s) I had with AVL (along with other demo-show producers like Chris Korody, Duffy White, Allan Kozlowski, and Richard Shipps) were exceptions to that rule.

ACUETONE

Instruction Manual



AUDIO VISUAL LABORATORIES, INC.
291 Ocean Boulevard • Atlantic Highlands • New Jersey 07716 • (201) 291-4404

1978 | AVL Manuals | Plate Nº 1

Acuetone tone programmer.

INTRODUCTION

The AVL ACUETONE is the first professional tone programmer with both a reasonable price tag and enough channel capacity to control a wide variety of equipment. The programmer is easy to use, yet will control all standard slide projectors, dissolve systems, and other electro-mechanical devices.

The ACUETONE has a contoured control console with lighted switches to allow convenient control of all 12 channels. The precision playback meter allows accurate settings for consistant programming. As in all AVL products, the ACUETONE is rugged and reliable to surpass demanding professional standards.

SPECIFICATIONS

TONES

Frequency: 200 Hz to 3200 Hz (normal audio range)
Record Level: LINE (or AUX), Standard PHONE jack
Playback Level: LINE or Speaker, Standard PHONE jack

CHANNELS

Type: 12 momentary, electrically isolated closures, pin 2 to pin 5
Ratings: 120 volts AC or DC, 3 amp
Receptacles: Standard 5 pin Kodak Carousel type

ELECTRICAL

Power Cord: Permanently attached 3-wire grounded
Voltage: 105-125 VAC, 50/60 Hz
Current: 1 ampere

DIMENSIONS

Size: HxWxD = 4½ x 11 x 11
Weight: 8 lbs.

ORIGIN

Manufactured in U.S.A.

ACCESSORIES

Carrying cases, Audio cords, and 25-foot Kodak extension cords.

SETUP FOR PROGRAMMING

The AVL ACUETONE uses an exclusive tone encoding technique for recording program commands on magnetic tape. The tape recorder used must be stereo, with a separate Record control for each channel. Channel 1 is used for the audio portion of the show and channel 2 is used to record the program control tones. This setup allows both monoral sound and total program control on one magnetic tape. If stereo audio is desired, a 4 channel tape recorder may be used.

To program a show, connect the RECORD output of the ACUETONE to channel 2 LINE or AUX input on the tape recorder. Normally, the cord required will have a PHONE plug on one end and an RCA plug (PHONO plug) on the other end. Put the ACUETONE and channel 2 of recorder in the Record mode by pressing the respective Record switches. Press switch B on the ACUETONE and set the record level to mid-range (approximately minus 3 db) on the tape recorder meter. Record this signal for approximately 10 seconds at either the head or the tail end of the show as a reference for playback adjustments. This reference signal will not activate any channel outputs and, hence, will not interfere with the operation of the programmed show. Other control signals will yield different signal levels as described later under "System Checkout".

The 12 channel plugs may be interconnected with any combination of projectors, dissolves, and other devices using standard 25-foot Kodak extension cords.

SETUP FOR PLAYBACK

Take the ACUETONE and the tape recorder out of the Record mode. Connect channel 2 LINE output of the recorder to the PLAYBACK input of the ACUETONE. Connect the ACUETONE channel outputs to the appropriate projectors, etc. using standard 25-foot Kodak extension cords. Turn the recorder on and adjust the Playback Sensitivity to 100 on the meter when the reference tone B is playing back.

If the recorder does not have a LINE output for playback, the SPEAKER output may be used by setting the speaker volume control to the appropriate level. For convenience during programming, the record and playback cords may both be connected at the same time.

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Acuetone tone programmer.

PROGRAMMING THE SHOW

The AVL ACUETONE has 12 channels grouped into 4 sets of 3 channels each; namely A1, A2, A3; B1, B2, B3; C1, C2, C3; D1, D2, and D3. To activate any desired channel requires selection of a letter plus a number. To activate channel C2, for example, press C followed by 2. Note that the group selections A, B, C, and D will "latch" on and that only one group may be selected at one time. Pressing any lettered group switch will automatically release the previous group selection. The ACUETONE will operate in 1/10 second, facilitating rapid switching between group selections.

An important feature of the ACUETONE is that the numbers 1, 2, and 3 are momentary and independent. Any combination of numbers within a group may be simultaneously selected. As an example, channels A1, A2, and A3 may be simultaneously activated. Obviously, it is important to connect the channels in a logical and efficient manner. Functions which must occur simultaneously should be connected within the same group.

After the necessary connections have been made, the programming is very easy. As the sound track is playing from channel 1 of the recorder, the operator presses the channel control switches at the appropriate times. The screen actions will take place and the program tones will be recorded on channel 2, all synchronized to the audio on channel 1. When the show has been programmed once, the ACUETONE will run the show each time exactly as recorded. Modifications may be made to the show by rerecording either the entire show or any sections of the show. Of course the operator should take care not to erase previously recorded "good" cues when reprogramming.

SELECTING THE TAPE RECORDER

Any good quality stereo tape recorder, with a separate Record control for each channel, may be used for programming. The recorder should have flat frequency response from 200 Hz to 3200 Hz, which is well within the normal audio range. Also, the tape recorder should run at consistant speeds and be properly maintained.

SYSTEM CHECKOUT

When the system is set up properly, the ACUETONE will accept volume dropouts as much as 2:1 and AC line voltage variations from 90 volts to 135 volts and still operate flawlessly. The system may be tested fully by performing the following checks:

(1) Check that all channels are functioning properly. Put the ACUETONE in the Record mode and see that each screen action occurs when the corresponding channel is activated. The channel control switches on the ACUETONE should light up when pressed.

(2) Check that the ACUETONE is outputing the proper tone levels. The meter should read approximately 100 for each of the five following conditions: B only, D only, A1, A2, and A3. When only A is lighted, the meter should read zero. When other combinations are selected, the meter should read over 100.

(3) Check the tape input. Set B to minus 3 db (mid-range level). Repeat (2) and see that all frequencies are recorded equally. The highest frequency is A1 (3200 Hz). The lowest frequency is D (200 Hz).

(4) Put the recorder and the ACUETONE to playback and adjust B playback to 100. Check that all tones recorded in (3) play back properly. Tones B only, D only, A1, A2, and A3 should all read 100 plus or minus 30. When no tone is being played back, A should light and the meter should read zero.

(5) Check that all the channel control switches light during playback and all of the channels output properly.

RELIABILITY

The AVL ACUETONE is designed to meet and exceed the most demanding professional standards. A rugged aluminum case; a virtually indestructible printed circuit board, shock mounted for component protection; solid state circuitry with electrically isolated channel outputs; a precision playback meter; and a wide tolerance to AC voltage variations and playback dropout conditions provide a reliability factor virtually unknown in a tone programmer at any price.

MARK IV
Instruction Manual

AUDIO VISUAL LABORATORIES, INC.
420 HIGHWAY 36 BELFORD, N.J. 07718 • TELEPHONE (201) 291-4404

1978 | AVL Manuals | Plate Nº 6

Mark IV two-projector dissolve.

INTRODUCTION

The AVL MARK IV is the most sophisticated dissolve system ever developed for the true professional. The system has four precision dissolve speeds, one of which is variable to over 60 seconds. The Freeze Right and Freeze Left feature allow the operator to hold either projector ON or OFF and operate the other projector independently for superimpositions or any combination of solo or dual animates or fades for the wildest possible screen effects. The system also has a Reverse Quick Cut; Direct Access to the Left, Right, or ON Projector; and Show, Standby, Setup, or Rehearsal Modes which will extend lamp life by 100 times. The system is designed as two separate modules to allow the controls and status lights to be placed at the operator's fingertips. The power module has an exclusive ballast network for elimination of signals which cause lamp flutter and interfere with sound systems.

As in all AVL products, the MARK IV is rugged and reliable to meet and exceed the most demanding professional standards.

SPECIFICATIONS

Speed: Internally adjustable
Inputs: Standard carousel-type receptacle, 30 Volt DC, .5 amp max.
Outputs: Permanently attached standard carousel-type cables.
AC Receptacles: Switched, 3-wire grounded, 1500 watts maximum each.
Power Cord: Permanently attached 3-wire grounded.
Electrical: 105-125 VAC, 60 HZ
50 HZ internally adjustable
220 VAC versions available
Size: H x W x D = 2½ x 11 x 9 (each module)
Weight: 19 lbs. total
Origin: Manufactured in U.S.A.

1978 | AVL MANUALS | PLATE Nº 7

Mark IV two-projector dissolve.

POWER SETUP

The AVL MARK IV is a two module system. The power module should be placed near the projectors and the control module may be placed in any location convenient to the operator. A five foot interconnect cable is permanently attached to the power module, but this may be extended several hundred feet with AVL cables. The projector power cords should be plugged into their respective convenience outlets on the rear of the power module. The projectors should be set to Fan position for normal dissolve use, but may be set to ON or OFF without damaging the dissolve system. The MARK IV has voltage clip suppressors, ballast networks, and heavy duty heat sinks for reliable operation with all standard 300, 500, or 1200 watt carousel-type slide projectors.

When the Power Switch is turned on, the dissolve system will always initialize with the left projector lamp on and the right projector lamp off. The red Power Light on the power module will come on immediately and the green Ready Light on the control module will come on in 5 seconds, indicating the system is fully initialized and ready for operation. Note that the left and right Status Lights on the control module indicate the respective conditions of the projector lamps. Further use of the status lights is explained in later sections.

PROJECTOR LAMP CONTROL SWITCH

The switch on the left front of the control module should be set to SHOW for most dissolve use. In this mode the projector lamps will dissolve from full brightness when ON to an imperceptible "glow" when OFF. The MARK IV has a precision glow circuit set internally at the factory and will never require adjustments in the field, so that your dissolves will be smooth and consistant from system to system and location to location.

The FAILSAFE setting may be used whenever alternates are not required. In this mode, the MARK IV will accept dissolve commands given before the completion of the previous action and remain in sequence.

The REHEARSAL setting on the control switch will cause the projector lamps to burn at half power. In this mode, the dissolve action is similar to the Show mode but less heat is generated and the projector lamps will last up to 100 times rated life. This mode is useful for rehearsals or even some show situations where full lamp brilliance is not required and lamp life is a factor.

The STANDBY setting on the control switch will shut off the projector lamps, but the MARK IV will retain the Show condition and the Status Lights will continue to indicate which projector lamps will come on when the switch is returned to Show or Rehearsal. In this mode, the dissolve will continue to accept commands so that an entire system may be run in Standby and switched on as needed during a show.

The SETUP mode will turn on both projector lamps for slide alignment prior to show time.

Mark IV two-projector dissolve.

DISSOLVE TIMING

The AVL MARK IV has FOUR independent, programmable dissolve speeds. These speeds are Cut (¾ sec.), 2 Sec, 4 Sec, and Lap (8 sec. - 60 sec.). Each speed is a factory precision setting, but may be internally set for individual preferences.

The CUT is an instantaneous electronic transition from one visual to the next, rather than a smooth blend as in the dissolve speeds. The MARK IV waits ¾ of a second following a Cut for what is called lamp thermal lag and then automatically advances the DOWN projector. The green Ready Light comes on when the projector starts to advance. Allowing 1 second for projector advance, a new visual may be presented every 1¾ seconds.

The 2 SEC dissolve in the AVL MARK IV provides a smooth blending from one visual to the next. The dissolve action takes precisely 2 seconds, immediately followed by an advance of the DOWN projector. As in the Cut and the other dissolve speeds, the green Ready Light goes off when the dissolve action is started and comes on with the start of the projector advance. Allowing 1 second for projector advance, a new visual may be presented every 3 seconds.

The 4 SEC dissolve operates like the 2 Sec dissolve except that the dissolve action takes precisely 4 seconds. Allowing 1 second for projector advance, a new visual may be presented every 5 seconds.

The LAP dissolve speed may be varied by adjusting the knob on the right front of the control module. When the knob is turned to 1, you will hear a click. In the "Click" position, the dissolve action will take precisely 8 seconds. Longer dissolves of up to 60 seconds can be attained by simply turning the knob to a higher setting.

The AVL MARK IV does not lock out commands during either the dissolve action or during the projector advance. One advantage of this approach is that the dissolve system will accept a command and stay in sequence if the command is given slightly premature. Caution should be exercised, however, with complex sequences and they should be carefully timed. The green Ready Light can be used as a check on timing, since it lights each time a dissolve action is complete. The Ready Light should remain on for at least 1 second between dissolve commands to allow for the projector advance and adequate timing margins.

ANIMATION, ALTERNATES AND OSCILLATIONS

The AVL MARK IV will perform a wide variety of special effects such as animation, random flashing and oscillations. As mentioned in the previous paragraph, additional commands are not locked out during a Cut or Dissolve action before the projector advance takes place. Each time a new command is given, the MARK IV will restart the dissolve timing.

Mark IV two-projector dissolve.

Example: Left projector lamp on, Cut followed ½ second later by another Cut followed ¼ second later by a 2 Sec dissolve. The MARK IV will cut the visual from the right projector onto the screen for ½ second, cut back to the left visual for ¼ second, and then dissolve to the right visual followed by an advance of the left projector. Various combinations of Cuts and Dissolves may be used for indefinite periods for random flashing of flames, explosions or product prices.

During animation and other special effects, each command must be given before the projector advance from the previous Cut or Dissolve command, so careful programmed timing must be used. One good method of programming one or several screens of dissolve action is with an AVL programmer.

SUPERIMPOSITIONS AND FADES TO BLACK

The AVL MARK IV has an exclusive Freeze Right and Freeze Left feature which allow the operator to hold either projector ON and operate the other projector independently for superimpositions or any combination of solo or dual animates or fades. Likewise, either projector may be held OFF and the other projector may be Cut or Dissolved off, yielding a black screen without the need for blank slides. The elimination of blank slides will, many times, save tray changes during a show.

When a Freeze Left or Freeze Right command is given, that projector will freeze in its present condition and remain frozen until a Cut or Dissolve action has been executed. The other projector will Cut or Dissolve either up or down independently of the frozen projector. As soon as the action has been completed, the frozen projector is automatically unfrozen but remains in the same condition until a new command is given.

Example 1: Left projector off, right projector on. Freeze Left followed by a 2 Sec dissolve. The left projector will remain off, and the right projector will dissolve down and advance to a new slide. When the projector started to advance, the green Ready Light came on and the left projector became unfrozen. Both projectors are now unfrozen and either one or both may be Cut or Dissolved up at any speed. If the operator gives a Freeze Left, followed by a 4 Second dissolve, the left projector will remain off and the right projector will dissolve up. The green Ready Light will come on in 4 seconds and the left projector will become unfrozen. Both projectors are now unfrozen and in a normal dissolve condition with the left projector off and the right projector on.

Example 2: Left projector off, right projector on. Freeze Right followed by a cut, followed ½ second later by another cut, followed ¼ second later by a 2 Sec dissolve. The right projector will remain on and the visual from the left projector will cut on for ½ second, cut off for ¼ second, and then dissolve back on. When the green Ready Light comes on following the dissolve, the right projector will become unfrozen. Both projectors are now unfrozen and either one or both may be Cut or Dissolved off at any speed. If the next

Mark IV two-projector dissolve.

command is a Cut, both projectors will cut off and both projectors will advance. The projectors will stay locked in sequence in this manner until one or the other is frozen followed by a Cut or Dissolve. The MARK IV will then return to a normal dissolve sequence.

The animation, superimpositions and other special effects are designed to give the sophisticated operator maximum flexibility. These functions require some practice, but they become progressively easier as the operator gains experience.

REVERSE

The AVL MARK IV has a true Reverse, and will Cut to the previous visual in a sequence each time a Reverse command is given either manually or from a programmer. In this manner, large sequences may be backed up very quickly.

UP PROJECTOR CONTROL

The AVL MARK IV has a plug on the rear of the control module which is automatically steered to the "UP" (or ON) projector. A standard Kodak remote control may be used for focusing the visual that is on the screen without the operator having to determine in which projector that slide is. Likewise, the forward and reverse buttons on the remote control may be used during a show for manual back up of the slide projector advance.

The UP projector may also be programmed for projector advance, or "Blink" effects, for additional variety in the presentation. Direct access to the left and right projector is also provided on the rear of the power module by the LA and RA plugs, respectively.

REMOTE CONTROL

The four Dissolve functions, plus Freeze Left, Freeze Right, Reverse and UP Projector Control, are all programmable and each is easily accessed on the rear of the control module with standard Kodak cords. In addition, the AVL SHOW PRO II and AVL EXHIBIT MASTER programmers will provide access to all four Dissolve speeds, plus the two Freezes and Reverse, over ONE standard Kodak cord plugged into the CUT input. Thus, interconnection is simple, economical and reliable.

RELIABILITY

The AVL MARK IV is designed to meet and exceed the most demanding professional standards. A rugged steel case; a virtually indestructible printed circuit board, shock mounted for component protection; solid state circuitry, with input and output isolation of spurious RF signals; voltage suppression of inductive "kicks"; and massive heat sinks to protect the triacs, provide a reliability factor virtually unknown in a dissolve unit at any price.

Mark IV two-projector dissolve.

MARK VII

Instruction Manual

Audio Visual Laboratories, Inc.

500 Hillside Avenue, Atlantic Highlands, New Jersey 07716 201-291-4400

Mark VII three-projector dissolve.

INTRODUCTION

Slide projection has historically played a major part in many audio visual presentations, because truly beautiful and effective visuals could be presented simply and inexpensively. Until recent years, however, many observers considered slides to be a rather poor second cousin to film because the transitions from visual to visual were unattractive, slow-moving and repetitive in nature. The advent of the first dissolve control using two projectors per screen area was a major breakthrough in the state of the art because it allowed blending from one visual to the next. As more sophisticated dissolve systems were developed, a greater variety of effects became possible. With the AVL MARK IV, for example, producers could create multiple speed dissolve blends, superimpositions, and two projector animation using slides in an AV show.

Even with all the advances in sophistication, however, a true feeling of motion remained difficult to achieve with any two projector dissolve system. The major stumbling block has been the delay while the "down" slide projector advanced to the new slide. This waiting period slowed down the motion and prohibited smooth flow through a sequence of visuals.

The new AVL MARK VII has overcome the inherent slowness of the slide projector advance and opened up an exciting new world of creativity in slide shows. The secret lies in sequencing with three projectors instead of two. The MARK VII advances the "down" projector at the same time that a dissolve action is occuring between the other two projectors, making possible continuous dissolve blends. In addition, the MARK VII offers far greater flexibility and speed during cuts, alternates, blends, and superimpositions than ever before possible. Shows may now be produced with such a feeling of motion, that the audience is unaware that slide projectors are being used rather than film, and yet the quality, beauty, simplicity, and economy of slides is maintained.

POWER SETUP

The AVL MARK VII is a two module system. The power module should be placed near the projectors and the control module may be placed in any location convenient to the operator.

A ten foot interconnect cable is permanently attached to the power module, and this may be extended several hundred feet with AVL interconnect cables if desired. The projector power cords should be plugged into their respective convenience outlets on the rear of the power module, unless two or more 1200 watt slide projectors are used. Then the power cords should be plugged into separate power outlets. The projectors should be set to FAN position for normal dissolve use, but may be set to ON or OFF without damaging the

Mark VII three-projector dissolve.

dissolve system. The MARK VII has voltage clip suppressors, ballast networks, and heavy duty heat sinks for reliable operation with all standard 250, 300, 500, or 1200 watt carousel-type slide projectors.

When the power switch is turned on, the dissolve system will always initialize in standby (all three projector lamps off). The red Power light on the power module will come on immediately and the green Ready light on the control module will come on in five seconds, indicating the system is fully initialized and ready for operation. Note that the three white Status lights indicate that all three projector lamps are off, and that the three red Preview lights indicate that the left projector lamp will be the first to come on. Further use of the status and preview lights is explained in later sections.

PROJECTOR LAMP CONTROL SWITCH

The switch on the left front of the control module should be set to SHOW for most dissolve use. In this mode the projector lamps will dissolve from full brightness when ON to an imperceptible "glow" when OFF. The MARK VII has a precision glow circuit set internally at the factory and will never require adjustments in the field, so that your dissolves will be smooth and consistant from system to system and location to location.

The REHEARSAL setting on the control switch will cause the projector lamps to burn at half power. In this mode, the dissolve action is similar to the show mode, but less heat is generated and the projector lamps will last up to 100 times rated life. This mode is useful for rehearsals or even some show situations where full lamp brilliance is not required and lamp life is a factor.

The STANDBY setting on the control switch will shut off the projector lamps, but the MARK VII will retain the show condition and the status lights will continue to indicate which projector lamps will come on when the switch is returned to show or rehearsal. In this mode, the dissolve will continue to accept commands so that an entire system may be run in standby and switched on as needed during a show.

The SETUP mode will turn on all three projector lamps for slide alignment prior to show time.

DISSOLVE TIMING

The AVL MARK VII has four independent, programmable dissolve speeds. These speeds are Cut, 2 sec, 4 sec, and Lap (8 sec-90 sec). Each speed is a factory precision setting, but may be internally set for individual preferences.

The CUT is an instantaneous electronic transition from one visual to

Mark VII three-projector dissolve.

the next, rather than a smooth blend as in the dissolve speeds. The MARK VII waits 0.65 seconds following a CUT for what is called lamp thermal lag and then automatically advances the down-going projector. The green Ready light comes on ¾ seconds after the CUT command, indicating the ideal timing for the fastest and smoothest possible screen actions on a repetitive basis. Note, however, that all actions are not on a repetitive basis. Certain actions may go faster than ¾ second. For example, if both of the "down" slide projectors have finished advancing from the previous screen actions, one Cut may follow another Cut by any speed up to 1/10 second. Actual subliminal transitions may be achieved using the proper visuals and proper timing. It is also important to note that the MARK VII has a strictly AVL exclusive fail safe sequencing mode. The MARK VII will not lock out commands, lose sequence, or skip projector advances in even the most rapidly moving, tightly timed AV show.

The 2 Sec dissolve in the MARK VII provides a smooth blending from visual to visual. The dissolve action takes precisely 2 seconds, immediately followed by an advance of the down-going projector. The green Ready light comes on 1.5 seconds after the start of a 2 second dissolve, indicating the ideal timing for the smoothest possible dissolve blends. Depending upon the effect desired, commands may be given either before or after the ready light comes on, and the MARK VII will maintain the proper sequence.

The 4 Sec dissolve operates like the 2 Sec dissolve except that the dissolve takes precisely 4 seconds. The green Ready light comes on 3.5 seconds after the start of a 4 second dissolve.

The LAP dissolve speed may be varied by adjusting the knob on the right front of the control module. When the knob is turned to "1" you will hear a click. In the "Click" position, the dissolve action will take precisely 8 seconds. Longer dissolves of up to 90 seconds can be attained by simply turning the knob to a higher setting. At each setting, the green Ready light will come on ½ second before the finish of the dissolve blend.

ALTERNATION AND ANIMATION

In addition to the four dissolve speeds, the MARK VII has a separate ALTERNATE.

The Alternate is exactly like the Cut, except that no projector advance takes place. Alternates may be used at any speed, either repetitively or randomly up to 10 visual changes per second for special effects such as limited animation, random flashing of flames, explosions or lightening bolts, etc.

*Alternates and other screen commands such as Cut should not be used faster than 10 per second. They may, however, be intermixed with independent commands up to 20 commands per second.

Mark VII three-projector dissolve.

SUPERIMPOSITIONS AND OTHER SPECIAL EFFECT SEQUENCING

The MARK VII will always sequence projectors left-center-right-left-center-right, etc., unless the independent controls are used, then any projector sequence is possible. Operation of "L", "C", or "R" automatically cancels the normal sequencing and puts the MARK VII into the independent mode. This mode is one of the most powerful features of the MARK VII and allows special effects virtually impossible with any other dissolve system. To use this mode, follow the steps listed below.

(1) LOOK at the WHITE status lights. These lights indicate which projector lamps are presently on. At this point, IGNORE the RED preview lights. The red preview lights indicate which projector would normally be sequenced. The operation of the independent controls will automatically cancel the normal sequencing.

(2) ANALYZE which projectors you want to effect. Operate their respective controls one at a time. Operating the "L" control only, for example, will cause only the left projector to be affected by the next alternate, cut or dissolve command. Similarly for "C" and "R". Any combination of the three may be activated.

(3) CHECK that the red preview lights properly indicate the status you want to achieve following the next screen action. If you have made a mistake,you may effectively cancel it by operating L, C, R, ALT, L, C, R, ALT. This always restores your initial condition. Then start again at step (1).

(4) ACTIVATE the proper screen action by operating Alternate, Cut or a dissolve blend.

(5) NOTE that the MARK VII will attempt to restore normal sequencing of left-center-right, etc. following the screen action. It never requires the MARK VII more than two screen commands to automatically restore normal sequence. If you do not want normal sequencing, simply continue to use the independent controls as required following each screen action.

EXAMPLE: You have a picture of a TV set in the left projector presently on the screen,and you want to superimpose a price using a 4 Sec dissolve. Immediately following the finish of the 4 Sec dissolve, you want to do a 2 Sec dissolve to a totally new visual. Perform the following. Place the price slide in the center projector and the new visual in the right projector. Activate the "C" control followed by the 4 Sec dissolve.

The center projector only will be effected by the 4 Sec dissolve, and the price will slowly superimpose onto the TV set. While the dissolve

Mark VII three-projector dissolve.

is in progress, activate the "L", "C", and "R" controls. As soon as the green ready light comes on, activate the 2 Sec dissolve. All three projectors will be effected by the 2 Sec dissolve, so that the TV set and price will simultaneously dissolve out while the new visual is dissolving in. The MARK VII is now back in normal sequencing and will remain in normal sequencing until the independent controls are again used.

The flexibility of the independent mode allows virtually any combination of animation, blends and superimpositions. Where extremely high speeds and flexibility are desired, two or more MARK VII dissolve systems may be used on one screen area for sequencing through six or more slide projectors.

STANDBY

The MARK VII has a programmable STANDBY control. Operation of the control turns all projector lamps off without projector advance. The operator should note, however, that this control need not be used since the MARK VII may always be put into stand-by by proper operation on the "L", "C", "R", and "ALT" controls. The control is included primarily for convenience during rehearsals and show setups.

REVERSE

The AVL MARK VII has a true reverse, and will rapidly Cut to the previous visuals in exact reverse sequence. Large sequences may be backed up very quickly either manually or from a programmer.

UP PROJECTOR CONTROL

The MARK VII has a plug on the rear panel which is automatically steered to the "UP" (or ON) projector. A standard Kodak remote control may be used for controlling focus, forward and reverse of the visual that is on the screen. The UP projector may also be programmed for projector advance, or "Blink" effects, for additional variety in the presentation. Direct access to the left, center and right projector is also provided on the rear of the power module by the LA, CA, and RA plugs, respectively.

REMOTE CONTROL

The most popular method of remotely controlling one or more AVL MARK VII dissolves is with an AVL programmer such as the AVL Show Pro II.

One standard Kodak cord plugged into the CUT input will provide control of the four dissolve speeds, plus control of "L", "R", and Reverse. If the operator desires control of Alternate and "C", then two additional cords will be required. AVL recommends plugging the

Mark VII three-projector dissolve.

Alternate input to the corresponding "A" channel number and the "C" input to the corresponding "B" channel number on the Show Pro II. In this manner, the operator has total control of the MARK VII using only eight channels of the programmer and only three standard Kodak cords.

In addition, all of the functions listed below are connected to individual Kodak compatible plugs. These functions may be accessed with Kodak cords for either manual or program control.

CUT	L (left)
2 SEC	C (center)
4 SEC	R (right)
LAP	STANDBY
ALT	REVERSE

RELIABILITY

The MARK VII has a rugged steel case, virtually indestructible printed circuit board, solid state circuitry, voltage suppression of inductive "kick", massive heat sinks, and exclusive ballast networks, to provide a reliability factor virtually unknown in a dissolve unit at any price.

SPECIFICATIONS

INPUT: Standard carousel-type receptacles, 30 Volt DC, .5 amp maximum

OUTPUTS: Permanently attached standard carousel-type cables

AC RECEPTACLES: Switched, 3-Wire grounded, 1500 watts maximum each

ELECTRICAL: 105-125 VAC, 60 Hz. 50 Hz. Internally adjustable. 220 VAC version available

SIZE: H x D = 2½ x17 x9 (each module)

WEIGHT: 22 lbs. total

ORIGIN: Manufactured in U.S.A.

Mark VII three-projector dissolve.

ACCESSORIES

Instruction Manual

- AVL EXHIBIT MASTER
- AVL ELECTRIC PUNCH
- AVL 40A ENCODER
- AVL 20A ENCODER
- AVL POWER CONTROL BOX

AUDIO VISUAL LABORATORIES, INC.

420 HIGHWAY 36 BELFORD, N.J. 07718 • TELEPHONE (201) 291-4404

AVL EXHIBIT MASTER

The AVL EXHIBIT MASTER is a 40 channel playback programmer for exhibit work, permanent installations, and "canned" shows. The Exhibit master has all of the performance features of the AVL SHOW PRO II, but without the control console. You can program your show on the Show Pro II and then play the program tape on the Exhibit Master in installations where the control console is not necessary. A complete description of the sychronizer, channel control, coding, etc. is included in the Show Pro II instruction manual. Instructions for use of the Exhibit Master for playback applications are detailed below.

SYNCHRONIZER: Connect the LINE output of the control track (the track without the audio) of the tape recorder to the PLAYBACK input of the Exhibit Master. This will ordinarily require an audio cable with a PHONO plug on one end and a PHONE plug on the other end. If the synch signals were recorded properly, no level adjustment is usually necessary. The synch level should read appoximately —3db. Slightly higher or slightly lower levels will also work properly. If the level is far too low, the synch signals may not "cue" the programmer. If the level is far too high, background hash may cause extra "cues" to the programmer.

In some instances, the operator may choose to use the SPEAKER level playback. When this is done, the playback level should be tested to find the safe operating range, and the level set in the center of the safe range. The margins are wide enough that reliable and consistent operation may be attained very quickly.

The Exhibit Master may also be "cued" with the CUE switch on the front panel, or with a standard Kodak remote control plugged into the REMOTE CUE input, or with a variety of other cueing devices plugged into the REMOTE CUE input.

OUTPUT CHANNELS: The output channels should be connected to the appropriate devices with standard Kodak extension cords. Normally, one cord is required for each AVL dissolve unit, and one cord for each of the other pieces of equipment to be controlled by the Exhibit Master.

HI/LOW SWITCH: The HI/LOW switch on the front panel should be set up to HI, or down to LOW, depending on the type of program tape. When the switch is set to LOW, the programmer will step one line of program tape each time the unit is cued. When the switch is set to HI, the programmer will start running when it is cued, and will run at 20 lines per second until a STOP code is read from the program tape.

LOADING THE PROGRAM TAPE: The program tape should always be loaded with the Power Off to clear the internal memory and initialize the Exhibit Master. Load the program tape on the blank leader of the tape and then turn the power on. Cue the programmer until the reader head steps to the desired line of tape. Turn on the Tape Recorder and enjoy your show.

SPECIFICATIONS

DISSOLVE CONTROL CHANNELS: One standard carousel-type male receptacle for each of five dissolve controls.
INDEPENDENT CHANNELS: 10 Electrically isolated, 120 VAC, 3 amp carousel-type male receptacles, momentary output.
SYNCHRONIZER: 2200 z output, MIC level; 1000—3000 Hz input, LINE or SPEAKER level, Minus 7db or higher.
ELECTRICAL: 105—125 VAC, 50/60 Hz
SIZE: HxWxD = 4x17x14½
WEIGHT: 30 lbs.
ORIGIN: Manufactured in U.S.A.

AVL ELECTRIC PUNCH

The AVL ELECTRIC PUNCH removes the drudgery of hand punching program tapes. The punch acts as a slave to the AVL SHOW PRO I or AVL SHOW PRO II programming system. As the screen commands are executed on the programmer, the punch will automatically punch the appropriate holes in the program tape. The control operations of the programmers are fully described in their respective instruction manuals.

The punch may be used to electrically punch, duplicate, or correct program tapes. To duplicate a tape, simply load the original tape into the programmer reader head and single step or run the original tape through the programmer at 20 lines per second. The duplicate tape produced on the electric punch will be an exact copy. To correct a tape, duplicate the good portions of the tape and use the controls of the programmer, as described in the programmer instruction manuals, to override the bad portions of the original tape. Using this technique you may change cues, add cues, or skip cues; and the new tape will be a clean, splice-free corrected copy. The operator may wish to do all of the programming and editing on inexpensive paper tape, then load mylar tape into the punch and make one or more duplicate copies to use as the show tape.

The electric punch may be used with any standard one inch wide paper or mylar tape. The punch will automatically punch sprocket holes, so sprocketed or unsprocketed tape may be used.

IMPORTANT NOTE when punching UNSPROCKETED TAPE: To insure even sprocketing the tape must be started properly and be

allowed to run freely through the punch head. If the tape is not started correctly, or if the tape is allowed to jam up during punching, the sprocket holes may be spaced too closely together approximately every eleventh sprocket hole. To properly start a new, unsprocketed tape, the operator should apply pressure to the tape hole down arm and run off about two feet of tape to insure even sprocketing. The pressure can then be released and the punch will continue to sprocket evenly. If the operator should allow the tape to jam during programming and uneven sprocketing results, the operator should again apply pressure to the tape hold down arm and run off about two feet of tape. No problem exists if the sprocketing drifts slightly from side to side. The programmer reader head registers on the sprocket holes and not on the edges of the tape.

The AVL ELECTRIC PUNCH is a heavy duty unit, designed to punch error-free tapes for hundreds of thousands of cues with no routine maintenance required.

SPECIFICATIONS

PROGRAM TAPE: Standard one inch wide, paper or mylar computer tapes.
ELECTRICAL: 105—125 VAC, 60 HZ, other versions available
SIZE: HXW D = 7x21x21
WEIGHT: 42 lbs.
ORIGIN: Manufactured in U.S.A.

AVL 40A ENCODER

The AVL 40A ENCODER will inexpensively expand an AVL SHOW PRO I or AVL SHOW PRO II programming system by 40 channels. The encoders may be stacked without additional interface equipment and will allow up to 200 or more channel expansion of the basic programming system.
The 40A ENCODER should be plugged into the back of the programmer, and the AVL ELECTRIC PUNCH plugged into the back of the encoder, if an Electric Punch is used. In this manner, both the encoder and the punch act as slaves to the programmer.

The 40A ENCODER uses codes to generate 40 electrically isolated outputs from the basic 8 track program tape. There are eight groups of five channels. Any five, or any combination of the five, within one group may be executed at exactly the same time. The codes are listed later in the "Specifications" section. You will note that the eight groups are generated by combination of tracks 6, 7, and 8; while the five channels (or screen members) within a group directly relate to tracks 1, 2, 3, 4 and 5. These codes may be generated on the SHOW. PRO I by simply cueing in the proper combination of numbers for the

channels desired. As an example, channels 61 and 63 may be activated by pressing #6, #1 and #3, and then cueing the programmer. An even easier system to use is the encoder in combination with the AVL SHOW PRO II. The SHOW PRO II automatically encodes the eight groups. Simply press one button for group selection, and one or more buttons for screens 1 through 5 within that group. The actual codes generated with the SHOW PRO II are listed in "Specifications" for reference.

The 40A ENCODER has Active and Standby lights to indicate the status of the encoder. When the encoder is in Standby, its outputs are disabled and the programmer is activated. When the encoder is Active, the outputs of the programmer are automatically disabled and the control signals will be executed from the encoder. The encoder may be activated by executing an "L" or "67" on the programmer WITH NO SCREEN NUMBER. The encoder will remain Active until an "R" or "68" with no screen number is executed on the programmer. The encoder will then go to Standby and remain in Standby until it is again made active by an "L" or "67" with no screen number. It is important to note that when any normal code with a screen number is used, such as "L12345", the encoder status will not change. The encoder status will change only with artificial codes such as "L" or "67" with NO screen number.

Two or more 40A ENCODERS may be stacked to allow even further expansion of the programming system. The first "L" or "67" command will activate the first encoder. The second "L" or "67" will activate the second encoder and automatically disable the first encoder. In this manner, the "L" or "67" commands will "step up" to the desired encoder. An "R" or "68" command will put all of the encoders in Standby.

When the 40A ENCODER is used with the 40 channel SHOW PRO II, the operator has control of 80 channels. When the 40A ENCODER is used with the 8 channel SHOW PRO I, the SHOW PRO I is automatically disabled and the operator has control of 40 channels. Encoders may be stacked with either programmer, but a SHOW PRO II programmer is easier to use and a more economically ideal building block for a large channel system.

SPECIFICATIONS

CHANNEL CODES:

1	2	3	4	5	671	672	673	674	675
61	62	63	64	65	681	682	683	684	685
71	72	73	74	75	781	782	783	784	785
81	82	83	84	85	6781	6782	6783	6784	6785

Accessories | 40A Encoder expands ShowPro I and ShowPro II by 40 channels.

GROUP SELECTION WHEN USING AVL SHOW PRO II:

CUT	—	L	67
2S	6	R	68
4S	7	A	78
LAP	8	A	678

OUTPUT CHANNELS: 40 Electrically isolated, 120 VAC or VDC, 3 amp carousel-type male receptacles.
SIZE: HxWxD = 4½x17x9½
Weight: 15 lbs.
ORIGIN: Manufactured in U.S.A.

AVL 20 A ENCODER

The AVL 20 A ENCODER is identical in operation to the AVL 40A ENCODER except that only 20 channels are generated. The 20A Encoders may be stacked or used in any combination with 40A Encoders for the exact number of channels desired.

SPECIFICATIONS

CHANNEL CODES:

1	2	3	4	5
61	62	63	64	65
71	72	73	74	75
81	82	83	84	85

GROUP SELECTION WHEN USING AVL SHOW PRO II:

CUT	—
2S	6
4S	7
LAP	8

OUTPUT CHANNELS: 20 Electrically isolated, 120 VAC or VDC, 3 amp carousel-type male receptacles.
SIZE: HxWxD = 2¼x17x9
WEIGHT: 10 lbs.
ORIGIN: Manufactured in U.S.A.

AVL POWER CONTROL BOX

The AVL POWER CONTROL BOX is a general purpose unit for controlling a wide variety of devices such as 16mm projectors, spotlights, speakers, etc. The first time the unit is cued, it will turn on a device. The second time the unit is cued, it will turn the device off.

The Power Control Box includes a power switch, a red neon lamp to indicate power to the unit, and a white neon lamp to indicate if the output of the unit is on or off. The unit has a red push-button switch for manual cueing and a standard carousel-type plug for remote cueing. A standard Kodak hand control may be plugged in for remote manual cueing, or a standard Kodak extension cord may be used to connect the unit to one channel of an AVL programmer.

The Power Control Box has two outputs. One output is a standard 15 amp, 120 VAC outlet. This output may be used for supplying power to devices such as spotlights, motion product displays, and 16mm projectors. In addition, the unit has a simple contact closure for applications such as turning a speaker on or off. In any application, the Power Control Box requires only one channel and will activate on the first cue and de-activate on the second cue.

SPECIFICATIONS

POWER OUTPUT: 15 amp, 120 VAC, 2 wire grounded outlet.
RELAY OUTPUT: Electrically isolated, 120 VAC, 3 amp carousel-type male receptacle.
REMOTE CUE INPUT: Carousel-type female receptacle
CUE SPEED: Up to 20 cues per second
CUE DURATION: 20 msec minimum (compatible with all AVL programmers)
SIZE: HxWxD = 4x5x7
WEIGHT: 3 lbs.
ORIGIN: Manufactured in U.S.A.

THE AVL BATTERY PACK

- Constantly monitors AC input
- Supplies power automatically if regular source is interrupted
- Provides supplemental voltage to equipment if power drop occurs
- Permits rapid dumping of memory to cassette recorder during blackouts

Audible Alarm

If current is cut off or drops below a level sufficient to assure continuous operation of your AVL programming unit, the Battery Pack emits a high pitched tone.

Audible Alarm Off/Normal Switch

Normal Position: Allows warning signal to be heard.

Off Position: Prevents the signal from being heard when power cuts off or falters. This position is a signal defeat only. It does *not* interfere with the Battery Pack's automatic takeover.

AC Power Problem (Red Light LED)

This is a visual warning of AC power failure. If AC voltage fails or drops to a level insufficient to maintain constant operation of your programmer, this light comes on.

Note: Both the audible alarm and red LED activate only if there's an AC voltage problem. Both warnings deactivate automatically when AC power is restored.

Unit Ready (Green Light LED)

This LED lights when the Battery Pack is connected to the programmer and the programmer's AC switch is in the "On" position so the unit is drawing from a normal AC source. If the light fails to come on, there is only one connection to check, the umbilical cord from Battery Pack to programmer.

Battery Not Fully Charged (Amber Light LED)

This light comes on if AC power is interrupted. After AC power is restored the amber light remains on until the battery's maximum charge level has been reached.

Approximate Recharge Time for AVL Battery Pack

Time Discharged	Time to Recharge
10 minutes	8 hours
8 minutes	7 hours
6 minutes	5 hours
4 minutes	3.5 hours
2 minutes	.5 hours

Note: The battery has a minimum power takeover time of ten minutes, ample to unload AVL's SHOW PRO V memory of 3,800 cues.

If your programmer's power cord is disconnected from the wall socket but everything else is still receiving power, the battery will automatically supply the power necessary to operate the programmer.

Battery Life

The AVL Battery Pack is designed to last a minimum of five years under continuous use. However, since it is unlikely that it will be used constantly, we recommend plugging the unit into the programmer and activating it every third month. The system should be left on until the amber warning signal goes off.

Note: Battery and programmer may be left on for an unlimited length of time.

Specifications

- Two gel cell rechargable 12-volt batteries
- Size: H 8½" X W 6¼" X D 8½" (22 X 16 X 22 cm)
- Weight: 10 pounds (4.5 kg)
- Programmer & Battery Connector: 8-prong cinch connector
- Origin: U.S.A.

Note: Because your time and creativity are involved in any program, periodic storage on magnetic tape should be a regular practice. Even if your program hasn't been transferred, however, your Battery Pack will allow you to dump cues quickly onto a cassette recorder with chromium dioxide tape in the event of a power failure.

Audio Visual Laboratories, Inc.

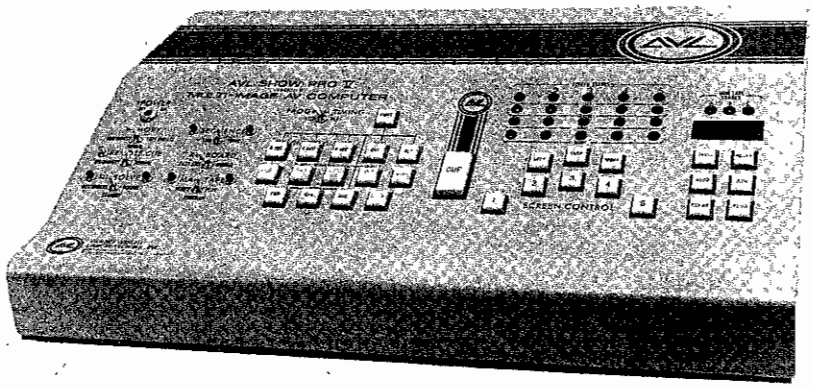
500 Hillside Avenue, Atlantic Highlands, New Jersey 07716 201-291-4400

NOTE: Memory loss occurs when **POWER** is disconnected.

Show Pro V

Version B

Multi-Image AV Computer



Operator's Manual

The professional team in multi-image programming systems.

INTRODUCTION

Congratulations

As a multi-image professional, you have chosen a system that, by any criteria, is the most significant advance yet made in your field.

Indeed, the SHOW PRO V represents a totally new concept in multi-image programming, one pioneered by AVL with the predecessor to this unit, the SHOW PRO III . . . all dissolves and program operations built into a single computer-controlled package.

With the SHOW PRO V, you now have total control of up to 15 slide projectors at your fingertips. The computer generates all cuts and dissolve blends, and additionall keeps track of all aspects of the program, including slide projector tray positions and lamp status. In effect, the computer does the "bookkeeping," allowing you to spend your time perfecting the artistic and creative elements of a show.

Until recently, a completely computerized programmer/dissolve system was merely an idea entertained by many professionals in the AV field. The prospects for production of such a system remained dim, however, until the introduction of high technology micro-processor integrated circuits.

With their advent, AVL took full advantage of the new technology. As a result, multi-image programs can now be generated, reviewed and edited more simply and far faster than ever before.

The SHOW PRO V is designed to control a number of slide show formats, including five screens with three projectors focused on each, a standard upon which the descriptions in this manual are based.

Our completely new system also has ten auxiliary channels for controlling additional equipment such as supplementary slide projectors, a 16 mm projector, or room lighting.

Each projector in the SHOW PRO V System may be controlled independently, allowing sophisticated split-screen and overlapping image effects. The result: Shows with motion and rich visual effects that an audience may well assume are produced by film . . . produced instead with the simplicity and economy of slides!

This manual will help familiarize you with the remarkable SHOW PRO V. From that point on, your multi-image programs can soar as high as your own imagination.

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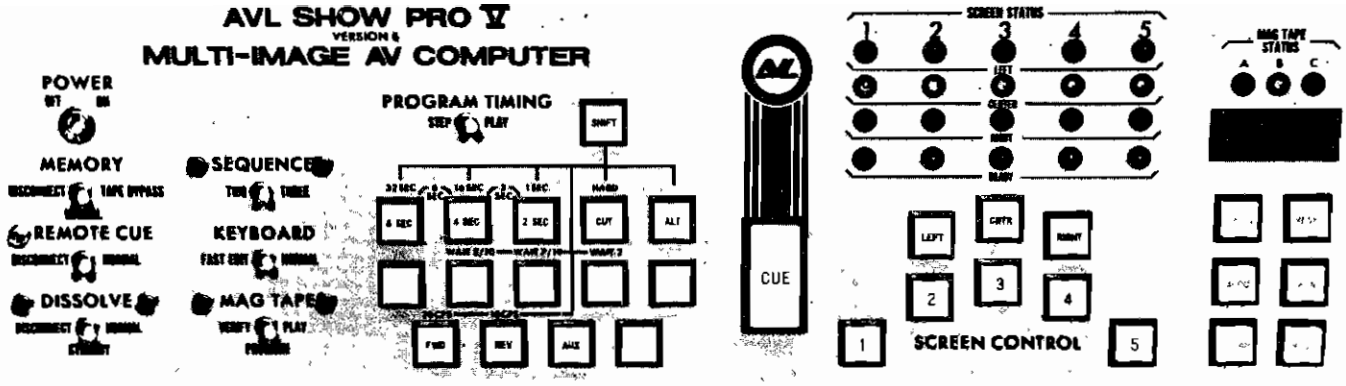


FRONT PANEL

The keyboard controls of your SHOW PRO V are designed for simple trouble-free editing and programming, with all phases of operation apparent at a glance, all command functions at your fingertips. Here are the specific functions of each keyboard control:

CONTROL TOGGLE SWITCHES

Power

Activates the system in the "ON" position. This key switch can be removed from the unit in the on position, a safety feature that prevents accidental interruption of a program.

Memory

This is a three position switch:

(A) The far left position is "DISCONNECT".
(B) The center position is "NORMAL".
(C) The far right position is "TAPE BYPASS".

Normal Position

This position is for:

(A) Loading memory from keyboard during programming.
(B) Recording data to magnetic tape from memory after programming.
(C) Reloading memory from magnetic tape.

Tape Bypass Position

While in this position the SHOW PRO V will execute all cues from magnetic tape, but will not enter these cues into memory, nor change the current cue counter position.

For Live portions of your show, cues can be accessed from memory without changing the memory switch position.

The Tape Bypass mode allows the operator to easily transfer from "Canned" show to "Live" show and back as many times as is necessary, maintaining the use of reverse cue in all Live portions.

Disconnect Position

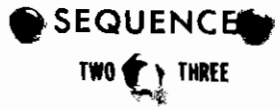
This position prevents keyboard commands and programmed data off magnetic tape from entering memory.

Remote Cue

Should be in NORMAL position during most operations, allowing cue commands by remote control. The red light to the left of the switch will come on whenever a remote hand control is activated, regardless of whether the switch is in NORMAL or DISCONNECT. In DISCONNECT, a remote cue will not activate the programmer.

NOTE: The Remote Cue switch must be in the NORMAL position when interconnecting SHOW PRO V's. Connect the program interconnect plug to the Remote Cue receptacle of the second SHOW PRO V. Simultaneous operation of both units can be achieved from one Remote control. This Remote controller would be plugged into the Remote control receptacle of the first SHOW PRO V.

Dissolve
This is a three-position switch. In DISCONNECT (left position) the switch disconnects all outputs to projectors and auxiliaries. A red light to the left of the switch remains on as a reminder to the operator. Use DISCONNECT with care. When the DISSOLVE switch is in this position, program memory responds to commands as if it's advancing or reversing trays. As a result, it will lose track of projector tray status. In NORMAL (right position) all dissolves are connected and will respond to commands. In STANDBY (center position) all projector lamps are turned off but dissolves are connected and will respond to commands.



Sequence
With this switch in the TWO position the programmer will sequence between left and right projectors, although the center projector will be activated if the CENTER Screen Control button is punched. With the SEQUENCE switch in the THREE position the programmer will sequence left-center-right.

Keyboard
This switch primarily governs the editing controls on the SHOW PRO V. When the keyboard switch is in the NORMAL position all editing buttons activate on a one step basis. The Keyboard switch should be in the NORMAL position for all playback situations.

The "Fast Edit" position allows the operator to "Edit" any number of cues in a Block, or "add" any given number of cues in a Block. This position also changes the run control from a hold down position to a Latching situation.

Keyboard "Fast Edit" changes the Reverse "Q" function also, allowing extremely rapid reversing through memory.

For more information on each Editing control, and the "Fast Edit" position for each control, refer to "Editing Controls".

NOTE: When the Keyboard switch is in the "Fast Edit" position the SHOW PRO V will alert the operator by blinking the Red Mag Tape Status Led.

Mag Tape Switch
MAG TAPE VERIFY is the far Left position, indicated by a Red Light. In this position a program that has been dumped to magtape may be completely checked without disturbing the contents of the SHOW PRO V memory.

To verify a program that has been dumped to magtape:

(1) Set Mag Tape switch to Tape Verify position.
(2) Reset the SHOW PRO V memory and rewind magtape.
(3) After connecting an Audio cable from Line Out of the recorded track to the Play jack on the back of your SHOW PRO V, start Tape Deck.

Each time a cue is Read back into the SHOW PRO V, it is checked and verified against memory. If the data is correct the cue counter will advance one step. If any cue is incorrect the cue counter will indicate BAD 4.

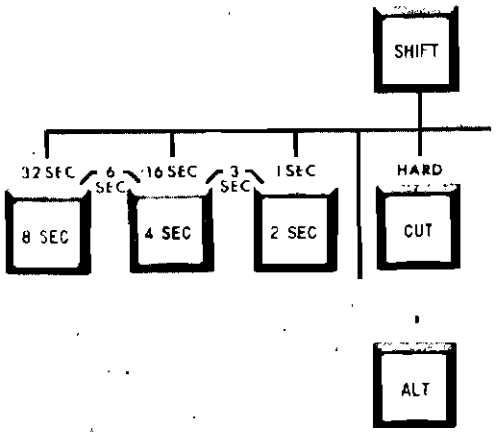
If all cues are good, the cue counter will indicate the number of good cues. If this count is the same amount as in memory, the dump is assured to be accurate and of high quality.

PROGRAM position is for programming your show and transferring all programmed data to magnetic tape.

PLAY position is for presenting shows from mag tape or memory.

Program Timing
This switch will undoubtedly be used more than any other during programming. In the STEP position it allows step-by-step programming. In the PLAY position it allows playback of single cues as well as pre-programmed high speed sequences.

DISSOLVE SPEED CONTROLS



Cut

Commands an instantaneous switch from one projector to another. Any projector going off will automatically advance.

(For further details see High Speed Programming)

2 Second (2 SEC)
4 Second (4 SEC)
8 Second (8 SEC)

These buttons are used to select the timing for blends from one projector to another. Any projector going off will automatically advance.

The combination of buttons 2 SEC and 4 SEC produce a 3 SECOND Dissolve Speed.

The combination of 4 SEC and 8 SEC produces a 6 SECOND Dissolve Speed.

Alternate (ALT)

ALT used in conjunction with a screen number switches lamps between projectors similar to a cut without a Tray advance.

The Alternate button may be combined with any Dissolve speed to perform a dissolve alternate (no tray advance) including the 3 and 6 SEC combination.

Shift Command Feature

Using some control buttons on the SHOW PRO V combined with "SHIFT" adds a host of performance features:

(A) SHIFT combined with the Dissolve Speed Controls for additional speeds.
(B) SHIFT combined with ALT for high performance screen effects.
(C) SHIFT combined with screen numbers for DISSOLVE FREEZE.
(D) SHIFT combined with forward for high speed action at 20 CPS (Cues Per Second).
(E) SHIFT combined with Reverse for shifting back to normal speed 10 CPS.

If a SHIFT can be combined with a control button this will be pointed out, and the procedure and result explained as we define each control button.

Dissolve Speeds Combined With Shift Button

SHIFT + CUT = HARDCUT. The down going projector begins advancing before the Lamp Status has changed, causing a harder visual effect than the Standard cut.

SHIFT + 2 SEC = a 1 SECOND Dissolve Speed.
SHIFT + 4 SEC = a 16 SECOND Dissolve Speed.
SHIFT + 8 SEC = a 32 SECOND Dissolve Speed.

ALL SHIFT Dissolve Speeds can also be combined with ALT to prevent advance of down going projector.

Shift ALT

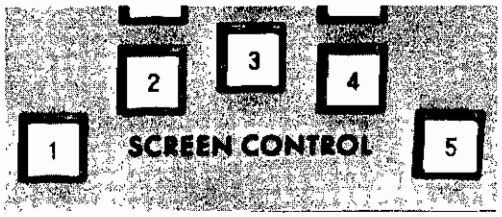
The lamp in a Slide Projector does not turn on or turn off instantaneously with the application or removal of power, because the lamp requires fractions of a second to heat up or cool down. This is called "thermal lag" of the lamp. The thermal lag is different for turn on than turn off. The SHOW PRO V automatically compensates for thermal lag differences in all dissolves and alternates. For Cut or ALT, the SHOW PRO V has what AVL calls an "Afterburner" to remove the possibility of any blink effect. This afterburner also has the advantage of allowing visuals to move at 20 CPS and have each visual reach full brilliance. However, a lamp may not be alternated on and off 20 times per second with ALT because the afterburner will hold the lamp on. Hence, the introduction of "SHIFT, ALT" which removes the afterburner and allows flashing a lamp at 20 CPS and/or flying visuals at 20 CPS at less than full brilliance. Additionally, the SHIFT ALT is used in the INTENSITY CONTROLLED ALTERNATE described later in High Performance Screen Affects using SHIFT.

Dissolve Freeze

The new SHOW PRO V can "Freeze" and hold a dissolve at any lamp intensity. You may program this effect by commanding SHIFT with the projector (or projectors) you wish to Freeze, AND NO DISSOLVE SPEED.

You may then release the dissolve in the same direction, or in the opposite direction, at any speed. These effects are explained later in High Performance Screen Effects using SHIFT.

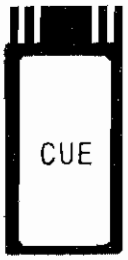
SCREEN COMMANDS



1
2
3
4
5

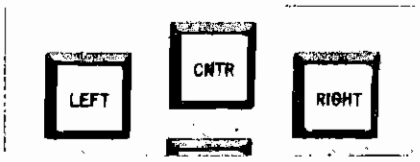
Designate which "screen" is to receive commands. A "screen" is a projector pair when the SEQUENCE switch is at TWO, or a group of three projectors when the SEQUENCE switch is at THREE. The Screen Command buttons can be operated singly, simutaneously, or in any combination in conjunction with black-lettered command buttons.

CUE COMMAND



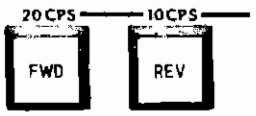
Cue
This button is the final command to execute, and must be cued before the computer will act on any function entered.

INDIVIDUAL PROJECTOR CONTROLS



Left Center Right
Designate specific projector(s) to be commanded. These buttons can be used independently or simultaneously with any dissolve speed or pre-set the next projectors to react to command. System logic always starts with the left projector and functions in a left - center - right sequence unless commanded to do otherwise by these individual projector controls. If the SEQUENCE switch is at TWO, system logic will start with the left projector in a left - right rotation unless commanded to do otherwise.

ADVANCE AND REVERSE PROJECTOR CONTROLS



Forward (FWD)
In conjunction with the appropriate Screen Control numbers this button commands all projector trays in a bank to advance simultaneously. Used in conjunction with a Screen Control number and LEFT, CENTER or RIGHT buttons, it will advance only the projector tray(s) selected.

Shift Forward
The command "SHIFT, FWD" shifts the programmer to 20 CPS. The programmer indicates that the cue speed is 20 CPS by lighting the amber Mag Tape Status LED. When 20 CPS cues are played from Mag tape into any AVL computer, the amber LED will light. NOTE: The Mag Tape switch should always be in "Program" when programming.

Reverse (REV)
In conjunction with the appropriate Screen Control numbers, this button commands all projector trays in a bank to reverse simultaneously. Used in conjunction with a Screen Control number and LEFT, CENTER or RIGHT, it will reverse only the projector tray(s) selected.

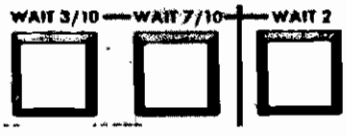
Shift Reverse
The command "SHIFT, REV" shifts the programmer back to 10 CPS. The new SHOW PRO V automatically shifts back to 10 CPS at POWER ON or following HOME or RESET.

AUXILIARY FUNCTION CONTROL

Auxiliary (AUX)
There are ten auxiliary channels on the SHOW PRO V. These momentary closures are identified on the rear panel as LEFT 1-2-3-4-5 and RIGHT 1-2-3-4-5. They accommodate connections from peripheral equipment such as additional slide projectors (forward only), movie projectors or room lighting. If AUX 1-2-3-4-5 is cued the left auxiliary channels will respond. With shows programmed on the AVL SHOW PRO III and played back on the SHOW PRO V, AUX 1-2-3 will play back as LEFT AUX 1-2-3.

HIGH SPEED TIMING CONTROLS

Start
With the PROGRAM TIMING switch in the STEP position, this cue may be entered alone or in conjunction with a screen action to program the start of any high speed run or sequence. With the PROGRAM TIMING switch in the PLAY position the computer will begin a high speed sequence when START is commanded, executing instructions at ten cues per second until WAIT or STOP is commanded.



Wait 1/10
Wait 1/2
Wait 1

These buttons establish waiting time between commands during a high speed run. They can be used simultaneously or consecutively in any combination to set waiting time between screen actions. When a WAIT is commanded the computer hesitates for the designated time, then continues performing at ten cues per second until WAIT or STOP is commanded.

When the SHIFT button is used with the WAIT commands it changes timing:
WAIT 1/10 becomes WAIT 3/10
WAIT 1/2 becomes WAIT 7/10
WAIT 1 becomes WAIT 2

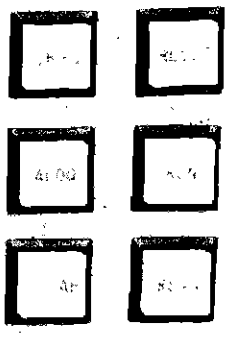
NOTE: When programmer is in the high speed mode a 1/20 SEC WAIT time can be achieved by programming a dummy cue, ie. any AUX channel not in use or a SHIFT FWD.

Stop
Dictates the end of a high speed sequence. STOP may be entered alone or in conjunction with the last screen action of the sequence.

PROGRAMMABLE HOME

Home
Brings memory and all projector trays to their starting points by the shortest route and leaves the sytem in standby. Similar to RESET except HOME becomes a part of the program and is stored in memory.

EDITING CONTROLS



Skip-A-Cue (Keyboard Normal)
Eliminates a cue at any point in the program memory and moves all subsequent cues forward.

Block Skip-A-Cue (Keyboard Fast Edit)
The programmer will continue removing cues as long as the SKIP-A-CUE button is held down. The programmer will automatically "close up" the memory as each cue is removed, hence the Cue counter will not advance. The operator can see each cue as it is being removed by observing the keyboard.

Add-A-Cue (Keyboard Normal)
Inserts new instructions at any point in the program by opening memory and moving all subsequent cues backward.

Block Add-A-Cue (Keyboard Fast Edit)
(A) SINGLE REPEAT – Imbed a START with the first cue in the sequence. Program the rest of the sequence. If the operator wants each sequence to generate exactly the same screen effect, the Screen Status LED's should be left identical to the Status at the START cue. (This may require one or more set up cues before START). Set the Keyboard switch to Fast Edit. Push Add-A-Cue. The entire sequence will be repeated one time. Each time Add-A-Cue is pushed, the sequence will be repeated one time because the START is imbedded with the first cue in the sequence and the programmer repeats from START. If desired, the starts may be removed easily later by single stepping through the sequences and using the Push-Push operation on the START switch each time it lights.

(B) DOUBLING REPEAT – When a sequence is to be repeated many, many times the second method of Block Add-A-Cue may be used. Repeat the above procedure **except** insert a START command immediately before the first Cue in the sequence. When Add-A-Cue is pressed, the sequence will be repeated without the START cue. The sequence is now in twice, with the START in front of only the first sequence. Press Add-A-Cue. Both sequences will be repeated, and the sequence will now be in 4 times. The next Add-A-Cue will double to 8, then 16, then 32, then 64, then 128, etc. Obviously, extremely large numbers of repeats can be programmed very rapidly. The operator may desire to put in extra sequences, time out as many as needed, then use Block Skip-A-Cue to remove the surplus.

Clear
(A) Clears the Keyboard.
(B) Clear also produces a signal for Level setting prior to recording program to magnetic tape. For more information see High Speed Dumping of Memory.

Reset
Takes computer memory and all projector trays back to start. Similar to HOME, except RESET may be used at any point in the program without affecting program memory. NOTE: If RESET and CLEAR are pushed simultaneously, memory is erased. To return trays to the start position, push RESET only and wait for trays to home, indicated by appearance of green ready lights. Then, to erase memory, push RESET and CLEAR simultaneously.

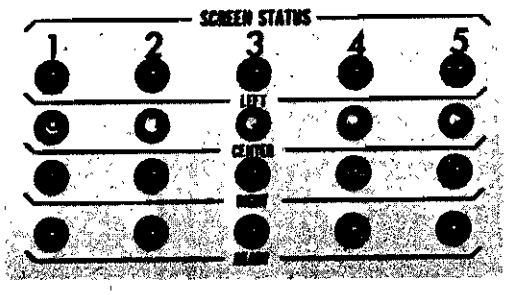
Run (Keyboard Normal)
Steps program forward to any selected point at a rate of ten cues per second. Tray positions will follow computer memory. Allow time for projectors to catch up, indicated by appearance of green ready lights. This button is also used for a high speed memory dump onto magnetic tape.

Run (Keyboard Fast Edit)
With the keyboard switch in Fast Edit the run function will latch on (the RUN switch will NOT remain lighted, however). The programmer will run forward at 20 CPS when the RUN button is pushed. The programmer will continue running forward until the RUN button is pushed a second time or until the end of the program is reached. This feature is convenient for rapidly advancing through large portions of memory, or in dumping memory to mag tape.

PROJECTOR AND LAMP STATUS LIGHTS

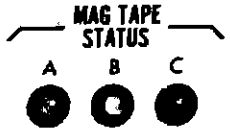
Reverse Cue (Keyboard Normal)
With the PROGRAM TIMING switch in the STEP position, this button reverses CUE COUNTER, trays and lamps one program step each time it is pushed. With the PROGRAM TIMING switch in PLAY position, the button will cause a high speed sequence to reverse to the start of the sequence.

Reverse Cue (Keyboard Fast Edit)
With the Keyboard switch in Fast Edit, the programmer will back up in 256 cue blocks each time the REV Q button is pushed, allowing extremely rapid reversing through memory.



Screen Status
Red lights indicate which of the left or right projectors are on. Yellow lights indicate which center projectors are on. Green lights are true "ready" lights that indicate the previous screen action is completed and additional commands can be given to the corresponding group of projectors.

MAGNETIC TAPE STATUS LIGHTS

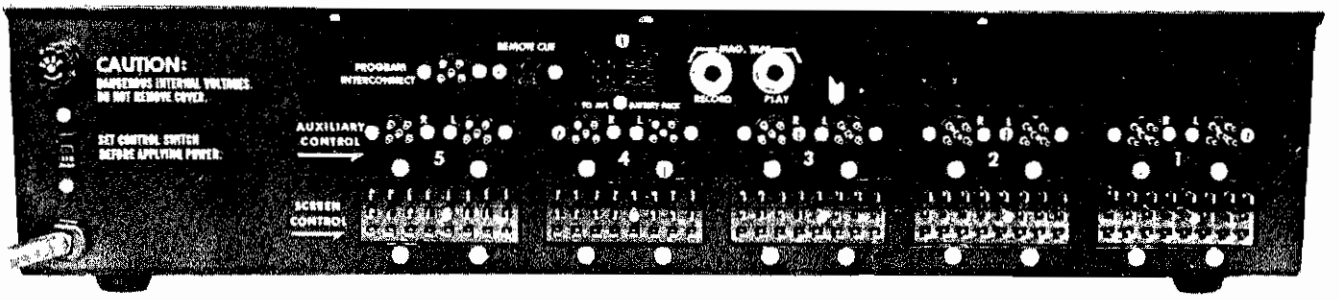


Mag Tape Status (Playback)
Indicate the condition of magnetic tape memory during playback. These status indicators provide a continuous grading of the quality of the magnetic tape.

A (green)	Acceptable
AB (green & yellow)	Acceptable
ABC (green, yellow & red)	Poor
C (red)	Unacceptable

DIGITAL CUE COUNTER

Digital Cue Counter
Records each cue as it is entered, beginning with 0001. At any point in the program the cue counter and control console preview the next cue to be executed. Each time the SHOW PRO V is turned on or its memory is cleared the memory section of the computer is automatically tested. If good, the cue counter will read 0001. If there is a problem, the cue counter will read b A d 1,2 or 3.



REAR PANEL

Screen Control 5 4 3 2 1
Jones plugs for each screen number (group of projectors). The plugs receive grey MARK VII Power Pack extension cables.

Left and Right Auxiliary Controls 5 4 3 2 1
Momentary closures that accept standard five-pin Kodak cables for peripheral equipment such as additional slide projectors or a 16 mm movie projector. 25 Volt AC/DC, 1 Amp max. Contact closure: Pin 2 to Pin 5.

Remote Cue Input
Receives Kodak remote hand control to remote CUE program each time FORWARD button (Pin 2 to Pin 5) is pushed, or REVERSE CUE each time REVERSE button (Pin 3 to Pin 5) is pushed.

Program Interconnect
Used to interconnect an additional SHOW PRO V or other AVL computer system. Remote cueing the first SHOW PRO V will simultaneously cue the other system.

Mag Tape Receptacles

To Record:
Connect phone plug from Record jack of SHOW PRO V to Line Level In on tape deck.

To Playback:
Connect phone plug from Play jack of SHOW PRO V to Line Level Out on tape deck.

Note:
Both Record and Playback may be connected simultaneously during programming.

International Voltage Change Switch
(Also appears on front of Power Packs)
Changes voltage from 115 to 230.
Important: Always set switches before applying power.

HOOKING UP YOUR SYSTEM

Preparing your SHOW PRO V System for operation requires relatively little time. Here's a step-by-step run-through for the standard five-screen format. To be sure you have everything properly connected, refer to the diagram in Figure 1, Page 12.

1. The SHOW PRO V System incorporates up to five MARK VII Power Packs, one for every three projectors. Each Power Pack has three black cords with seven-pin plugs. Insert left plug into rear of the left projector, the center plug into the rear of the center projector, and the right plug into the rear of the right projector. Then plug the projectors' AC cords into the AC outlet of the respective Power Packs. If you are running only two projectors per screen and have the SEQUENCE switch at the TWO position the center seven-pin plug can be left out.

2. Now take the grey extension cables from the Power Packs and plug them into the proper screen control outlets on the rear panel of the SHOW PRO V.

3. There's a voltage control switch near the On/Off switch of each Power Pack. Check to be sure it's set for either 115 or 230 according to the voltage being used. (230 is common in Europe).

4. Plug MARK VII Power Pack AC cords into power outlet.

5. Now check the voltage control switch on the rear panel of the SHOW PRO V to be sure it, too, is in the proper position.

6. Plug the SHOW PRO V's AC cord into a power outlet.

7. Now turn the Power switch to the right or ON position. Lights will flash momentarily on the keyboard and then clear. The Digital Cue Counter will indicate 0001. The Screen Status red and yellow lights will be off, green ready lights will be on.

8. With your projectors in the fan position move the Power Pack On/Off switches to the ON position.

9. That's it. Your SHOW PRO V System is hooked up and ready to use.

SCREEN FORMATS

Because of the SHOW PRO V's flexibility and independent projector control, you have a wide choice of screen formats for your shows. The programmer controls up to 15 projectors on dissolve, and ten auxiliary projectors can be added. To simplify, we present layouts for two of the most popular formats.

The standard format consists of two or three projectors focused on each of five or less screens. **(Figure 1, Page 12.)**

The second is an overlapping screen format using masked slides. **(Figure 2, Page 13.)**

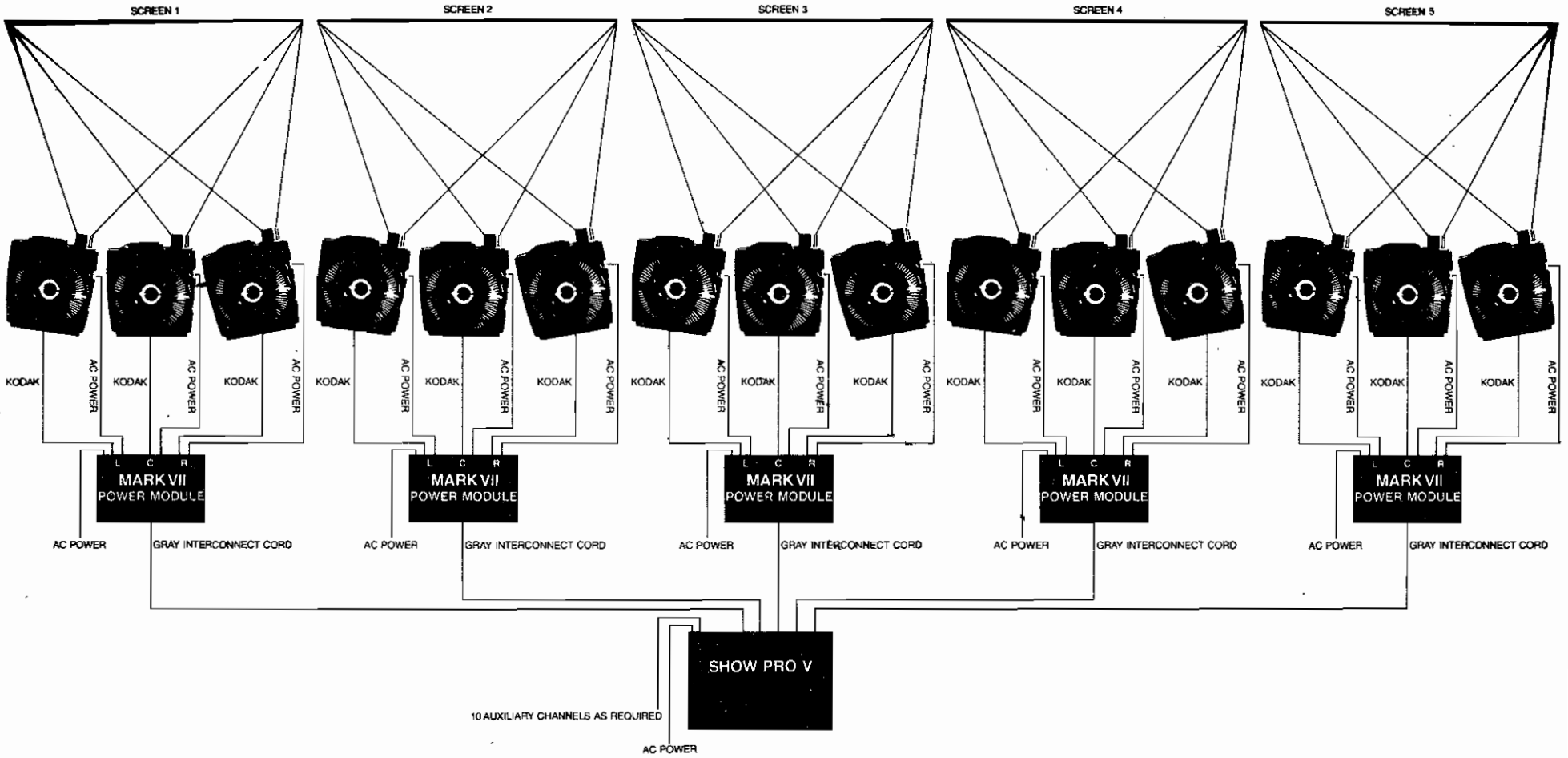

SCREEN 1
SCREEN 2
SCREEN 3
SCREEN 4
SCREEN 5
KODAK
AC POWER
L C R
MARK VII
POWER MODULE
AC POWER
GRAY INTERCONNECT CORD
SHOW PRO V
10 AUXILIARY CHANNELS AS REQUIRED
AC POWER

Figure 1

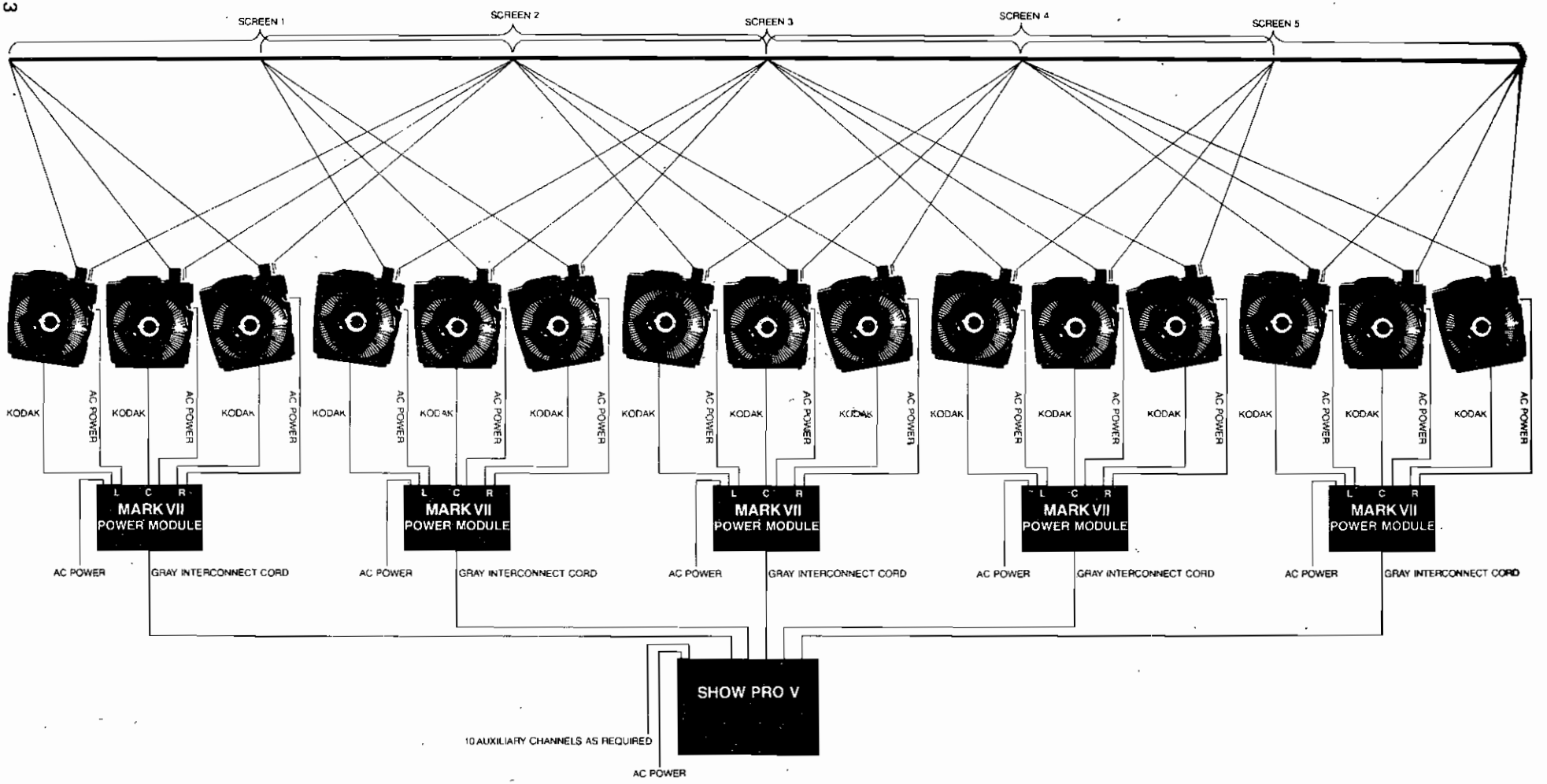

SCREEN 1
SCREEN 2
SCREEN 3
SCREEN 4
SCREEN 5
KODAK
AC POWER
L C R
MARK VII
POWER MODULE
AC POWER
GRAY INTERCONNECT CORD
SHOW PRO V
10 AUXILIARY CHANNELS AS REQUIRED
AC POWER

Figure 2

BEFORE YOU PROGRAM . . .

In the preparation of Tiger Stew, the most difficult step is the first one: "Catch a tiger."

Before you can take advantage of the electronic wizardry built into your SHOW PRO V, your first step is preparation of a show . . . script and slides. In short, your creativity comes into play before ours goes to work for you.

Normally, the script comes first. When it says what you want it to, preparation of a storyboard is your next step. This is a series of rough drawings arranged in comic strip sequence that suggests the visuals you'll employ to illustrate the script. And it serves as a guide to collating your slides.

When you have the slides you'll need, prepare a sound track. Determine what screen effects you want to use and note them on a "Cue" or "Dope" sheet. Once your slides have been collated and trayed, the cue sheet will be your programming guide.

A practical tip for best performance: We recommend using glass-mounted slides and the grey, 80-slide universal trays.

Done? Good. Now you're ready to sit down and begin programming. And to explore the amazing capacities of the SHOW PRO V.

PROGRAMMING WITH YOUR SHOW PRO V

Note: These directions are based on the standard screen format employing three projectors on each of five screens as illustrated in Figure 1, Page 12.

1. Place slide trays on projectors, align and focus.

2. Now set trays in the exact positions you want as the "home" or starting positions. Your first slides should be in the left projectors' gates, your second slides in the center projectors' gates and your third slides in the right projectors' gates on each screen. (A unique feature of the SHOW PRO V is the fact that once you've established home for your program the computer will always keep track of tray positions and lamp status).

3. All keyboard toggle switches should be to the right except the PROGRAM TIMING switch, which should be at the left or STEP position. If you are programming a show with only two projectors per screen your SEQUENCE switch should also be in the left (TWO) position.

4. Follow directions for Hooking up Your System, Page 10.

5. You're ready to program.

"A GET ACQUAINTED" PROGRAM

Perhaps the best way to become familiar with programming techniques on your SHOW PRO V is to run through a simple, normal speed program using all the dissolve speeds. A normal speed program will not call for the use of the START, WAIT or STOP buttons. Here is how you proceed, step by step. (Note: If your System doesn't have five MARK VII Power Packs you should still include the commands given to the additional screens):

STEP	ACTION		PROJECTOR STATUS	LIGHTS	CUE COUNTER READS
1	Push	8SEC 1 2 3 4 5 CUE	All left projectors dissolve on in eight seconds	Red status lights show left projectors on; green ready lights come back on, indicating the System is ready for your next command	0002
2	Push	4SEC 1 2 3 4 5 CUE	Left projectors dissolve off as center projectors dissolve on in four seconds.	Yellow status lights show center projectors on. After the left or downgoing projectors advance, green ready lights come on	0003
3	Push	2SEC 1 2 3 4 5 CUE	Center projectors dissolve off as right projectors dissolve on in two seconds.	Red status lights show right projectors on. After center or down-going projectors advance, green ready lights come on	0004
4	Push	CUT 1 2 3 4 5 CUE	Right projectors cut off as left projectors cut on	Red status lights show left projectors on. After downgoing projectors advance, green ready lights come on	0005
5	Push	ALT 1 2 3 4 5 CUE	Left projectors cut off as center projectors cut on	Yellow status lights show center projectors on. Note that no trays advance on ALT and ready lights remain on since there is no projector advance	0006
6	Push	4SEC ALT 1 2 3 4 5 CUE	Center projectors dissolve off as right projectors dissolve on	Red status lights show right projectors on. Any dissolve may be pushed with ALT to get a dissolve ALT, **and** note that no tray advances on dissolve ALT, and green ready lights come on after the dissolve. In a dissolve ALT the down-going projectors do not advance	0007

These were all normal dissolves, cuts, alternates and dissolve alternates. Now we'll use the SHIFT button to change dissolve speeds. Using the SHIFT button with dissolve speeds creates these changes:

SHIFT 8SEC = 32 seconds
SHIFT 4SEC = 16 seconds
SHIFT 2SEC = 1 second
SHIFT CUT = Hard Cut

STEP	ACTION		PROJECTOR STATUS	LIGHTS	CUE COUNTER READS
7	Push	SHIFT 8SEC 1 2 3 4 5 CUE	Right projectors dissolve off as left projectors dissolve on in 32 seconds	Red status lights show left projectors on. After advance of the downgoing projectors, green ready lights come on	0008
8	Push	SHIFT 4SEC 1 2 3 4 5 CUE	Left projectors dissolve off as center projectors dissolve on in 16 seconds	Yellow status lights show center projectors on. After downgoing projectors advance, green ready lights come on	0009
9	Push	SHIFT 2SEC 1 2 3 4 5 CUE	Center projectors dissolve off as right projectors dissolve on in one second	Red status lights show right projectors on. After downgoing projectors advance, green ready lights come on. Note the very fast but smooth effect, unlike a cut that is fast but "harder"	0010
10	Push	SHIFT CUT 1 2 3 4 5 CUE	Right projectors cut off as left projectors cut on	Red status lights show left projectors on. After downgoing projectors advance, green ready lights come on. Note that this cut has a "harder" look than the normal cut, and that the ready lights come on sooner than the normal cut.	0011
11	Push	SHIFT 2SEC ALT 1 2 3 4 5 CUE	Left projectors dissolve off as center projectors dissolve on in one second	Yellow status lights show center projectors on. Because we used ALT there was no projector advance and after the dissolve the green ready lights come on	0012

As you went from Step 1 to Step 11, you started with all lamps off. With the first command (8SEC, 1, 2, 3, 4, 5, CUE), the left projectors came on. Your next two commands moved you to the center, then the right projectors in turn. All subsequent commands continued this left-center-right sequence. The SHOW PRO V will automatically operate in this left-center-right sequence unless you command it to do otherwise by using your LEFT-CENTER-RIGHT buttons.

Want to see what you've programmed so far? Here's how: Push RESET. Wait for the projectors to home, indicated by the green ready lights. Now repeat your program simply by pushing the CUE button one step at a time. When the downgoing projectors are off you can continue without waiting for the ready lights to tell you the next projectors are ready . . . you are using three projectors per screen and the extra projectors have already advanced.

When your Cue Counter reaches 0011 the center projectors will be on and you're ready to proceed with further programming.

STEP	ACTION		PROJECTOR STATUS	LIGHTS	CUE COUNTER READS
12	Push	RIGHT 2SEC 1 2 3 4 5 CUE	Right projectors dissolve on while the center projectors remain on	Yellow and red status lights show center and right projectors on. After the dissolve, green ready lights come on	0013
13	Push	LEFT RIGHT 2SEC 1 2 3 4 5 CUE	Right projectors dissolve off as left projectors dissolve on. Center projectors remain on since we have not called on them	Red and yellow status lights show left and center projectors on. After downgoing projectors advance, green ready lights come on	0014
14	Push	LEFT CENTER 4SEC 1 2 3 4 5 CUE	Left and center projectors dissolve off	Red and yellow status lights show all projector lamps off. Green status lights come on after advance of downgoing projectors	

The LEFT, CENTER and RIGHT buttons can be used singly, together or in any combination in conjunction with any of the dissolve speed buttons to command any projector or group of projectors on or off at any rate selected.

The LEFT, CENTER and RIGHT buttons can also be used in any combination with screen numbers in order to pre-set, if necessary, the next screen action. As an example, if you end up with the left projector on Screen 1, the center projector on Screen 2 and the right projector on Screen 3, you could make them dissolve off together by programming LEFT, 1, CUE; CENTER, 2, CUE; RIGHT, 3, CUE; 2SEC, 1, 2, 3, CUE.

The LEFT, CENTER and RIGHT buttons can also be used with FWD and REV to cause any projector or group of projectors to move trays forward or backward. LEFT and RIGHT buttons are also used in conjunction with the ten auxiliary channels.

VALID COMBINATIONS

CUT	With any combination of 1 2 3 4 5
2SEC	With any combination of 1 2 3 4 5
4SEC	With any combination of 1 2 3 4 5
8SEC	With any combination of 1 2 3 4 5
ALT	With any combination of 1 2 3 4 5
2SEC 4SEC	With any combination of 1 2 3 4 5
4SEC 8SEC	With any combination of 1 2 3 4 5
ALT 2SEC	With any combination of 1 2 3 4 5
ALT 4SEC	With any combination of 1 2 3 4 5
ALT 8SEC	With any combination of 1 2 3 4 5
ALT 2SEC 4SEC	With any combination of 1 2 3 4 5
ALT 4SEC 8SEC	With any combination of 1 2 3 4 5
SHIFT CUT	With any combination of 1 2 3 4 5
SHIFT 2SEC	With any combination of 1 2 3 4 5
SHIFT 4SEC	With any combination of 1 2 3 4 5
SHIFT 8SEC	With any combination of 1 2 3 4 5
SHIFT ALT	With any combination of 1 2 3 4 5
SHIFT ALT 2SEC	With any combination of 1 2 3 4 5
SHIFT ALT 4SEC	With any combination of 1 2 3 4 5
SHIFT ALT 8SEC	With any combination of 1 2 3 4 5
SHIFT (No Dissolve)	With any combination of 1 2 3 4 5
ANY DISSOLVE	With any combination of 1 2 3 4 5
LEFT	With any of the above commands plus Screen Number(s)
CENTER	With any of the above commands plus Screen Number(s)
RIGHT	With any of the above commands plus Screen Number(s)
LEFT	With any Screen Number
CENTER	With any Screen Number
RIGHT	With any Screen Number
FORWARD	1 2 3 4 5
FORWARD	With any combination of L C R and 1 2 3 4 5
REVERSE	1 2 3 4 5
REVERSE	With any combination of L C R and 1 2 3 4 5
SHIFT FORWARD	No screen numbers
SHIFT REVERSE	No screen numbers
LEFT AUX	With any combination of 1 2 3 4 5
RIGHT AUX	With any combination of 1 2 3 4 5
START	With any combination of above commands Except Dissolve Freeze and Dissolve Release
STOP	With any combination of above commands Except Dissolve Freeze and Dissolve Release
START	alone
STOP	alone

Only valid combinations can be cued on the SHOW PRO V. If an invalid combination is entered, the last button pushed will clear the invalid portion of the command. If a valid combination is incomplete, the SHOW PRO V will reject the cue or clear the keyboard.

START and STOP can be programmed together with any black-lettered button or as separate commands

The HOME button must be programmed alone.

The Timing buttons (WAIT 1/10, WAIT 1/2, WAIT 1) may be cued alone or in any combination. Use of the SHIFT button changes timing as follows:

SHIFT WAIT 1/10 = WAIT 3/10
SHIFT WAIT 1/2 = WAIT 7/10
SHIFT WAIT 1 = WAIT 2

These may also be cued in any combination. All WAIT buttons are used exclusively during high speed programming as explained in the next section.

HIGH SPEED PROGRAMMING

Now let's look at high speed programming and your SHOW PRO V's capacity to produce sophisticated screen effects. In normal speed programming, each cue is a single step, and you provide synchronization through use of the CUE botton. High speed is also programmed a step at a time. The big difference between the two programming modes is the fact that in high speed the SHOW PRO V will automatically activate cues at speeds up to ten or twenty per second!

A high speed sequence is begun by pushing the START button, concluded by pushing the STOP button. Timing within the sequence is dictated by your use of the WAIT buttons. When the START cue tells the SHOW PRO V a high speed sequence is about to be entered, the programmer is prepared to accept ten cues per second. But you still determine the intervals between screen actions by means of the WAIT cues you enter.

When the SHOW PRO V is playing back a high speed section or synchronizing a high speed portion, the CUE button is pushed at the beginning and the programmer automatically performs the timing until it reads a stop.

In regard to timing, it's important to note that when commands are given to a specific screen (group of projectors), timing must be added to allow for the transition time of the dissolve plus time for the down-going projector to advance before returning to that projector (projector advance time = 1 second). The SEQUENCE switch in the THREE position allows you to go faster than the TWO position because, as you go from left to center projector the right projector is advanced and waiting. With all projectors ready any two moves may be made 1/10 second apart, but you must wait the prescribed time for repetitive commands. Waiting times to be added between cues for smooth visual-to-visual transitions on a screen are as follows:

A new HARD CUT	add	1/2 second
CUT	add	7/10 second
1SEC	add	1 second
2SEC	add	1-1/2 seconds
4SEC	add	3-1/2 seconds
8SEC	add	7-1/2 seconds
16SEC	add	15-1/2 seconds
32SEC	add	31-1/2 seconds

After ALT there's no need to make allowance for a time interval. Alternates can be cued as rapidly as ten times a second because they don't involve the advance of the downgoing projector.

With the SEQUENCE switch in the TWO position, the proper waiting time to be added between cues on a screen is:

HARD CUT	add	7/10 second
CUT	add	1-6/10 seconds
1SEC	add	2 seconds
2SEC	add	3 seconds
4SEC	add	5 seconds
8SEC	add	9 seconds
16SEC	add	17 seconds
32SEC	add	33 seconds
ALT	add	0

Ready to try your hand at high speed? Here's a program prepared to familiarize you with some SHOW PRO V features.

A "GET ACQUAINTED" HIGH SPEED PROGRAM

We'll begin with basic set-up, just as we did in normal speed programming.

- Place your slide trays on projectors, align and focus
- Set all trays in home or starting position . . : first slides in left gates, second slides in center gates, third slides in right gates
- All keyboard toggle switches to right except PROGRAM TIMING, which should be in the left or STEP position, and MAG TAPE, which should be in the PROGRAM position.

OK, you're ready to program.

1. Push START, 8SEC, 1, 2, 3, 4, 5, CUE
2. Push SHIFT, WAIT 2, WAIT 7/10, WAIT 3/10, CUE
3. Push SHIFT, WAIT 2, WAIT 7/10, WAIT 3/10, CUE
4. Push WAIT 1, WAIT 1/2, CUE
5. Push 4SEC, 1, 2, 3, 4, 5, CUE
6. Push SHIFT, WAIT 2, WAIT 7/10, WAIT 3/10, CUE
7. Push WAIT 1/2, CUE
8. Push 2SEC, 1, 2, 3, 4, 5, CUE
9. Push WAIT 1, WAIT 1/2, CUE
10. Push SHIFT, 1SEC, 1, 2, 3, 4, 5, CUE
11. Push WAIT 1, CUE
12. Push CUT, 1, 2, 3, 4, 5, CUE
13. Push SHIFT, 7/10, CUE
14. Push SHIFT, CUT, 1, 2, 3, 4, 5, STOP, CUE

Cue Counter Reads 0015

This is a good point at which to check results. Here's how to review:

- Move the PROGRAM TIMING switch to PLAY position
- Push REVQ. Notice all projectors are going back to the starting position. With the Program Timing switch in PLAY, REVQ reverses program memory and all projectors to the last START cue. Green ready lights tell you when projector trays have reached the starting point.
- Push CUE

Result: Left projectors dissolve on in eight seconds, then dissolve off with center projectors coming on in a four-second dissolve. After three and a half seconds the center projectors dissolve off with right projectors coming on in a two-second dissolve. A second and a half later, the right projectors dissolve off with left projectors coming on in a one-second dissolve. One second after the start of the one-second dissolve the left projectors cut off, the center projectors cut on. Seven-tenths of a second after the cut to the center projectors they hard cut off as the right projectors hard cut on and the programmer stops.

We've programmed several dissolves and cuts with intervals that allow smooth transitions. More time can be added to slow the program down by putting additional timing codes between actions, or timing may be added in some areas and deleted in others as long as timing is allowed for the downgoing projectors to advance before their respective lamps are turned on. Now that you've programmed to this point, let's continue. The next commands will create several screen wipes. To keep it simple, we'll work with just the first three screens.

Put PROGRAM TIMING switch to STEP.

1. Push START, 4 SEC, 1, CUE
2. Push SHIFT, WAIT, 2, CUE
3. Push 4SEC, 2, CUE
4. Push SHIFT, WAIT, 2, CUE
5. Push 4SEC, 3, CUE
6. Push SHIFT, WAIT, 2, CUE
7. Push 2SEC, 1, CUE
8. Push WAIT 1/2, CUE
9. Push 2SEC, 2, CUE
10. Push WAIT 1/2, CUE
11. Push 2SEC, 3, CUE
12. Push WAIT 1, CUE
13. Push SHIFT, 1SEC, 1, CUE
14. Push SHIFT, WAIT 3/10, CUE

15. Push SHIFT, 1SEC, 2, CUE
16. Push SHIFT, WAIT 3/10, CUE
17. Push SHIFT, 1SEC, 3, CUE
18. Push SHIFT, WAIT 7/10, CUE
19. Push CUT, 1, CUE
20. Push CUT, 2, CUE
21. Push CUT, 3, STOP, CUE

Cue Counter Reads 0036

Review time again:

- PROGRAM TIMING switch to PLAY
- Push REVQ, wait for green ready lights
- Push CUE

Result: Screen 1 dissolves from right to left projector in a four-second dissolve. Two seconds later, Screen 2 dissolves from right to left projector in a four-second dissolve. Two seconds later Screen 3 dissolves from right to left projector in a four-second dissolve. In another two seconds Screen 1 starts a two-second dissolve from left to center projector. A half second later, Screen 3 starts a two-second dissolve from left to center projector. A one-second interval and Screen 1 starts a one-second dissolve from center to right projector. In another 3/10 of a second Screen 2 starts a one-second dissolve from center to right projector. Another 3/10 second and Screen 3 starts a one-second dissolve from center to right projector. A final 7/10 second interval sees Screen 1 cut to the left projector, followed by Screens 2 and 3. Then the programmer stops.

Now that you've reviewed screen wipes, let's try some alternates on three screens.

Put PROGRAM TIMING switch to STEP.

1. Push START, ALT, 1, 2, 3, CUE
2. Push WAIT 1/2, CUE
3. Push ALT, 1, 2, 3, CUE
4. Push WAIT 1/2, CUE
5. Push ALT, 1, 2, 3, CUE
6. Push WAIT 1/2, CUE
7. Push ALT, 1, 2, 3, CUE
8. Push WAIT 1/2, CUE
9. Push ALT, 1, 2, 3, CUE
10. Push WAIT 1/2, CUE
11. Push ALT, 1, 2, 3, CUE
12. Push SHIFT, WAIT 3/10, CUE
13. Push ALT, 1, 2, 3, CUE
14. Push SHIFT, WAIT 3/10, CUE
15. Push ALT, 1, 2, 3, CUE
16. Push SHIFT, WAIT 3/10, CUE
17. Push ALT, 1, 2, 3, CUE
18. Push SHIFT, WAIT 3/10, CUE
19. Push ALT, 1, 2, 3, CUE
20. Push SHIFT, WAIT 3/10, CUE
21. Push ALT, 1, 2, 3, CUE
22. Push SHIFT, WAIT 3/10, CUE
23. Push ALT, 1, 2, 3, CUE
24. Push WAIT 1/10, CUE
25. Push ALT, 1, 2, 3, CUE
26. Push Wait 1/10, CUE
27. Push ALT, 1, 2, 3, CUE
28. Push WAIT 1/10, CUE
29. Push ALT, 1, 2, 3, CUE
30. Push WAIT 1/10, CUE
31. Push ALT, 1, 2, 3, CUE
32. Push WAIT 1/10, CUE
33. Push ALT, 1, 2, 3, CUE
34. Push WAIT 1/10, CUE
35. Push ALT, 1, 2, 3, CUE
36. Push ALT, 1, 2, 3, CUE
37. Push ALT, 1, 2, 3, CUE
38. Push ALT, 1, 2, 3, CUE
39. Push ALT, 1, 2, 3, CUE
40. Push Cut 1, 2, 3, CUE
41. Push CUT, 1, 2, 3, STOP, CUE

Cue Counter Reads 0077

OK, let's review that section

- Put PROGRAM TIMING switch to PLAY

Push REVQ, wait for green ready lights
Push CUE
Result: Screens 1, 2, and 3 begin alternating every half second. After six half-second alternates, the pattern repeats with only 3/10 second between each, then repeats again with 1/10-second intervals. This is followed by five alternates at the rate of ten per second. The sequence ends with cuts and advancement of the center and right projectors and the programmer stops.

Now let's use a mix of dissolves, independent projectors, cuts and dissolve alternates.

Put PROGRAM TIMING switch to STEP.

1. Push START, 2SEC, 1, 2, 3, CUE
2. Push SHIFT, WAIT 2SEC, CUE
3. Push SHIFT, WAIT 2SEC, CUE
4. Push 2SEC, RIGHT, 1, 2, 3, CUE
5. Push SHIFT, WAIT 2SEC, CUE
6. Push SHIFT, WAIT 2SEC, CUE
7. Push SHIFT, 1SEC, ALT, LEFT, RIGHT, 1, 2, 3, CUE
8. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
9. Push SHIFT, 1SEC, ALT, LEFT, RIGHT, 1, 2, 3, CUE
10. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
11. Push SHIFT, 1SEC, ALT, LEFT, RIGHT, 1, 2, 3, CUE
12. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
13. Push SHIFT, 1SEC, ALT, LEFT, RIGHT, 1, 2, 3, CUE
14. Push SHIFT, WAIT, 2SEC, 7/10, 3/10, CUE
15. Push SHIFT, 1SEC, LEFT, RIGHT, 1, 2, 3, CUE
16. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
17. Push 4SEC, LEFT, CENTER, RIGHT, 1, 2, 3, CUE
18. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
19. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
20. Push SHIFT, CUT, 1, 2, 3, CUE
21. Push SHIFT, CUT, 1, 2, 3, CUE
22. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
23. Push SHIFT, WAIT 2SEC, CUE
24. Push 4SEC, LEFT, 1, 2, 3, CUE
25. Push SHIFT, WAIT 2SEC, CUE
26. Push 2SEC, RIGHT, 1, 2, 3, CUE
27. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
28. Push SHIFT, WAIT 2SEC, CUE
29. Push SHIFT, 16SEC, LEFT, 1, 2, 3, CUE
30. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
31. Push SHIFT, WAIT 2SEC, CUE
32. Push 8SEC, CENTER, 1, 2, 3, CUE
33. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
34. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
35. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
36. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
37. Push SHIFT, WAIT 2SEC, 7/10, 3/10, CUE
38. Push SHIFT, 32SEC, RIGHT, 1, 2, 3, STOP

Cue Counter Reads 0115

Let's review this section. We started with a two-second dissolve of screens 1, 2 and 3 to the center screens. After a four-second wait we dissolved up the right projectors in a superimposition. Another four-second wait was followed by a one-second alternate between left and right projectors while holding center projectors, with three-second intervals between actions. The one-second alternates were repeated twice, followed by a one-second dissolve off of left projectors, a one-second dissolve on of the right. We added three seconds timing, then did a one-second dissolve off of right projectors and dissolve on of the left, adding another three-second time span. Next we performed a four-second dissolve off of left and center projectors while we dissolved on the right projectors, adding six seconds of timing. Then two consecutive hard cuts were followed by five seconds timing. Now, after a four-second dissolve up of the left projectors and a two-second dissolve up of the right, all nine projectors were on. We waited five seconds before a 16-second dissolve off of the left projectors, then another five seconds before an eight-second dissolve off of the center projectors, and 15 seconds later we did a 32-second dissolve off of the right projectors and stopped the program.

Now let's review from the start:

- Push RESET
- Wait for projectors to home, indicated by green ready lights
- Put PROGRAM TIMING switch to PLAY
- Push CUE, and continue doing so each time the programmer stops

There. You've programmed . . . and seen . . . a very small sample of the effects possible with your SHOW PRO V. Remember you have total control of each projector. And don't be afraid to experiment. Because nothing you do is necessarily final. Any effect entered can be erased or modified by editing, the subject of our next section.

PROGRAM EDITING

The editing controls of the SHOW PRO V are the red-lettered buttons at the far right of the keyboard. The specific function of each button is explained in the Editing Controls section of the manual, page 6.

Editing is the process of making revisions, additions or deletions in a program sequence that's been entered into memory. To reach the point you wish to edit you simply place the PROGRAM TIMING switch in the STEP position, then

Move forward one cue each time you press the CUE button - or -

Move forward rapidly by pushing the RUN button, which advances cues at a rate of ten per second

To reverse a cue at a time, push the REVERSE CUE button

Using the cue-at-a-time procedure, you'll notice that the keyboard previews your next screen action or timing code. And if the DISSOLVE SWITCH is in NORMAL, the slide projectors will also move forward or backward with the program memory.

After using the RUN button, be sure to allow time for the projectors to catch up with memory, indicated by the green lights.

The best way to understand editing is by entering a brief program into memory, then making changes.

1. All keyboard switches to the right except PROGRAM TIMING switch to STEP and MAG TAPE switch to PROGRAM. Put all trays to starting points and clear MEMORY. To make our editing job easier to follow, we'll use Screens 1, 2 and 3 only.
2. Push 8 Sec, 1, 2, 3, CUE
3. Push 4 SEC, 1, 2, 3, CUE
4. Push 2SEC, 1, 2, 3, CUE
5. Push CUT, 1, 2, 3, CUE
6. Push 4SEC, 1, 2, 3, CUE
7. Push 2SEC, 1, 2, 3, CUE
8. Push CUT, 1, 2, 3, CUE

CUE COUNTER Reads: 008

9. Push RESET
   Note that memory and all projectors return to the starting position. The keyboard is previewing your first cue (8 SEC, 1, 2, 3).
10. Push CUE

Result: The left projectors dissolve on in eight seconds and the keyboard previews the next screen action (4 SEC, 1, 2, 3).

Now let's change the 4 SEC, 1, 2, 3 to a CUT, 1, 2, 3.

Push CUT. Notice that 4 SEC cleared and the keyboard now reads CUT, 1, 2, 3.

Push CUE. Result: You've changed the 4 SEC, 1, 2, 3 to a CUT, 1, 2, 3.

Want to change only the speed of a dissolve? Pushing the new dissolve speed clears the old. These changes are typical of basic editing, requiring none of the red editing buttons.

Now that you've changed the 4 SEC, 1, 2, 3 to CUT, 1, 2, 3, you're previewing cue 003, a 2 SEC, 1, 2, 3. Change it to a 2 SEC, 2 only by doing the following:

Push CLEAR

Push 2 SEC, 2 CUE

Result: When you pushed CLEAR you cleared the keyboard, allowing you to change cue 3 to a two-second dissolve on Screen 2. Use CLEAR when you wish to change the Screen Numbers, or to change Left, Center or Right, since they do not automatically cancel each other out.

Alternate Method

Using Push-Push feature. To clear any lighted switch, simply Push it. It clears automatically.

You've now previewing cue 004 (CUT, 1, 2, 3). At this point you want to "Add a cue" before doing CUT, 1, 2, 3 . . . says a four-second dissolve on Screens 1 and 3

Push CLEAR

Push 4 SEC, 1, 3

Push ADDQ

Result: Cue 004 has now become 4 SEC, 1 and 3, and this cue has been inserted between cue 003 (2 SEC, 2) and what used to be cue 004 (CUT, 1, 2, 3). The cue you added (4 SEC, 1 and 3)) has become cue 004 and CUT, 1, 2, 3 . . . now previewing . . . has become cue 005.

Let's continue by keeping cue 005 (CUT, 1, 2, 3).

Push CUE

Result: CUT, 1, 2, 3 stays in your program. You are now previewing cue 006 (4 SEC, 1, 2, 3).

Now eliminate cue 006 from your program. Here's how:

Push SKIPQ

Result: The keyboard is now previewing cue 006 (2 SEC, 1, 2, 3). You have taken the old cue 006 out of your program and moved all other cues forward one slot, converting 2 SEC, 1, 2, 3 into cue 006.

Keep the new cue 006 by doing the following:

Push CUE

Result: 2SEC, 1, 2, 3 stays in your program and you are previewing cue 007 (CUT, 1, 2, 3), the last cue in your program. Notice all the center projectors are on. To end the program, change cue 007 (CUT, 1, 2, 3) to a dissolve, and fade the projectors off in a four-second dissolve.

At this point stop and look at your keyboard. Try to figure out how to do it. Have you got it? If not, ask yourself this question: What do I want to happen? Answer: I want the center to go off in a four-second dissolve on all screens. And you do it this way.

Push 4SEC
Push CENTER
Push CUE

Result: The center projectors fade off in a four-second dissolve. When you pushed the 4SEC button it cleared the CUT button. Then because you

did not want them to dissolve to the right projectors, you pushed CENTER, thereby telling the center projectors only to dissolve off.

Now let's look at your edited show.

Push RESET

Result: Memory and all projectors go to the starting point. Now . . . waiting for the green ready lights each time . . . push the Cue button when you want to see the next screen action.

Ready for more editing? Push RESET again and wait for your projectors to home. Then push RESET and CLEAR together. This clears the programmer's memory so you can start a new program.

One of the most significant advantages of your SHOW PRO V System is its capability to edit while keeping track of memory and projector status. It means changes can be made while you're programming. And instant replay of a high speed sequence can tell you if an effect you programmed is what you really want. If not, it can be changed immediately. Each section of a show can be programmed, reviewed and edited before you continue. And it's all done without ever touching a slide projector.

OK. Here's our new program.

1. All switches to the right except PROGRAM TIMING switch to STEP and MAG TAPE switch to OFF.
2. Push 4SEC, 1, 2, 3, CUE
3. Push START, 2SEC, 1, CUE
4. Push WAIT 1/2, CUE
5. Push 2SEC, 2, CUE
6. Push WAIT 1/2, CUE
7. Push 2SEC, 3, STOP, CUE

Cue Counter Reads 0007

Result: You have programmed a dissolve up of the left projectors followed by a two-second dissolve wipe on three screens. Since you've programmed this wipe effect one step at a time, you're not sure if it's the exact effect you wanted. Check by doing this.

Put PROGRAM TIMING switch to PLAY
Push REVQ

Result: Program memory and projectors go back to start, cue 0002.

Push CUE and watch the screen effect.

Now that you've seen it, let's say you don't like it. You decide to substitute a four-second dissolve wipe with longer intervals between screen changes. Here's the way to do it.

1. Push REVQ
2. Put PROGRAM TIMING switch to STEP
3. Push 4SEC (Changing the 2SEC to a 4SEC)
4. Push CUE (Entering the 4SEC into memory)
5. Push WAIT 1 (Making the waiting time 1 - 1/2 seconds)
6. Push CUE (Entering your new timing)
7. Repeat steps 3 and 4
8. Repeat steps 5 and 6
9. Repeat steps 3 and 4 (Keeping the STOP cue)

Result: You've changed the two-second dissolves to four-second dissolves and the waiting time between dissolves to one and a half seconds.

Now review the change.

Put PROGRAM TIMING switch to PLAY
Push REVQ

Result: Again memory and projectors go back to the start cue

Push CUE and watch the screen effect

Let's say now your effect is fine. (If you wanted to try others you could continue editing). Here's additional input for your program.

1. Put PROGRAM TIMING switch to STEP
2. Push START, ALT, 1, 2, 3, CUE
3. Push SHIFT, WAIT 3/10, CUE
4. Push ALT, 1, 2, 3, CUE
5. Push SHIFT, WAIT 3/10, CUE

6. Repeat steps 4 and 5, in order, ten times
7. Push ALT, 1, 2, 3, STOP, CUE
   Cue Counter Reads 0032

Result: Starting with the center projectors you've alternated center-right-left, with 3/10-second waits between alternates, ending on the right projectors. To review, do this:

Put PROGRAM TIMING switch to PLAY
Push REVQ
Push CUE

After reviewing, you want to increase the delay between alternates by 1/10 of a second. Edit this in this way.

1. Push REVQ
2. Put PROGRAM TIMING switch to STEP
3. Push CUE (Keeping the START, ALT 1, 2, 3)
4. Push CUE (Keeping the 3/10 WAIT). Note your keyboard is previewing your next move, ALT, 1, 2, 3. But you want to increase your delay another 1/10 second. Do this.
5. Push WAIT 1/10 (This clears the ALT, 1, 2, 3 and your keyboard now reads WAIT 1/10)
6. Push ADDQ. Note that this added another 1/10 second to the wait and your keyboard again reads ALT, 1, 2, 3
7. Push CUE (Entering ALT, 1, 2, 3 into memory)
8. Push CUE (Entering your 3/10 wait into memory)
9. Push WAIT 1/10, ADDQ (Clearing the ALT, 1, 2, 3 and entering an additional 1/10 wait)

Continue stepping through your program and after entering each WAIT 3/10, push WAIT 1/10, ADDQ until you come to the end. Note your cue counter now reads 0043. You have added 11 WAIT 1/10 cues.

To review.

Put PROGRAM TIMING switch to PLAY
Push REVQ
Push CUE

OK, let's do a bit more programming.

1. Put PROGRAM TIMING switch to STEP
2. Push START, CUT, 1, 2, 3, CUE
3. Push SHIFT, WAIT 7/10, CUE
4. Push WAIT 1/10, CUE
5. Push CUT, 1, 2, 3, CUE
6. Push SHIFT, WAIT 7/10, CUE
7. Push WAIT 1/10, CUE
8. Push CUT, 1, 2, 3, CUE
9. Push SHIFT, WAIT 7/10, CUE
10. Push WAIT 1/10, CUE
11. Push CUT, 1, 2, 3, CUE
12. Push SHIFT, WAIT 7/10, CUE
13. Push WAIT 1/10, CUE
14. Push CUT, 1, 2, 3, STOP, CUE

    Cue Counter Reads 0056

Let's review.

Put PROGRAM TIMING switch to PLAY
Push REVQ (Wait for ready lights)
Push CUE

After reviewing, let's say we want to speed up this section by 1/10 second. Do this.

1. Push REVQ
2. Put PROGRAM TIMING switch to STEP
3. Push CUE (Entering your START, CUT, 1, 2, 3)
4. Push CUE (Entering your WAIT 7/10). Note you're now previewing WAIT 1/10

5. Push SKIPQ. The WAIT 1/10 has been taken out of memory. Continue stepping through this section. Each time you preview a WAIT 1/10, push SKIPQ until you read CUT, 1, 2, 3, STOP
6. Push CUE (Entering CUT, 1, 2, 3, STOP

Cue Counter reads 0052

Once again, let's review.

Put PROGRAM TIMING switch to PLAY
Push REVQ (Wait for green ready lights)
Push CUE

These exercises have introduced you to a few editing features. They demonstrate that it's not only easy to change dissolve speeds, but also to insert new cues or delete cues from your program using the ADDQ and SKIPQ buttons.

You will find these buttons most helpful in changing timing during high speed sequences. Here again, remember your SHOW PRO V System has a basic logic. Each button does exactly what it says. So when programming or editing, ask yourself the question, "What do I want to do?" Once you answer it, you should be able to push the right buttons. And if you should make a mistake, don't worry, your REVQ will back up through mistakes as well as it does through good cues.

Now you've used the SKIPQ, ADDQ, CLEAR, RESET, and REVQ buttons. What about the RUN button? This button advances memory at ten steps per second to any cue number and also brings the slide projectors to that spot in the program automatically.

At this point you have 52 cues in memory. Remember the slides you have on the secreen at cue 0052. Then do this.

Push RESET
Put PROGRAM TIMING switch to STEP
Wait for all projectors to home
Push RUN and hold it down until the counter gets to 0052 again

Result: When the Screen Status ready lights come on, the visuals that were on for cue 0052 have reappeared. This technique lets you get to any cue number very quickly. If you pass the number you want, use the REVQ to get back. If you don't want the projectors to flash on the screen while you're reaching a point, put the DISSOLVE switch to STANDBY.

High Performance Screen Effects Using Shift

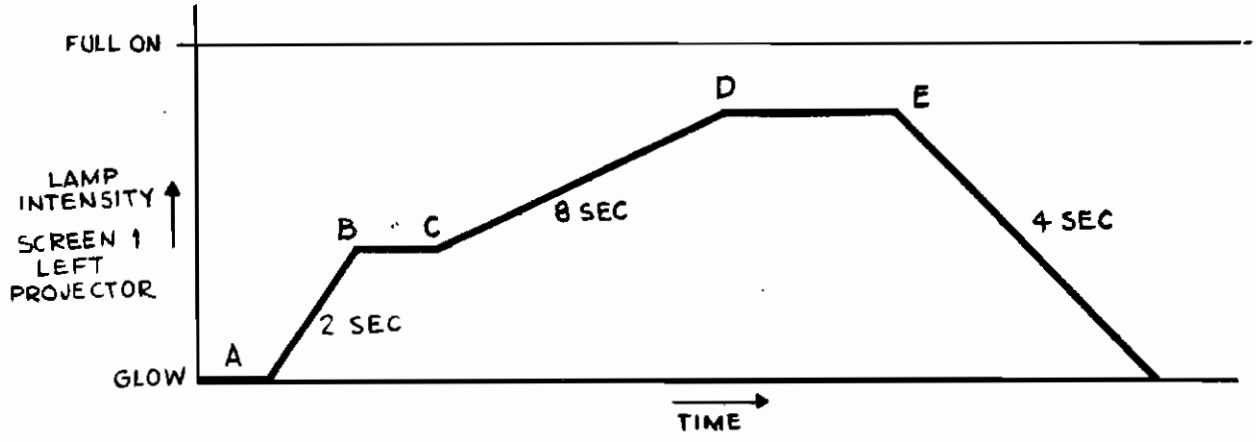
Dissolve Freeze

Although imperceptable on the screen, the SHOW PRO V creates dissolves and fades by using hundreds of tiny descrete steps. The new SHOW PRO V allows new creative freedom by enabling the operator to stop the stepping action and "Freeze" a dissolve at any point. The lamp then may be held indefinitely at that intensity, or the dissolve may be resumed either up or down at any dissolve speed. The dissolve is frozen by simply programming SHIFT plus SCREEN and PROJECTOR number (with NO dissolve speed specified.) The dissolve may be resumed at the same speed and same direction latter by repeating the SHIFT cue. The first SHIFT freezes the dissolve, the second SHIFT releases the freeze, the third SHIFT would freeze the dissolve again at a new intensity, etc.

When a dissolve is frozen, it may be resumed in the same direction at a new speed by simply programming the new speed with no screen or projector number. This command will release all the dissolves which are frozen and change the speed on only those dissolves, without affecting any other screen actions.

Likewise, the dissolve may be resumed at a new speed in the opposite direction. To achieve this, simply program in the new dissolve speed PLUS screen and projector numbers.

The following graph will show how easily complex dissolve effects may be created:



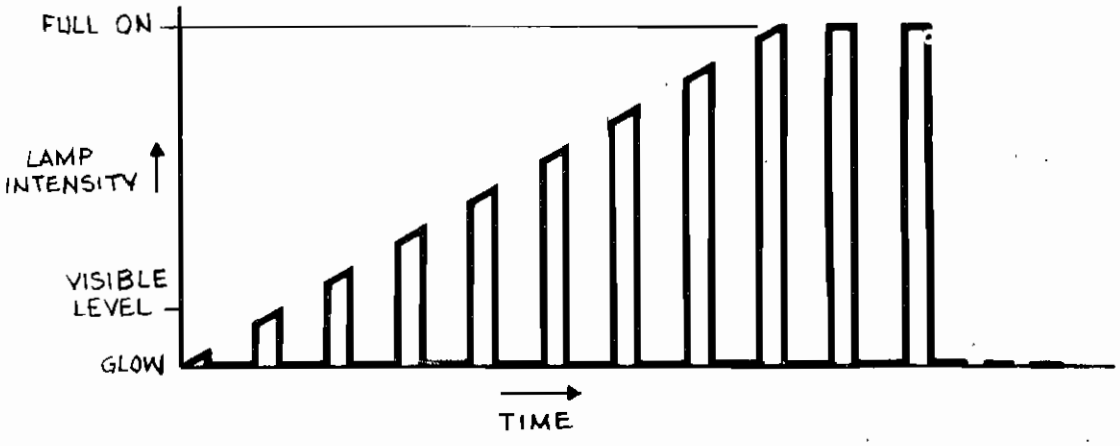
	PROGRAM	EFFECT
A)	2 SEC LEFT 1	Start 2 SEC up
B)	SHIFT LEFT 1	FREEZE DISSOLVE
C)	8 SEC	Resume Upward Dissolve at 8 SEC rate.
D)	SHIFT LEFT 1	Dissolve Down at 4 SEC
E)	4 SEC ALT LEFT 1	Rate with No Projector Advance

Experienced operators may notice that the new SHIFT feature not only allows FREEZING of dissolves, but also smooth changes of speed and/or direction.

Intensity Controlled Alternate

It has always been AVL policy to make basic programming as simple and logical as humanly possible. In addition, we have sought to advance the limit of creative sophistication. The new SHOW PRO V fills both requirements. It remains a remarkably easy unit to use and yet offers screen effect possibilities to challenge the most advanced operator. The most dramatic new effect is the Intensity Controlled Alternate (or Envelope Alternate). This new feature allows the control of a changing intensity (or Envelope) while simultaneously alternating lamps between glow and the controlled intensity. We recommend that the operator become familiar with all other features of the new SHOW PRO V before tackling this new effect. When the operator is comfortable with advanced programming techniques, then the Intensity Controlled Alternate will follow rather easily.

One example of a use for this new feature is fading up a rotating marque from black to full intensity. The marque effect is generated by using three different slides in the LEFT, CENTER, and RIGHT projectors on Screen 1 and sequencing between them. For simplicity, we show the intensity of the LEFT projector only on the following figure:



	PROGRAM	EFFECT
1)	8 SEC L, C, R, 1	All Lamps Start Up
2)	SHIFT, ALT, L, C, R, 1	All Lamps Shut Off Before they become visible
3)	SHIFT, ALT, L, 1	Left Lamp Comes On
4)	SHIFT, ALT, L, C, 1	Left Goes Out, Center Comes On
5)	SHIFT, ALT, C, R, 1	Center Goes Out, Right Comes On
6)	SHIFT, ALT, L, R, 1	Right Goes Out, Left Comes On
7)	REPEAT STEPS 4 thru 6 as many times as desired	The MARQUE continues to rotate and get brighter for 8 SEC until it reaches full intensity then rotates at full intensity

Note a number of significant aspects:

(1) The 8 SEC dissolve describes the maximum intensity

(2) The SHIFT ALT allows the maximum intensity to continue fading up, while switching the lamp between glow and the controlled intensity.

(3) Always use the independent controls L, C, and R to absolutely describe the sequence of lamps while using SHIFT ALT in this effect.

(4) Step 7 would be an ideal time to use DOUBLING ADD-A-CUE if a START were programmed between Step 3 and Step 4.

(5) When the dissolve is finished (going up or going down), the SHIFT ALT then returns to a normal effect of switching between glow and full intensity.

(6) On the SHOW PRO V, the Screen Status LED's follow the alternating intensity to assist the operator in programming the sequence.

The Intensity Controlled Alternate may similarly be used to fade a Marque down, with one programming distinction. The 8 SEC command starts the lamp fading down and the Status LED goes out immediately even though the projector lamp is still "ON" fading towards "OFF". The SHOW PRO V uses the first SHIFT ALT as a book keeping move to light the Screen Status LED with no effect on the projector lamp intensity. The LED then corresponds with the true lamp intensity and hence is useful to assist the operator in programming the sequence. All following SHIFT ALT's then turn the corresponding projector lamp's and LED's on and off simultaneously. The Marque should be timed to stop rotating just before the dissolve finishes, because after the dissolve completion the lamps will return to the normal screen effect of alternating between glow and full intensity.

Dissolve Freezes, changes, etc., may also be used with the SHIFT ALT. Thus, the rotating Marque could be dimmed up, held, dimmed further up, then dimmed off if desired. This is a true challenge for the experience professional operator. If you are so inclined to accept the challenge, then we offer a hint. Always use an **even** number of SHIFT ALT's following a freeze before resuming the dissolve. The LED STATUS then corresponds with the beginning dissolve direction and the lessons learned under the paragraph titled DISSOLVE FREEZE, will apply directly.

HIGH SPEED DUMPING OF MEMORY ONTO MAGNETIC TAPE

The SHOW PRO V System lets you store program memory on magnetic tape by means of high speed dump of the information, or by synchronizing information stored in memory to a sound track. The information can be replaced in memory by playing back the recorded tape. So you can store memory temporarily during programming, or permanently for a "canned" show. And changes can still be made by re-entering memory into the programmer.

Here's how to store your program . . . temporarily or permanently . . . on magnetic tape.

1. Push RESET. Wait for memory and projectors to home, indicated by green ready lights.
2. All switches to the right except MAG TAPE, which should be in PROGRAM position. Be sure, too, that the SEQUENCE switch is the position that coincides with your program. If you want projectors to remain home, put DISSOLVE switch to DISCONNECT.
3. Interconnect from Record Mag Tape Receptacle on rear panel of programmer to Line Level In on tape deck.
4. Put tape deck in Record and start.
5. Push CLEAR. A tone is generated to set tape deck level, which should play back at zero VU. We have found many tape decks recording at +3 DB will play back at zero. To check your tape deck, play back the tone recorded. If it reads approximately zero, proceed with the next step. If it does not, change the record level and try again. Once you have established a record level, you should not have to change the setting during programming.
6. After level is set, return KEYBOARD switch to FAST EDIT.
7. Push RUN. WAIT until DIGITAL CUE COUNTER stops. Your program is now recorded on magnetic tape at 20 cues per second.

Note: Do not enter a HOME cue at the end of a program when high speed dumping or it will cause the program to record continuously.

8. Stop tape deck.

MEMORY RE-LOADING FROM MAGNETIC TAPE

1. All switches should be to the right except the DISSOLVE switch, which should be in DISCONNECT. Be sure that the SEQUENCE switch is in the position that coincides with your program.
2. Interconnect from the Playback Mag Tape Receptacle on the rear panel of the programmer to Line Level Out on the tape deck.
3. Find the level-setting tone on the tape. This can be determined by by tape deck counter or the appearance of a steady green MAG TAPE STATUS light on the keyboard.
4. Run tape deck. DIGITAL CUE COUNTER will show program cues loading and keyboard lights will flash
5. When Cue Counter stops, program is loaded in memory.
6. Stop tape deck.
7. Push RESET.
8. Move the DISSOLVE switch to NORMAL.

Now memory is loaded back into the programmer, and all projectors, as well as memory, are in home position.

RECORDING CUES TO SOUND TRACK

1. Push RESET. Wait for memory and projectors to home, indicated by green ready lights on keyboard.
2. All switches should be to the right except MAG TAPE which should be in PROGRAM position.
3. Interconnect from Record Mag Tape Receptacle on rear panel of programmer to Line Level In on the #2 track of the tape deck.
4. Put tape deck in Record on #2 track and Play on #1 track and start.
5. If you have not set your record level, see Step 5 of High Speed Dumping section. If you have previously set your record level, proceed immediately with the next step.
6. After level is set, move KEYBOARD switch to NORMAL.
7. Now you're ready to cue your show to the sound track. This is done by pushing the CUE button at the point in the sound track at which you wish the next screen action to occur.
8. Continue until entire show is recorded to sound track.
9. Stop tape deck.

PLAYING BACK YOUR SYNCHRONIZED, RECORDED SHOW

1. Push RESET. This brings memory and projectors to home.
2. All switches should be to the right. SEQUENCE switch should be in the position that coincides with your program. Put MEMORY switch to DISCONNECT unless you intend to re-load memory.
3. Interconnect from Mag Tape receptacle on rear panel of programmer to Line Level Out on tape deck. Both Record and Playback cords may be connected during programming if desired.
4. Set both tracks of tape deck to Play. Find line level override tone on tape. This can be determined by tape deck counter or appearance of steady green MAG TAPE STATUS light.
5. Let tape deck run.
6. Your show should now run exactly as programmed. If your MEMORY switch was in NORMAL, note that your program has also been loaded into memory in case you want to edit and re-cue.
7. At end of recorded show, stop tape deck.

SHOWING A "MIXED" SHOW

There may be times when you want to incorporate a "live" speaker or narrator into your "canned" show, or to inject a manually-controlled segment. The SHOW PRO V System makes it easy to do, because it lets you pre-load memory for the live portion, then switch to canned at the appropriate time.

(A) Loading Memory

1. All switches should be to the right except DISSOLVE, which should be on DISCONNECT and SEQUENCE must be in proper position.
2. Start tape deck and load memory.
3. Stop tape deck after memory load.
4. Push RESET.

(B) Playing "Canned" Show

1. Move DISSOLVE switch to NORMAL.
2. Move MEMORY switch to TAPE BYPASS.
3. Start tape deck for canned portion.
4. Stop tape deck at end of canned portion.

(C) Cueing The Speaker

1. Push CUE as appropriate.

NOTE: You may then restart tape deck for a latter canned portion if desired without moving any switches on the new SHOW PRO V.

CONCLUSION

Now you have some idea of where your SHOW PRO V System can take you.

As you become increasingly familiar with it, and more confident in your use of it, you'll find the SHOW PRO V will encourage your best creative efforts.

You doubtless already recognize that its capacities are such as to motivate your search for techniques and effects previously untried.

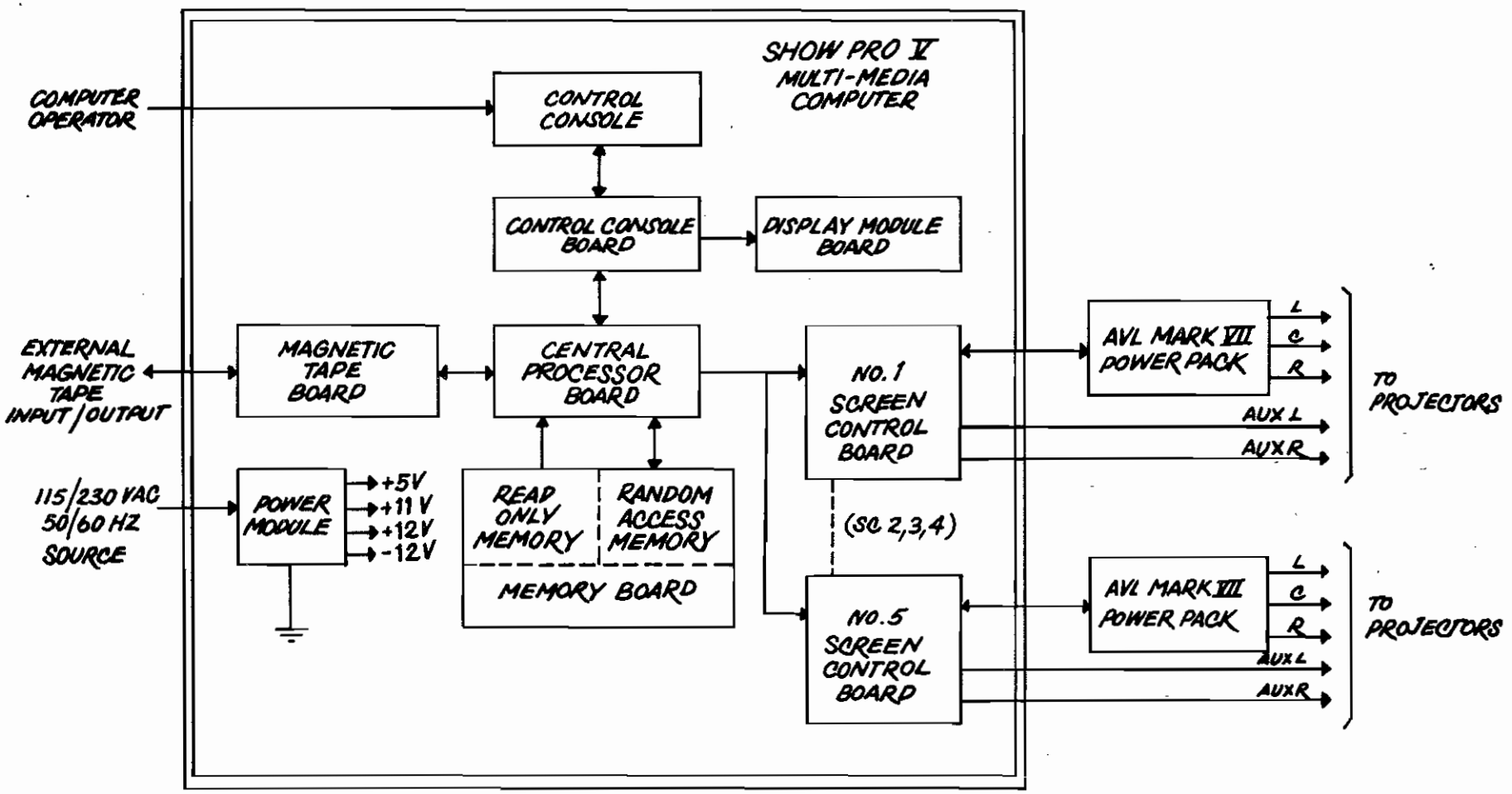
So don't hesitate to experiment. The system's tolerant of errors. And its range of capabilities is beyond the scope of any manual.

If you have comments or questions, or need assistance of any sort, contact us.

In the meantime, your SHOW PRO V System is your means of exploring a whole new universe of multi-image possibilities.

Explore boldly. And enjoy it.

APPENDIX
SHOW PRO V SYSTEM BLOCK DIAGRAM



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SHOW PRO V INTERCONNECTION DIAGRAM

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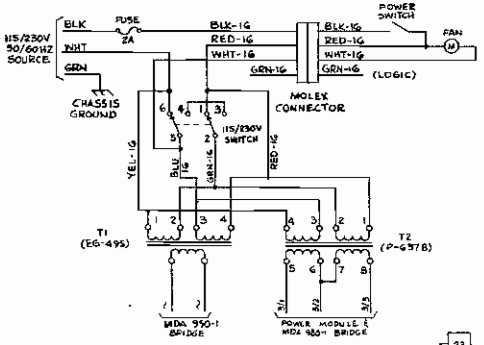
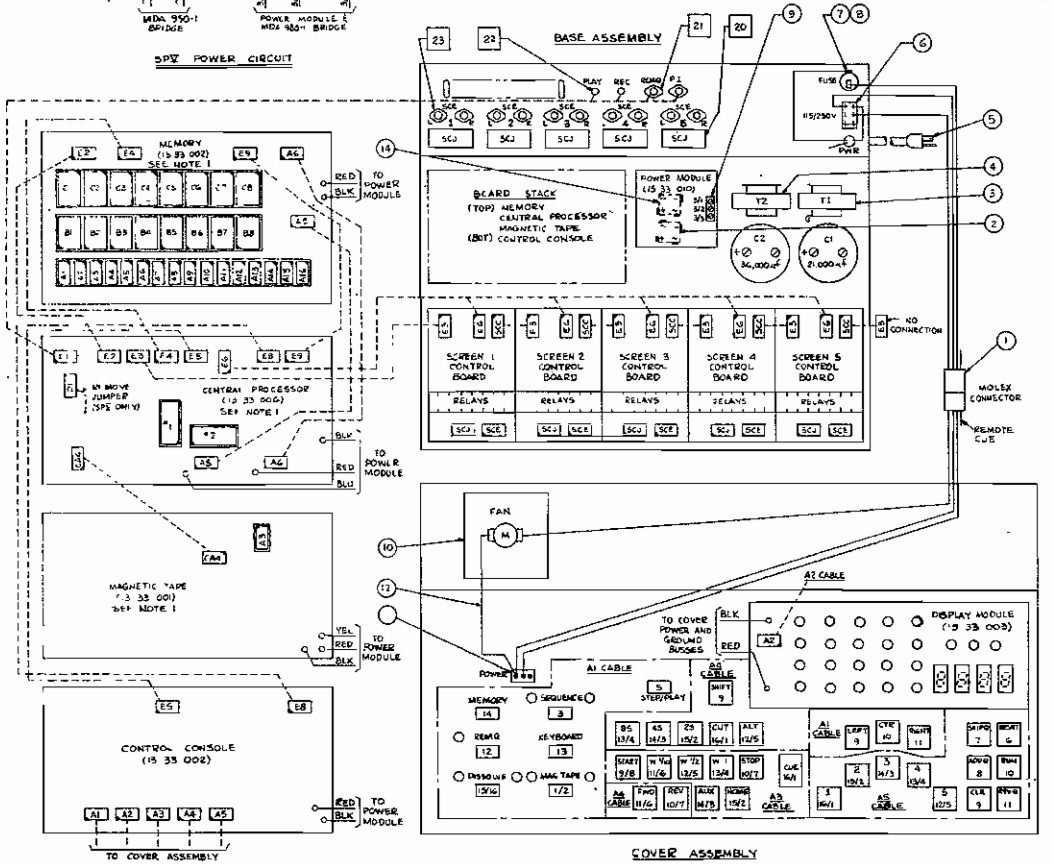


SPV POWER CIRCUIT

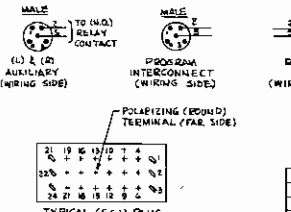
SCREEN CONTROL CONNECTIONS (TYP) NOTE 6				
SCJ CABLE			SCE CABLE	
JONES PIN NO.	FUNCTION	CABLE PIN NO.	CABLE PIN NO.	CONNECT TO
1	FORWARD LEFT	2	16	NO CONNECTION
2	FORWARD CENTER	16	1	
3	FORWARD RIGHT	7	15	
7	REVERSE LEFT	3	2	
8	REVERSE CENTER	12	14	
9	REVERSE RIGHT	8	3	
14	FORWARD GROUND	1	13	
16	+28VAC	9	4	
18	-28VAC	10	12	
19,20,22	+30VDC	11	5	AUX L-2
21	FIRE RIGHT	13	11	NO CONNECTION
23	FIRE CENTER	14	6	AUX L-5
24	FIRE LEFT	15	10	NO CONNECTION
4,5,6, 10,11,12, 13,15,17	NO CONNECTION	4,5,6	7	AUX R-2
			9	NO CONNECTION
			8	AUX R-5

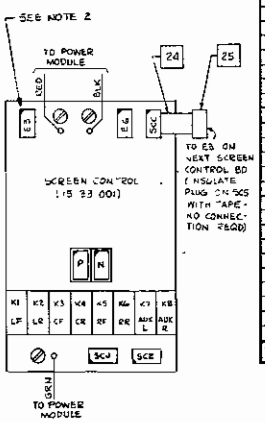
NOTES:

1. CAUTION - THIS ASSEMBLY CONTAINS MOS-TYPE DEVICES WHICH ARE SUBJECT TO ELECTROSTATIC (STATIC) CHARGES. INDIVIDUALS AND TOOLS SHOULD BE GROUNDED BEFORE COMING IN CONTACT WITH THE ASSEMBLY OR DEVICE. BOARD ASSEMBLIES MUST BE WRAPPED IN METALLIC FOIL FOR HANDLING AND/OR STORAGE
2. ⌜ DENOTES PIN 1 OF A DEVICE OR CABLE PLUG
3. ITEM NUMBERS 1 THRU 14, DESIGNATED WITH ○ ARE AC POWER COMPONENTS.
4. ITEM NUMBERS 20 THRU 27, DESIGNATED WITH □ ARE LOGIC LEVEL COMPONENTS.
5. APPROVED ALTERNATE MANUFACTURERS:
6. THE (SCJ) CABLE CONNECTS A SCREEN CONTROL BOARD WITH THE CORRESPONDING 24 PIN OUTPUT CONNECTOR. THE (SCE) CABLE CONNECTS A SCREEN CONTROL BOARD TO THE CORRESPONDING (L) AND (R) AUXILIARY OUTPUT CONNECTORS.
7. THESE SPECIFICATIONS ARE FOR DOMESTIC UNITS. REFER TO D15 99 003 FOR IEC MODEL SPECIFICATIONS



COVER ASSEMBLY





SCREEN CONTROL BOARD (TYPICAL OF 5 BOARDS)

ITEM NO.	PART NUMBER	MANUFACTURER	DESCRIPTION	NOTE
30				
29				
28				
27	CM7-7945	CHICAGO MIN LAMP	BULB, INCAN, (PUSH SWITCHES)	4
26	CM-345	CHICAGO MIN LAMP	BULB, INCAN (CUE SWITH)	4
25	3416-0000	3M CO.	CONNECTOR, RIBBON CABLE	4
24	3365-16	ALPHA	CABLE RIBBON, 16 COND	4.5
23	119-5M	EBY	PLUG, MALE, 5 PINS	4
22	HHS-275	H.H SMITH	JACK, AUDIO	4
21	119-5F	EBY	JACK FEMALE 5 PINS	4
20	P 524-AB	VERNITRON	PLUG, MALE 24 PINS	4
19				
18				
17				
16				
15				
14	MDA 980-1	MOTOROLA	BRIDGE RECTIFIER	3
13	R18-GF5	THOMAS & BETTS	TERMINAL LUG SPADE, CRIMP	3
12		ALPHA	WIRE 16 AWG, STRANDED	3
11	LL-123		SWITCH, TOGGLE, SPDT	3
10	BT 2A-1	ROTRON	FAN	3
9	12503	VERNITRON	TERMINAL STRIP, BARRIER, 3 POS	3
8	AGC 2	BUSSMAN	FUSE 2 AMPERE	3
7	LF-342004	LITTLEFUSE	FUSE HOLDER	3
6	46256 LFR	SWITCHCRAFT	SLIDE SWITCH, DPDT	3
5	17419	BELDEN	POWER CORD	3
4	P-6378	STANCOR	TRANSFORMER	3
3	EG-495	ELEC WINDINGS	TRANSFORMER	3
2	MDA 990-	MOTOROLA	BRIDGE, RECTIFIER	3
1	03-09-1047 (03-09-2068)	MOLEX	CONNECTOR, 4 POS	3

SHOW PRO V SPECIFICATIONS DOMESTIC UNIT (NOTE 7)

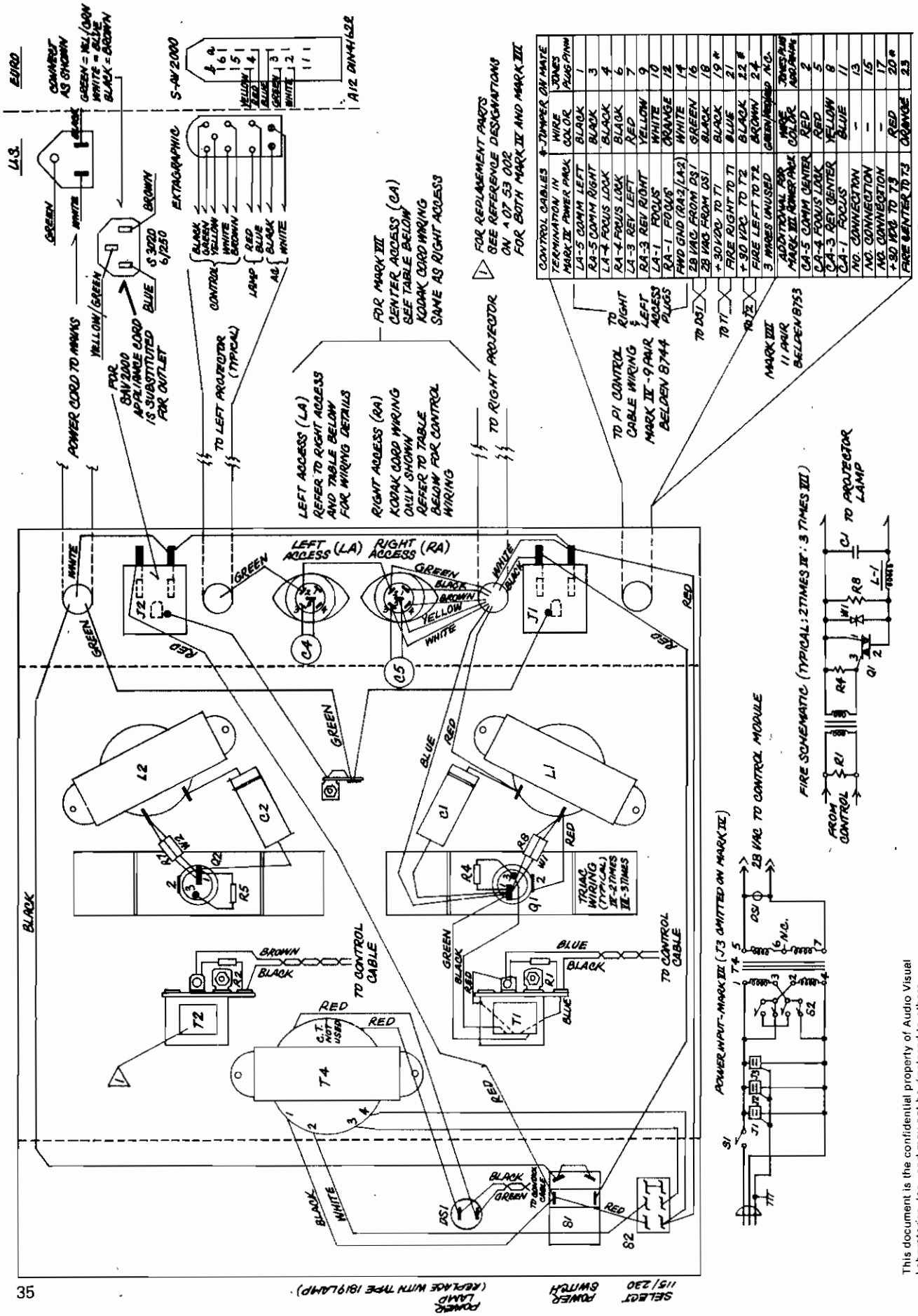
DRAWN TL 1/21/77 CHECKED BY SC

AUDIO VISUAL LABORATORIES, INC ATLANTIC HIGHLANDS NEW JERSEY 07716

D 15 99 002 SHT 1 OF 1 REV B

REV B 3/8/77 MISC MODIFICATIONS
REV A 2/1/77 REV POWER CKT

SHOW PRO V, MARK IV AND MARK VII SERVICE INTERCONNECTION DIAGRAM



CONTROL CABLES & JUMPER ON MATE		
TERMINATION IN MARK III POWER PACK	WIRE COLOR	JONES PLUG P/NO
LA-5 COMM LEFT	BLACK	1
RA-5 COMM RIGHT	BLACK	3
LA-4 FOCUS LOCK	BLACK	4
RA-4 FOCUS LOCK	BLACK	6
LA-3 REV LEFT	RED	7
RA-3 REV RIGHT	YELLOW	9
LA-1 FOCUS	WHITE	10
RA-1 FOCUS	ORANGE	12
FWD GND (RA-2/LA-2)	WHITE	14
28 VAC FROM DS1	GREEN	16
28 VAC FROM DS1	BLACK	18
+30 VDC TO T1	BLACK	19 *
FIRE RIGHT TO T1	BLUE	21
+30 VDC TO T2	BLACK	22 #
FIRE LEFT TO T2	BROWN	24
3 WIRES UNUSED	GREEN/YELLOW	NO.
ADDITIONAL FOR MARK III POWER PACK	WIRE COLOR	JONES PLUG P/NO
CA-5 COMM CENTER	RED	2
CA-4 FOCUS LOCK	RED	5
CA-3 REV CENTER	YELLOW	8
CA-1 FOCUS	BLUE	11
NO CONNECTION	-	13
NO CONNECTION	-	15
NO CONNECTION	-	17
+30 VDC TO T3	RED	20 #
FIRE CENTER TO T3	ORANGE	23

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SHOW PRO V SPARE PARTS LIST

MECHANICAL PARTS

ITEM NO.	QTY.	DESCRIPTION
1	1	Transformer, EG - 495
2	1	Transformer, P -6378
3	1	Capacitor, 36,000 uf, Sprague 36D or Mallory CGS (Specify)
4	1	Capacitor 21,000 uf, Sprague 36D or Mallory CGS (Specify)
5	1	Rectifier Bridge, MDA - 980 - 1
6	1	Rectifier Bridge MDA - 990 - 1
7	1	Transistor, Power Tip - 35 (Incl. Mtg. Pkg.)
8	1	Plug, P324 - AB (24 Pin Males)
9	1	Plug, 119 - 5F (5 Pin Females)
10	1	Plug, 119 - 5M (5 Pin Male)
11	1	Fuseholder, LF - 342004
12	1	Jack, Audio, HHS - 275
13	5	Fuse, AG - 2 (2 Amp)
14	1	Switch, 3 Position, JMT - 121
15	1	Switch, 2 Position, JMT - 123
16	1	Switch, Power, LL - 123
17	1	Switch Pushbutton, LUS - 05 - 1
18	10	Bulb, Incandescent, CM - 7 - 7945
19	2	Bulb, Incandescent, CM - 345 (Cue Switch Only)
20	1	Fan, BT2A - 1
21	2	Clip, Flat Cable, 4J10
22	4	Spacer, 88 - 4344/FF
23	4	Spacer, 18 - 4343/MF
24	1	Lamp, Led Assembly, 2L5SRTL - FL5/35 (Red)
25	1	Lamp, Led Assembly, 2A5SATP - FL5/33 (Amber)
26	1	Lamp, Led Assembly, 2G5SGTP - FL5/33 (Green)
27		Assorted Hardware Package

PRINTED WIRING BOARD

PART NO.	QTY.	DESCRIPTION
13 33 001	1	Magnetic Tape PWB Assembly
13 33 002	1	Control Console PWB Assembly
13 33 003	1	Display Module PWB Assembly
15 33 002	1	Memory PWB Assembly
15 33 001	1	Screen Control PWB Assembly
15 33 003	1	Central Processor PWB Assembly
15 33 014	1	Power Module PWB Assembly

SHOW PRO V SPECIFICATIONS

DISSOLVE CONTROL: One 24 pin Jones plug for each of five MARK VII Power Packs. Each Power Pack controls 3 slide Projectors.

AUXILIARY CHANNELS: Ten momentary, electrically isolated, 25 volt AC on DC, 3-amp Carousel type male receptacles.

MAGNETIC TAPE: Line Level record and playback. Time Division Multiplex (Digital), multiple pass with cyclic redundancy check (CRC) characters and computer analysis on playback.

ELECTRICAL: 115/230 VAC, 50/60 Hz.

SIZE: H x W x D = 4½ x 21 x 15 inches.
12 x 54 x 38 cm.

WEIGHT: 22 pounds
10 kg.

ORIGIN: Manufactured in U.S.A.

Audio Visual Laboratories, Inc.

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EXCLUSIVE AVL SHOW PRO VB MEMORY SELF-TEST

AVL has provided a unique feature in the SHOW PRO VB for the customer, which allows testing of the system memory elements and internal program on site. This feature provides two important time-saving functions for the user: (1) to assure himself the memory of the unit is operating properly in those situations where a problem could either be caused by the person programming or the machine; (2) if the machine is at fault, the time spent with AVL service personnel expediting getting the unit back on-line.

WHAT DOES IT DO? During the test, over a million checks per second are performed. To test all elements on the Memory board requires five seconds.

If the memory is operating properly, the Cue Counter will advance 1 number every five seconds. However, if there is a problem, the location of the defective "chip" will be shown on the Cue Counter, e.g., "OCO4" would indicate the device in that location on the Memory board will have to be replaced.

HOW DO I PERFORM THIS TEST? Every SHOW PRO VB that is equipped with the Memory checker-chip has a 6-pin Memory Test Plug shipped with the unit. To perform the test, do the following:

1. If some program is presently loaded in the unit, perform a high-speed dump to mag tape to store the work you have done to this point.
2. Turn OFF a-c power to the unit.
3. Install the Memory Test Plug in the Battery Connector located on the rear panel of the unit.
4. Turn power back ON.
5. Observe the Cue Counter. If properly operating, it will indicate "0000", then five seconds later will read "0001", and increase by one each five seconds thereafter.

If there is a problem on the Memory board, it will readout the location.

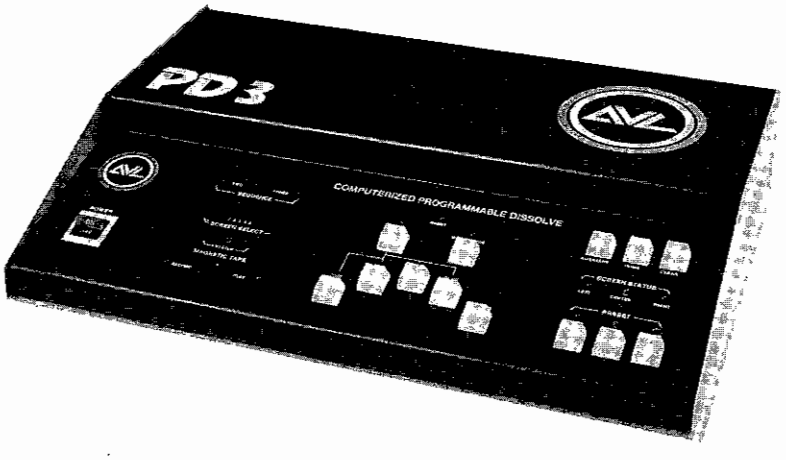
Write down the chip location shown on the Cue Counter.

6. Turn OFF the a-c power and remove the Memory Test Plug.
7. Contact the nearest AVL service center and tell them the number you wrote down. They will assist you in getting your unit back on-line as soon as possible.

HOW LONG SHOULD I TEST THE UNIT IF IT STARTS COUNTING CORRECTLY?

Although each element is tested every five seconds, a failure may not occur until the unit has warmed up. We recommend letting the unit run in the test made for at least ten minutes.

PD3
Computerized
Programmable Dissolves



Operator's Manual

The professional team in multi-image programming systems.

INTRODUCTION

Here's AVL's micro-computer magic applied to single screen slide shows: PD 2 and PD 3.

Totally compatible with our larger computer systems, these remarkable units combine ease of operation and a broad range of visual effects.

"PD" designates programmable dissolve. The numbers . . . 2 and 3 . . . indicate the number of projectors each is designed to control.

Their advantages, as you will quickly learn, are many. For example, every dissolve can be programmed on magnetic tape to "real time" of the second track of your tape deck. As a result, you can create a program with PD alone. No additional programming equipment is necessary! Another convenient and time-saving feature is programmable home . . . add it to the end of your show and projectors return to their starting points automatically.

Although the PDs do not have complete memory systems such as those of AVLs SHOW PRO III and SHOW PRO V, allowing leisure time programming, they may nonetheless be used to play back programs generated on the larger systems. In addition, the PDs can be "ganged" in series and, by using the **Screen Select** switch, each unit will react only to the screen selected.

This manual will introduce you to the capabilities of your new PD.

Enjoy it as a beginning unit or as a sophisticated playback system, assured of its compatibility with AVL's computer products of today.

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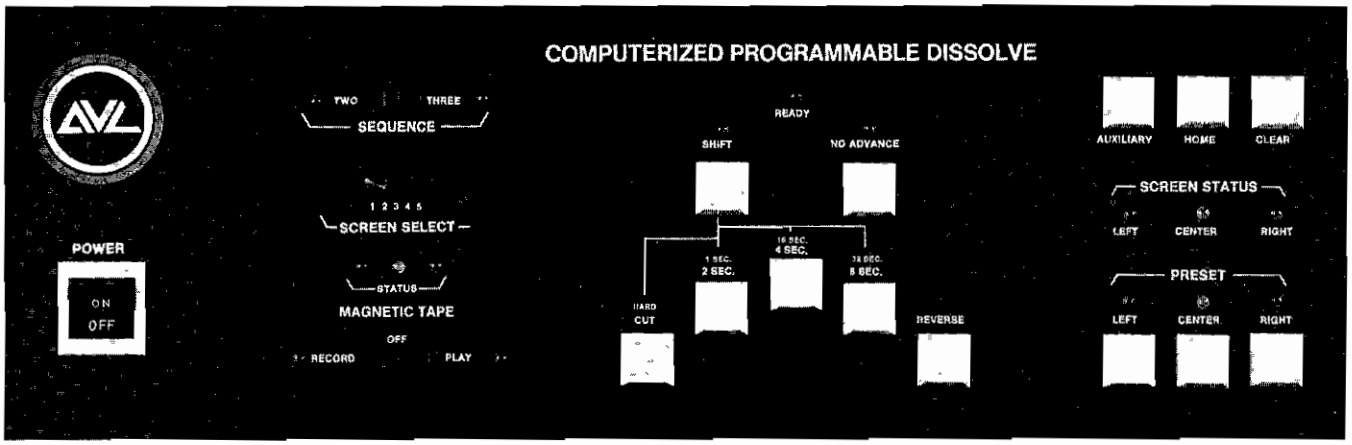
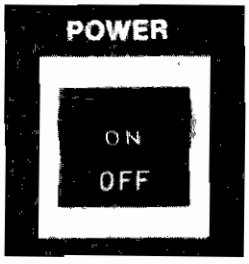


FRONT PANEL

The keyboard controls of your PD 3 are designed for simple, trouble-free real time programming, with all phases of operation apparent at a glance and all command functions at your fingertips. The specific functions of each keyboard control are as follows:

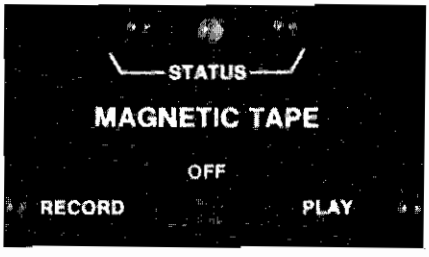


Power

Activates system in the ON position. With power on the system is in standby mode until your first cue is entered.

Screen Select

For normal operation during programming and playback, this switch should be in position ONE. For further information, see page



Mag Tape Switch

This is a three-position switch: RECORD/OFF/PLAY.

RECORD position is for real time recording of digital information produced when any command function on the keyboard is activated.

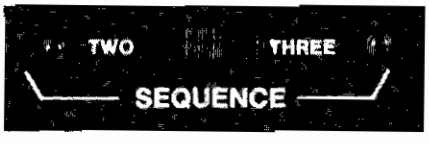
OFF position prevents information from being recorded from, or played back through, your PD 3.

PLAY position is strictly for presentation of your recorded show.

Mag Tape Status

Indicates the condition of magnetic tape program signal during playback. These status indicator lights provide a continuous grading of the quality of the magnetic tape.

Green	Perfect
Green Yellow	Fair to Good
Green Yellow Red	Poor
Continuous Red	Unacceptable



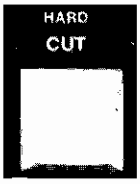
Sequence Switch

With this switch in the TWO position the programmer will sequence between LEFT and RIGHT projectors, although the CENTER projector will be activated if the CENTER projector PRESET button is punched. With the sequence switch in the THREE position the PD 3 will sequence LEFT-CENTER-RIGHT.

Ready Light

The READY light comes on when *ALL PROJECTORS* are ready. Because this system works with three projectors you do not have to wait for the READY light when going in a LEFT, CENTER, RIGHT sequence. Cuts may be done every 3/4 seconds and dissolve commands as soon as the previous dissolve is completed. Since you have a third projector to go to you do not have to wait for an advance of the downgoing projector.

DISSOLVE SPEED CONTROLS



Cut

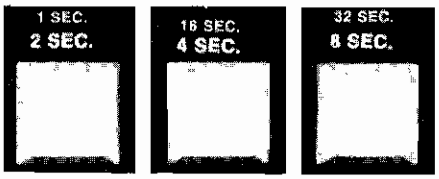
Commands an instantaneous switch from one projector to the other. The projector going off will automatically advance.

2 SECOND
4 SECOND
8 SECOND

These buttons are used to select the timing of dissolve blends from projector to projector. The downgoing projector will automatically advance.

Shift

When SHIFT is programmed with a dissolve speed it changes dissolve timing. CUT becomes HARD CUT. The downgoing projector begins advancing before the lamps change, causing a "harder"visual effect than the standard CUT.



2 SECOND (2 SEC) becomes a 1-Second
4 SECOND (4 SEC) becomes a 16-Second
8 SECOND (8 SEC) becomes a 32-Second

The SHIFT command is latching with an LED display when activated. To activate, press button; to deactivate press button again. To obtain a HARD CUT, 1 - second dissolve, 16 - second dissolve or 32 - second dissolve, the combination of SHIFT with each rate is necessary.

No Advance

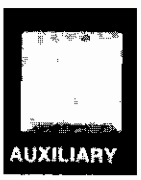
Switches status of lamps between projectors. NO ADVANCE *must be* combined with either a CUT, or any one of the dissolve rates. There will *not* be a tray advance when using this mode.

NOTE:

The NO ADVANCE button is latching with an LED display when activated. This is especially helpful in real time programming of your show. (To activate, press button; to deactivate, press button again).

Reverse

Will set projectors back one space at a time in normal sequence.



Auxiliary

The PD 3 has two AUXILIARY channels AUX L and AUX R. Two standard Kodak receptacles for momentary action closures on the rear panel of your PD 3 accommodate connections from peripheral equipment such as additional slide projectors (forward only), 16 mm projectors or room lighting. When selecting AUX L or AUX R, left or right PRESET must be activated first, then AUXILIARY key.

Home

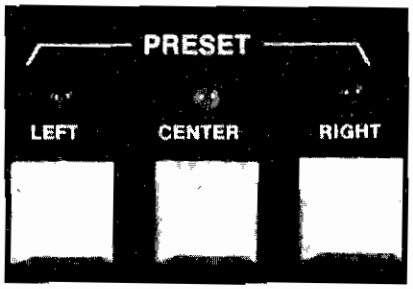
The HOME command can be programmed on mag tape or used manually. It brings all projector trays to their starting points by the shortest route and leaves the system in standby with projector lamps off.

Clear

This button clears keyboard presets, SHIFT key and NO ADVANCE, as well as MAG TAPE status lights. It also activates a recordable signal for level setting prior to recording a program. See PROGRAMMING WITH YOUR PD 3, page 7.

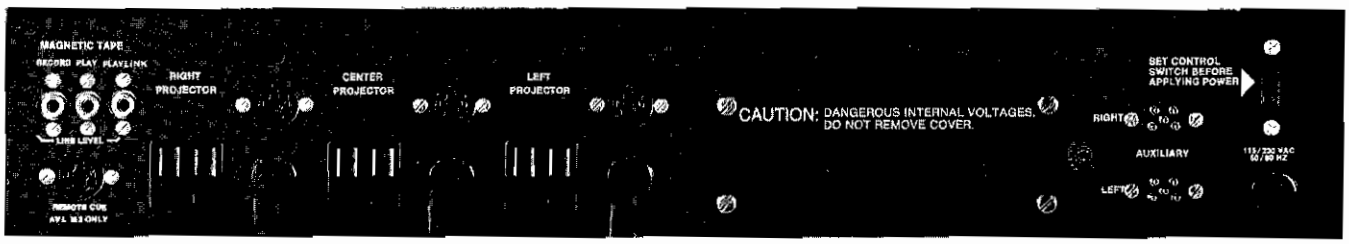
Screen Status

Indicates which projector is "up" (projecting image).



Preset

For independent selection of projectors. When projector PRESET is pushed it will remain latched until a screen action takes place. The projector PRESET may be cleared by pressing a second time or by use of the CLEAR button. For further information, see SCREEN EFFECTS, page 8.



REAR PANEL

Mag Tape Receptacles

To Record:

Connect RCA plug from RECORD jack of PD 3 to line level "in" on tape deck.

To Playback:

Connect RCA plug from PLAY jack on PD 3 to line level "out" on tape deck.

NOTE:

RECORD and PLAY may be connected simultaneously during programming.

Play Link

Is available on later models for multiplexing PD 3s in series, allowing playback of shows generated on AVL's larger computer programming systems.

Remote Cue Input

Standard Kodak female receptacle for AVL MARK II remote control only. Allows remote manual operation of CUT, 2 SECOND DISSOLVE and REVERSE.

Projector Control

Three permanently attached seven-pin standard Kodak Carousel type cables and three switched three-wire grounded 1500 watt maximum AC receptacles for control of each projector from the keyboard. Next to each seven-pin cord is a standard Kodak type receptacle for direct access to each projector for forward, reverse, and focus, (30 volt DC, 5 amp maximum).

Auxiliary Control

Two momentary closures that accept standard five-pin Kodak cable for peripheral equipment such as additional slide projectors or 16 mm projectors. AUXILIARY is 25 volt AC/DC, 1 amp maximum. Contact closure: Pin 2 to Pin 5.

International Voltage Change Switch

Changes voltage from 115 to 230.

Important:

Always set this switch before applying power.

NOTE:

At 50 cycles we recommend SAV type projectors; at 60 cycles, standard Ektagraphic projectors are recommended for best screen effects.

HOOKING UP YOUR SYSTEM

Preparing your PD 3 for operation requires relatively little time. Here is a step-by-step runthrough for the standard single screen format. To be sure you have everything properly connected, refer to the diagram below

The PD 3 has three black cords with seven-pin plugs. Insert the left plug into the rear of the left projector, center plug into the rear of the center projector, the right plug into the rear of the right projector. Then plug the projectors' AC cords into the corresponding AC outlets on the PD 3.

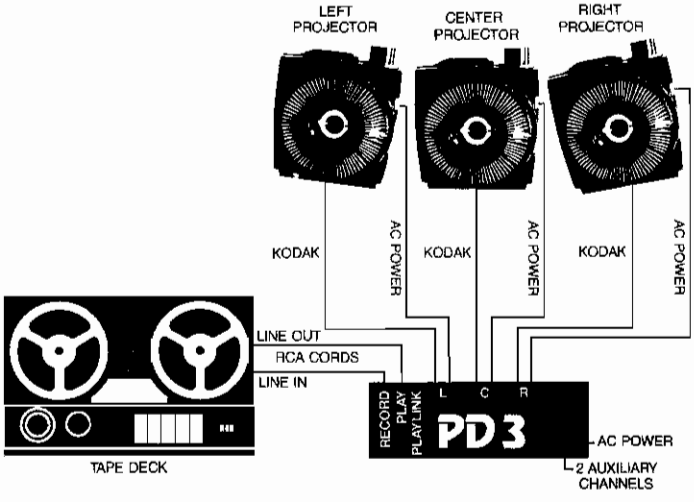
There's a voltage control switch on the back panel of the PD 3, directly above the AC cord. Check to be sure it's set for either 115 or 230 according to the voltage being used. (115 is common in North America).

Plug PD 3 AC cord into power outlet.

Now push the POWER switch of the PD 3 to the ON position. Lights will flash momentarily on the keyboard, then clear. The PD 3 will be in standby until a screen action button is activated.

A very important component of your system is the tape deck. To complete your hook up, run an RCA cord from the RECORD jack of the PD 3 to line level "in" on the tape deck. Next run an RCA cord from the PLAY jack of the PD 3 to line level "out" on the tape deck.

Your PD 3 is now ready for programming or playing back.



PROGRAMMING WITH YOUR PD 3

Place slide trays on projectors, align and focus.

Now set the trays in the exact positions you want as "home" or starting positions. Your first slide should be in the left projector gate, your second in the center projector gate, your third in the right projector gate.

The PD 3 will now keep track of tray positions and return trays to these starting positions when HOME is recorded.

A "GET ACQUAINTED" PROGRAM

Here is a step-by-step, "hands-on" run through of some programming procedures:

STEP	ACTION	PROJECTION STATUS	LIGHTS
1	Push CUT	Left projector comes on instantly.	Screen status lights show LEFT projector on. Green READY light is on, indicating PD 3 is ready for next cue.
2	Push 2 SEC	Left projector dissolves off in two seconds, center projector dissolves on in two seconds.	Status lights show CENTER projector on. Green READY light comes back on after downgoing projector advances.
3	Push 4 SEC	Center projector dissolves down and advances in four seconds. Right projector dissolves up in the same interval.	Screen status shows RIGHT projector up. READY light comes back on after downgoing projector advances.
4	Push 8 SEC	Right projector dissolves down and advances. Left projector dissolves up in the same interval.	Screen status shows LEFT projector up. READY light comes back on after downgoing projector advances.

So far you have activated CUT, 2 SEC, 4 SEC and 8 SEC. With the first command, the left projector came on. Your next command activated the center projector. Subsequent commands continued this alternating left-center-right sequence. The PD 3 will automatically operate in this left-center-right sequence until you command it to do otherwise by using the left and/or center and/or right preset buttons.

5	Push SHIFT 2 SEC	Left projector dissolves down and advances in one second. Right projector dissolves up in the same interval.	SHIFT LED is on. Status lights show center projector on. READY light comes back after downgoing projector advances.

Note: When SHIFT LED is on, screen action buttons react to speeds printed in GRAY.

6	Push NO ADVANCE 2 SEC	Center Projector dissolves down in one second. Right projector dissolves up. There is no tray advance.	NO ADVANCE LED is on. Status lights show RIGHT projector is up. READY light comes back on after dissolve is complete.

Note: When NO ADVANCE LED is on, all screen action buttons at any speed can be activated without a tray advance.

STEP	ACTION	PROJECTOR STATUS	LIGHTS
7	Push SHIFT NO ADVANCE CUT	Light instantly transfers from right projector to left projector. Right projector advances.	SHIFT LED goes off. NO ADVANCE led goes off. Status lights show LEFT projector is up. READY light returns after right projector advances.

SCREEN EFFECTS

The PD 3 offers a choice of screen actions. Here are a few examples:

SUPERIMPOSITION

STEP	ACTION	PROJECTOR STATUS	LIGHTS
8	Push CENTER PROJECTOR PRESET 2 SEC	Left projector remains up. Center projector dissolves up independently at a two second rate.	Screen Status shows LEFT and CENTER projectors up. READY light comes back on after CENTER projector attains full brilliance.

TO REMOVE SUPER AND STILL HOLD LEFT IMAGE ON SCREEN

9	Push CENTER PROJECTOR PRESET 2 SEC	Left projector remains up. Center projector dissolves down at a two-second rate, then advances.	Screen status shows LEFT projector up. Green READY light comes back on after CENTER projector advances.

The Super can be achieved using LEFT, CENTER or RIGHT PRESET and any of the forward screen action buttons, including the shift rates.

Note: Superimpositions can be done with two or three projectors as desired.

THREE PROJECTOR ANIMATION

10	Push NO ADVANCE CUT	Light transfers instantly from left to center without projector advance.	Screen status shows CENTER projector up. READY light blinks
11	Push CUT	Light instantly switches from center to right projector without projector advance.	Screen status shows RIGHT projector up. READY light blinks.
12	Push CUT	Light instantly switches from right projector to left projector without projector advance.	Screen status shows LEFT projector up. READY light blinks.
13	Push CUT	Light instantly switches to center projector without projector advance.	Screen status shows CENTER projector up. READY light blinks.
14	Push NO ADVANCE CUT	Light instantly switches to right projector. Center projector advances.	Screen status shows RIGHT projector up. READY light comes back on after CENTER projector advances.

Steps 7 through 11 give you animation among three projectors, ending with the RIGHT projector up and a new visual in the gates of the LEFT projector and CENTER projector.

SINGLE PROJECTOR FLASHING

15	Push CUT	Light transfers from right to left projector. Right projector advances.	Screen status shows LEFT projector up. READY light comes back on after RIGHT projector advances.
16	Push NO ADVANCE LEFT PROJECTOR PRESET CUT	Left projector light goes down. No projector advance.	Status lights are out, indicating no image on screen.
17	Push LEFT PROJECTOR PRESET CUT	Left projector light comes on.	Screen status shows LEFT projector on.

18	Push LEFT PROJECTOR PRESET CUT	Left projector light goes down. No projector advance.	Status lights are out, indicating no image on screen.
19	Push LEFT PROJECTOR PRESET CUT	Left projector light comes on.	Screen status shows LEFT projector on.
20	Push LEFT PROJECTOR PRESET CUT	Left projector light goes down. No projector advance.	Status lights are out, indicating no image on screen.
21	Push LEFT PROJECTOR PRESET CUT	Left projector light comes on.	Screen status shows LEFT projector on.

When a single projector flashing effect is desired, it is not necessary to wait for the READY light because the only porjector in use is already up. Speed of flashing is entirely up to the user and his dexterity.

NOTE:
When NO ADVANCE key is pushed any one of the screen action speeds can be commanded without projector advance.

All of the procedures outlined can be used with either the LEFT—CENTER—RIGHT projectors. Several variations can be incorporated into any program. Once you're familiar with how your PD 3 operates, all you have to add is imagination.

RECORDING IN "REAL TIME"

Because the PD 3 is *NOT* a memory programmer you must transfer program commands to mag tape at the speed of your sound track.

Choice of tape deck is important. It is necessary to have one that will record at least two channels independently, allowing, for example, simultaneous playback of the left channel and record on the right.

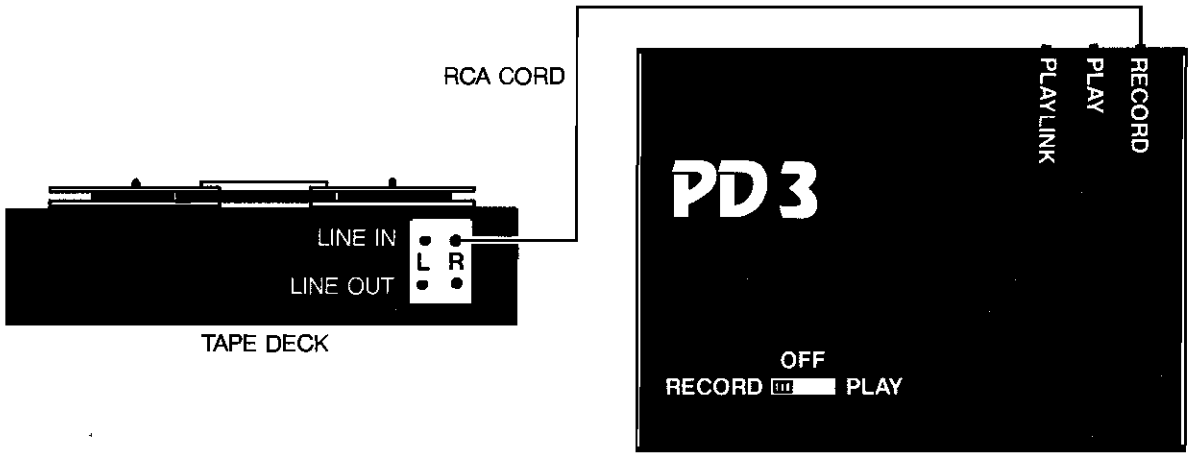
The PD 3 MAG TAPE switch must be in RECORD position, with an RCA cord running from the RECORD jack on the back panel to line level "in" on the tape deck.

To set a level for recording after hook up, splice in a section of blank mag tape before the audio portion of your show.

Then with the tape deck in record and running, press the CLEAR button on the PD 3 and set the tape deck's VU meter to +3 VU.

NOTE:
When going from canned show to manual operation of your PD 3, it is necessary to push CLEAR. This will clear all residual presets left on the PD 3 from the canned show.

Here is a diagram of the record hook up:



PLAYING BACK YOUR SYNCHRONIZED SHOW

After programming all cues, including HOME, if desired, wait for projectors to return to start, then recycle tape on recorder. Put both tape deck and PD 3 in PLAY mode, with a line running from the PLAY jack of the PD 3 to line level "in" of the tape deck's right channel. Play your show.

NOTE:

After recording at +3 VU, the level should be adjusted to "O" VU for playback. Make this a standard practice, since not all tape decks have adjustable VU control on playback.

PLAYING BACK SHOW PRO III AND SHOW PRO V PROGRAMS

The PD 3 can be used to play back shows generated on AVL's larger computer programming systems. The SCREEN SELECT switch is for this purpose.

The SHOW PRO III uses three screens. So three PD 3s, with SEQUENCE switches in position TWO, would be required to play back a three-screen format Show Pro III program.

Using the SCREEN SELECT switch, set each PD 3 at the screen number you wish it to play back. Then, using the PLAY link jack on the back panels, connect the PD 3.

To be sure of proper connection, use the diagram on page

There are five positions on the SCREEN SELECT switch of the PD 3. This makes possible playback of any three projectors per screen of shows produced on the SHOW PRO V.

SHOWING A "MIXED" SHOW

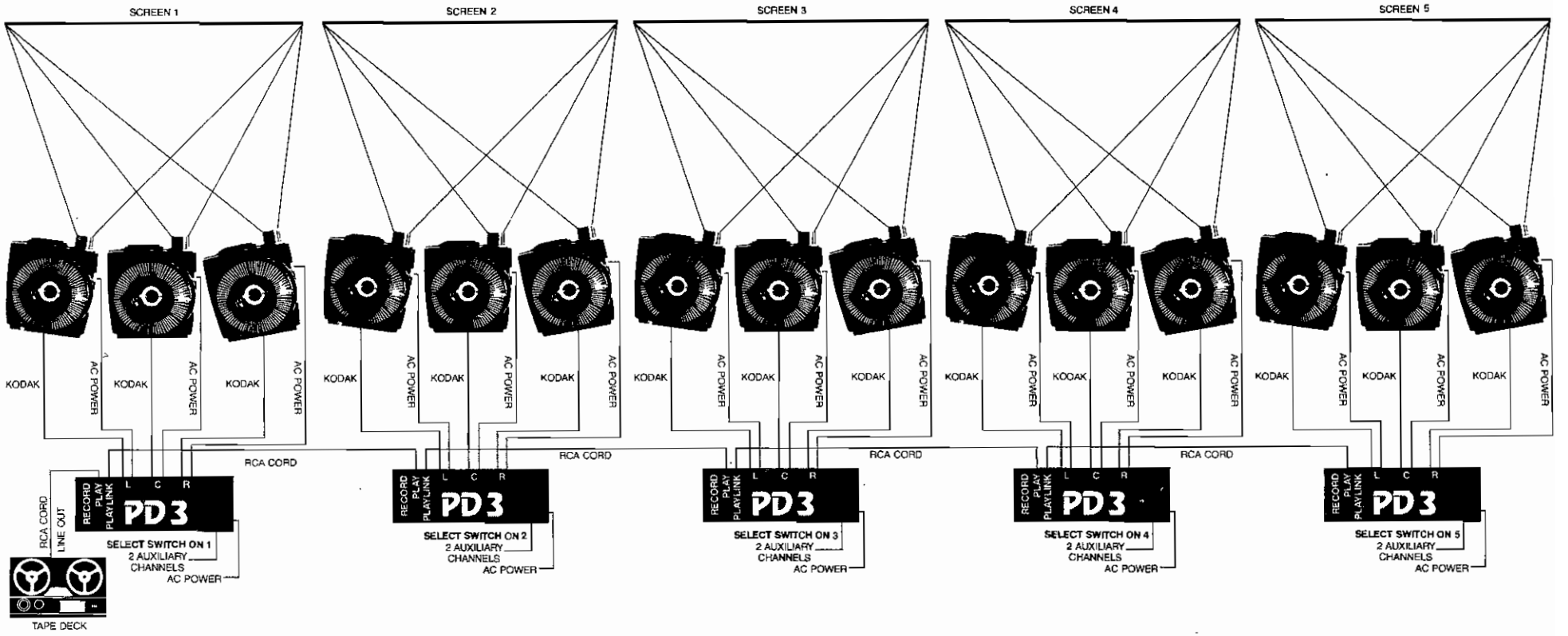
There may be times when you want to incorporate a "live" speaker into your canned show, with support slides in a manually controlled section. The AVL MARK II remote hand control allows remote forward commands of CUT and 2 SEC, plus REVERSE. The PD 3 will sequence left-center-right with each forward command.

NOTE:

When going from canned show to manual operation of your PD 3, it is necessary to push CLEAR. This will clear all residual presets left on the PD 3 from the canned show.

CONCLUSION

Your PD 3 is a remarkably effective instrument for injecting excitement into single screen slide shows, easy to work with and tolerant of errors. Experiment . . . create . . . and enjoy.


SCREEN 1
SCREEN 2
SCREEN 3
SCREEN 4
SCREEN 5
KODAK
AC POWER
RCA CORD
RECORD
PLAY
PLAY/LINK
L C R
PD3
SELECT SWITCH ON 1
SELECT SWITCH ON 2
SELECT SWITCH ON 3
SELECT SWITCH ON 4
SELECT SWITCH ON 5
2 AUXILIARY CHANNELS
AC POWER
RCA CORD
LINE OUT
TAPE DECK

SPARE PARTS LIST

ITEM NO.	QTY.	AVL PART NO.	DESCRIPTION
1	1	60-001	Transformer, 8V
2	1	60-005	Transformer, 28V
3	1	60-003	Transformer, Pulse
4	1	30-021	Bridge
5	1	34-001	LED, Red
6	1	34-002	LED, Green
7	1	34-003	LED, Amber
8	2	71-010	Switch, Pushbutton
9	1	72-001	Switch, Slide, 5 Position
10	1	72-007	Switch, Slide, DPDT
11	1	72-009	Switch, Slide, DPDT
12	1	73-001	Switch, Rocker
13	1	30-052	Triac
14	1	35-001	Voltage Regulator (+5V)
15	1	35-013	Voltage Regulator (+12V)
16	1	35-021	Voltage Regulator (–12V)
17	1	33-002	Transistor (Tip-35)
18	1	33-015	Transistor (Tis-37)
19	1	70-001	Relay
20	5	99-025	Fuse, 1 Ampere (AGC-1)
21	1	81-021	Connector, Female, EBY, 5Pin
22	1	81-022	Connector, Male, EBY, 5Pin
23	1	81-016	Jack, Audio, RCA-Type
24	2	99-010	Spacer, Shockmount, F/F
25	2	99-011	Spacer, Shockmount, M/F
26	4	99-001	Foot, Bumper
27	2	30-015	Diode, 1N4002
28	1		Asst. Hardware Package

SPECIFICATIONS

AUXILIARY CHANNEL: One momentary electrically isolated 3 amp carousel type male receptacle

MAGNETIC TAPE: Line level record and playback. Time division multiplex (digital) multiple pass with cycle redundancy check (CRC) characters and computer analysis on playback.

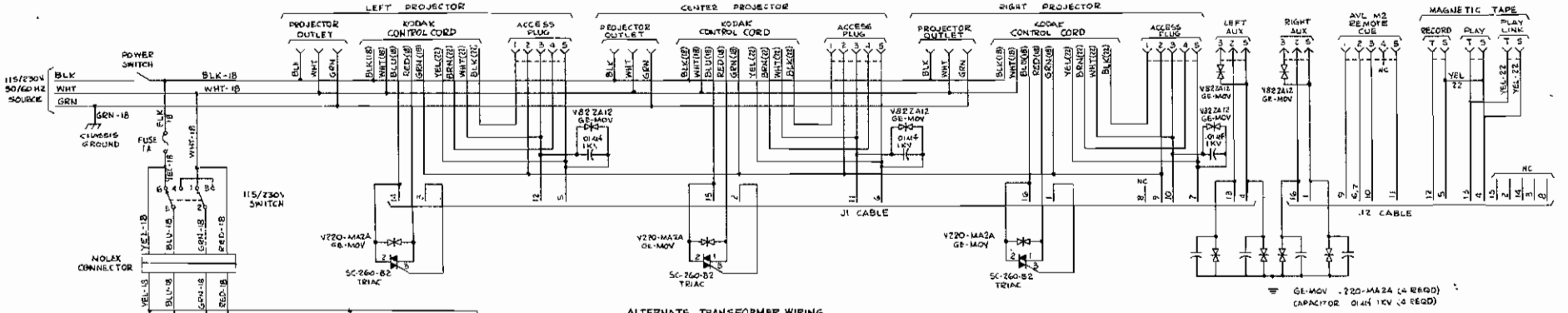
ELECTRICAL: 115/230 VAC, 50/60 HZ Switchable

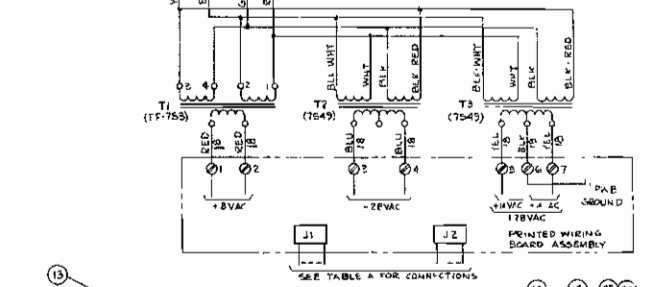
SIZE: H x W x D = 4" x 19" x 13½" (11 x 49 x 35cm)

WEIGHT: 15 pounds (7kg)

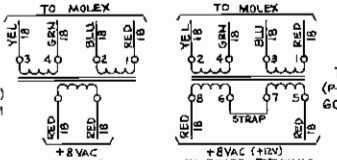
ORIGIN: Manufactured in U.S.A.

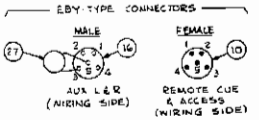
INTERCONNECTION DIAGRAM

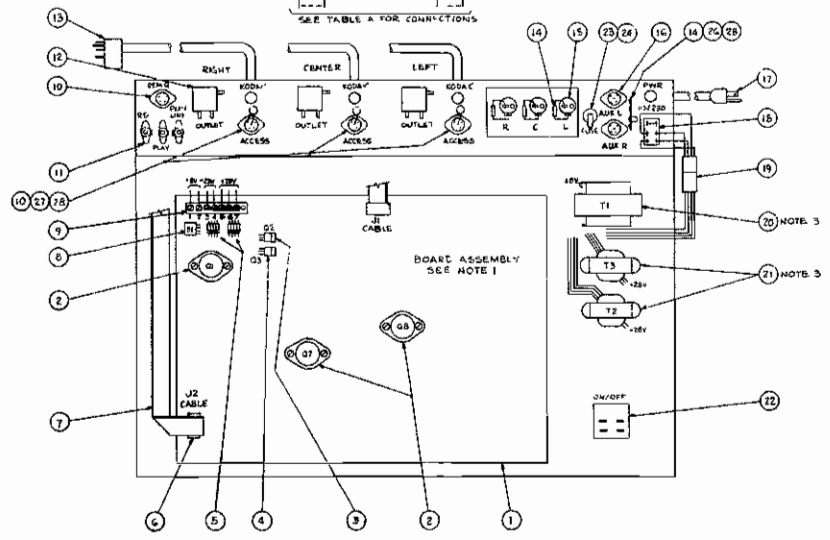




ALTERNATE TRANSFORMER WIRING







NOTES:

1. CAUTION - THIS ASSEMBLY CONTAINS MOS-TYPE DEVICES WHICH ARE SUBJECT TO ELECTROSTATIC (STATIC) CHARGES. INDIVIDUALS ANT TOOLS SHOULD BE GROUNDED BEFORE COMING IN CONTACT WITH THE ASSEMBLY OR DEVICES. BOARD ASSEMBLY MUST BE WRAPPED IN METALLIC FOIL FOR HANDLING AND/OR STORAGE
2. THIS COMPONENT IS LOCATED ON THE COMPONENT SIDE (FAR SIDE) OF THE PRINTED WIRING BOARD
3. THIS COMPONENT IS LOCATED ON THE BASE ASSEMBLY AND IS SHOWN IN ITS RELATIVE LOCATION WHEN THE COVER AND BASE ARE ASSEMBLED
4. BOARD ASSEMBLY PART NUMBERS
   PD2 - .16 93 006
   PD3 - .16 93 007

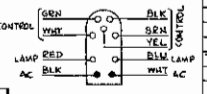


TABLE A

WIRE NO.	J1 CABLE	J2 CABLE	
16	RIGHT FIRE	RIGHT AUX-2	
1	RIGHT FIRE	RIGHT AUX-5	
15	CENTER FIRE	(NO CONNECTION)	
2	CENTER FIRE		
14	LEFT FIRE		
3	LEFT FIRE		
13	LEFT AUX-2	PLAY & PLAY LINK JACKS	TIP
4	LEFT AUX-5		SLEEVE
12	LEFT ACCESS-3 (REV)	RECORD JACK	TIP
5	LEFT ACCESS-5 (FWD)		SLEEVE
11	CENTER ACCESS-3 (REV)	REMOTE CUE (AVL M2 ONLY)	5 (DISSOLVE)
6	CENTER ACCESS-5 (FWD)		2 (FWD GRD)
10	RIGHT ACCESS-3 (REV)		3 (CUT)
7	RIGHT ACCESS-5 (FWD)		2 (FWD GRD)
9	ACCESS-2 (FWD GRD)		1 (REVERSE)
8	(NO CONNECTION)	(NO CONNECTION)	

ITEM NO.	PART NUMBER	MANUFACTURER	DESCRIPTION	NOTE
30				
29				
28	30-023	CENTRALAB	CAPACITOR, DISC, .01µF/1KV	
27	30-040	GENERAL ELECTRIC	GE-MOV SUPPRESSOR V822A12	
26	82-024		TERMINAL STRIP 4 POSITION	
25				
24	99-025	BUSSMAN	FUSE 1 AMPERE AGC-1	
23	99-020	LITTLEFUSE	FUSEHOLDER	
22	73-001	ALCO ELECTRONICS	SWITCH ROCKER, DPST	
21	60-005	ENSIGN	TRANSFORMER, STEPDOWN, 7549	3
20	60-001	ELEC WINDINGS	TRANSFORMER, STEPDOWN, EF-753	3
19	81-005(M), 81-006(F)	MOLEX	CONNECTOR 4 POS	
18	72-008	SWITCHCRAFT	SLIDE SWITCH, DPDT (115/230V)	
17	83-007	BELDEN	POWER CORD	
16	5-322	EBY	PLUG, MALE, 5 PINS	
15	30-052	GENERAL ELECTRIC	TRIAC, SEMICONDUCTOR SC-260-B2	
14	30-041	GENERAL ELECTRIC	GE-MOV SUPPRESSOR V220-MA2A	
13	83-001	AVL	CORD, PROJECTOR	
12	99-005	H.H. SMITH	RECEPTACLE, AC, WITH GRD	
11	81-016	H.H. SMITH	JACK, AUDIO (RCA-TYPE)	
10	81-021	EBY	JACK, FEMALE, 5 PINS	
9	32-044	VERNITRON	TERMINAL STRIP, BARRIER 8 POS	
8	30-021	MOTOROLA	BRIDGE	2
7	83-030	ALPHA	CABLE, RIBBON, 16 COND	
6	80-001	3M	CONNECTOR RIBBON CABLE	
5	30-015	ZTT	DIODE, SEMICONDUCTOR, 1N4002	2
4	35-021	MOTOROLA	VOLTAGE REGULATOR (-12V)	2
3	35-013	MOTOROLA	VOLTAGE REGULATOR (+12V)	2
2	35-001	MOTOROLA	VOLTAGE REGULATOR (+5V)	2
1	(SEE NOTE 4)	AVL	PRINTED WIRING BOARD ASSEMBLY	1

PROGRAMMABLE DISSOLVE SCHEMATIC AND SPECIFICATIONS

DRAWN BY: [illegible]
DATE: 1/16/77
APPROVED BY:
DESIGNED BY:

AUDIO VISUAL LABORATORIES, INC
ATLANTIC HIGHLANDS, NEW JERSEY 07716

D16 99 001

SHT 1 OF 1 | REV C

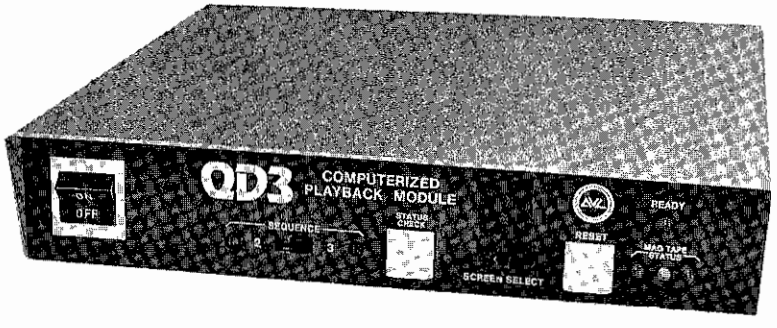
REV C 6/1/77
REV B 3/28/77 MODIFIED CKT; ADDED VIEWS
REV A 1/31/77 REV POWER CKT

Audio Visual Laboratories, Inc.

500 Hillside Avenue, Atlantic Highlands, New Jersey 07716 201-291-4400

QD3 and QD2

Computerized Playback Module



Operator's Manual

The professional team in multi-image programming systems.

-INSERT-

THE LATEST WORD ON QD'S

Since this manual went to print, two small improvements have been made in the operation of the QD.

STATUS CHECK

The status check operation has been simplified to eliminate confusion by non-technical operators with the lamp status digit. When the Status Check switch is pushed, the QD now responds simply and clearly with 6 digits. The first two digits indicate the position of the left projector tray. The next two digits indicate the position of the center projector tray. The next two digits indicate the position of the right projector tray.

NOTE: The QD assumes that "Home" position for all trays is zero. If you home your trays at tray position #ONE, then add one to the status number for exact tray position during show conditions.

MAG TAPE

The transformer input has been replaced by a high impedance RC networks. This allows up to five QD's to be connected to either high impedance tape decks or low impedance tape decks without the need for any amplification.

Simply stated, this means that you may connect any number of QD's up to your existing system and not worry about impedance matching problems.

INTRODUCTION

The QD3 and QD2 – AVL's Multi-Image Magic – Made Simple.

The QD2 controls 2 projectors, the QD3 controls either 2 or 3 projectors. Either QD is a super simple, super performance playback module for multi-image shows. Combine it with a tape deck and two or three projectors for a truly outstanding single screen show, or use it as a building block for a multi-media extravaganza.

You may use the power of an AVL Multi-Image Computer such as the AVL SHOW PRO V, SHOW PRO III, or PD system to program a dazzling AV show. The QD will then playback screen effects such as animation, super impositions, and fade to black. The QD has 20 dissolve effects including Hard Cut, Cut, 1 Sec, 2 Sec, 3 Sec, 4 Sec, 6 Sec, 8 Sec, 16 Sec, 32 Sec, Shift Alt, Alt, 1 Sec Alt, 2 Sec Alt, 3 Sec Alt, 4 Sec Alt, 6 Sec Alt, 8 Sec Alt, 16 Sec Alt and 32 Sec Alt. Programming your show is explained in the manual for the AVL programming system you select.

The QD automatically performs the show, verifies the program track, tests the projectors, tests itself, clearly indicates all status, shows the tray positions at the touch of a button, and returns all trays home at the end of your show.

Super Simple, Super Performance, Super Reliable – The AVL QD3 and QD2.

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Front Panel 3
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Hooking up Your System 5
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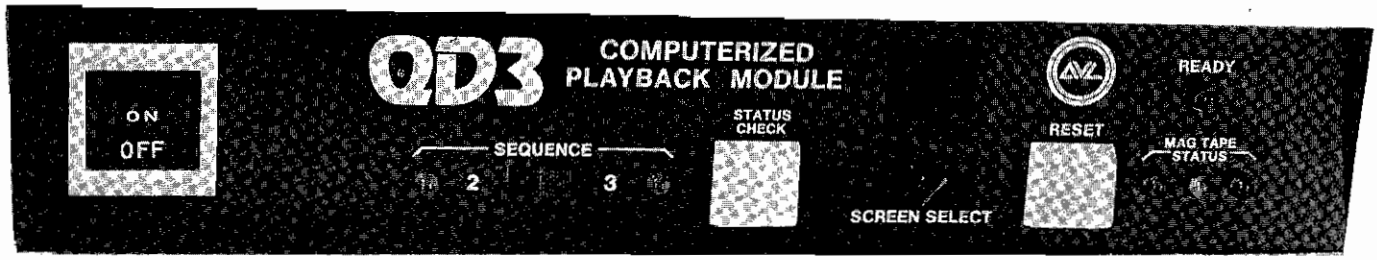
Checking Your System 6
Trouble Shooting Your System 6
Replacing a Lamp During a Show 7
Specifications 8



FRONT PANEL

The photograph shown is for the QD3. The QD2 does not have the Sequence 2/3 switch. The IEC units for use with SAV projectors have an additional fuse, and lamp switch not shown.

On/Off Switch

Activates power to the system when ON is pushed. When power is applied, the QD will initialize with projector lamps off, automatically test itself, and test the projectors. Within 2 seconds the following conditions should exist:

(1) Mag Tape Status LED's all OFF.
(2) READY LED ON
(3) Screen Select indicator displays 1, 2, 3, 4, or 5.
(4) (QD3 only) Sequence 2 LED or Sequence 3 LED ON. If any of these conditions do not occur, see the Trouble Shooting section.

Mag Tape Status LED's

These status indicator lights provide a continuous grading of the quality of program signal during playback. Each time a signal is received from the program track of audio tape, the Green LED will light momentarily. If the Green LED lights, or the Green and Amber LED's light, then the program signal is acceptable. If the Red LED lights, an unacceptable condition exists.

Ready LED

This LED will light shortly after power is turned on, indicating that all conditions appear Normal, and the QD is Ready for the first Program Cue. Each time a Program Cue is received, this LED will turn off until the screen action has been completed and the QD is Ready for the next Cue.

Reset Switch

This switch will turn the projector lamps off and return the projector trays to the Home position. Obviously, the operator should use this switch with discretion.

Screen Select Switch

Up to five QD's may be independently controlled by a single program track. If only one QD is being used, this switch should normally be set to 1. If more than one QD is being used, set each QD to its corresponding screen number.

Screen Select Indicator

This indicator will normally display number 1, 2, 3, 4, or 5 corresponding to the Screen Select Switch.

Status Check Switch

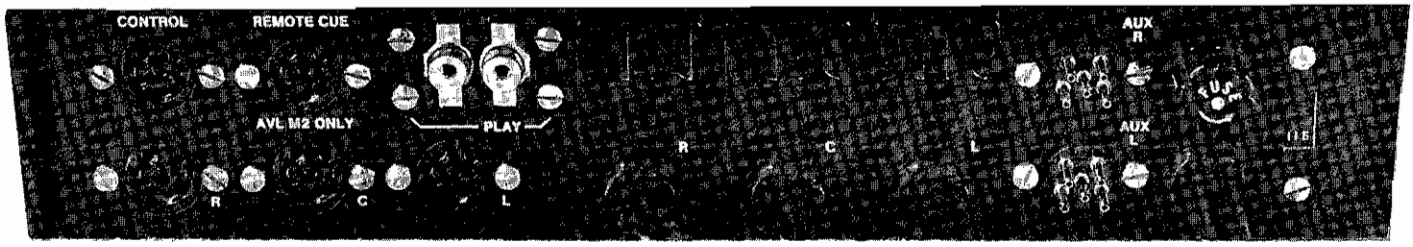
This switch may be used to check the tray position and lamp status of each projector, even during a programmed show. When this switch is pushed, the Screen Select Indicator will temporarily display the projector status and then return to a normal condition, displaying the selected screen number. For more information, see Checking Projector Status.

Sequence Switch (QD3 only)

When this switch is set to 3, the corresponding Green LED will light, and the QD3 will sequence through three projectors. The sequencing will be left, center, right, left, center, right, etc. unless controlled differently by the program signal. When this switch is set to 2, the corresponding Red LED will light, and the QD3 will function as QD2. The QD2 will sequence projectors left, right, left, right, etc. unless controlled differently by the program signal.

Lamp Switch (IEC units for SAV projectors only)

The SAV projectors do not have a lamp control switch like the Ektagraphic projectors. The QD Lamp switch will allow convenient slide alignment (Setup) and lamp replacement (Standby) on SAV projectors. The Green Ready LED will not light unless this switch is in the Normal position.



The photograph shown is for the QD3. The L relates to the LEFT projector, the C to the CENTER projector, and the R to the RIGHT projector. The QD2 is similar in layout except it has no center projector, and only one auxiliary. The IEC units for SAV projectors have similar layouts except they have the appropriate plugs and cords.

115/230 Switch

Always set this switch before applying power. This switch allows the QD to be used virtually anywhere in the world. The projectors should also be selected for the appropriate voltage. At 50 Hz we recommend SAV type projectors, at 60 Hz we recommend Ektagraphic projectors for optimum screen effects.

Left and Right Aux Plugs (QD2 has only one)

Two momentary, normally open contact closures for control of peripheral equipment such as additional slide projectors or 16 mm projectors.

Projector Control

For each projector the QD has a switched AC power receptacle, a projector control cable, and a projector access socket. Under normal conditions, the power and control cables are always connected. The projector access sockets may be used, if desired, for manual control of each projector.

Play Jacks

These jacks allow the QD to be connected to the program track of the audio deck. If only one QD is used, then one jack is used. If more than one QD is used, either jack may be used to link the QD's together, and to the audio. The jacks are RCA (phono) type, hard wired together, and electrically isolated from the chassis to avoid any ground loop problems.

Remote Cue Socket

Use an AVL M2 cord or equivallent for manual remote control of CUT, 2 SEC DISSOLVE, and REVERSE DISSOLVE. A standard Kodak control will cause a CUT when the FWD button is pushed.

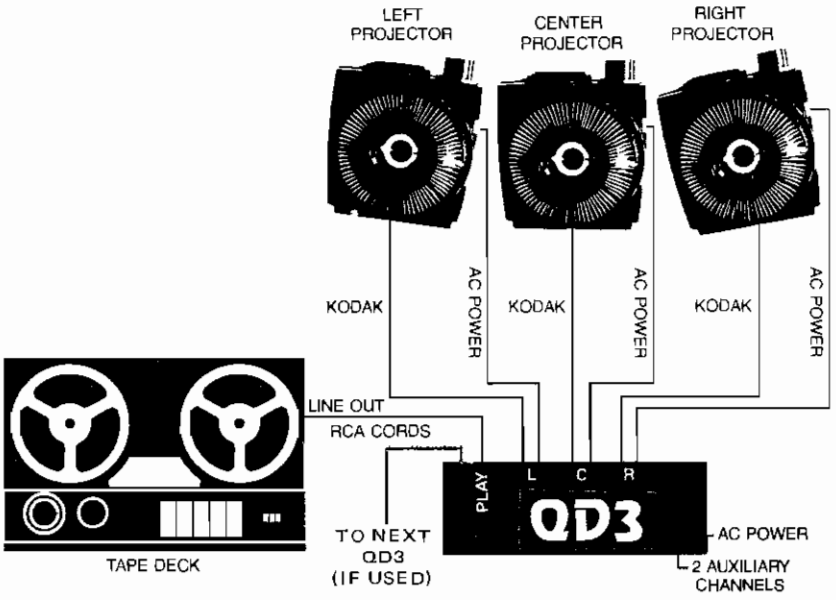
Control Socket

This socket is primarily intended for use in permanent exhibits, for indicating to a remote location that projectors are Home, and/or a trouble exists.

HOOKING UP YOUR SYSTEM

After reading and understanding the first two sections of this manual, preparing your QD for operation is very easy and requires relatively little time. A step-by-step approach follows:

1. Connect the power and control cords to the corresponding projectors.
2. Turn the projectors on. (Ektagraphics to FAN)
3. Connect Power to the QD. Check the 115/230 switch. Push ON.
4. Check that the READY LED comes on, Projector Lamps are off.
5. Set the Screen Select Switch and check that the Indicator corresponds.
6. Set Sequence switch to the number of projectors (QD3 only).
7. Connect the program track of the tape deck to one of the PLAY jacks.
8. Place slide trays on projectors, align and focus.
9. Set the trays to the exact positions you want as Home.
10. Run your show.



CHECKING PROJECTOR STATUS

As the program is running, the QD automatically remembers the projector tray position and lamp status. The projector status may be checked by pushing the STATUS CHECK. The QD will then sequence a series of seven digits on the Screen Select Indicator. The first two digits indicate the position of the left projector tray. The next two digits indicate the position of the center projector tray (only when three projectors are used). The next two digits indicate the position of the right projector tray. The last digit indicates which projector lamps are on and which lamps are off. This last digit has eight conditions (0 thru 7). Each number has a unique meaning, defined on the following page:

LAMP STATUS DIGIT	LEFT	CENTER	RIGHT
0	off	off	off
1	off	off	ON
2	off	ON	off
3	off	ON	ON
4	ON	off	off
5	ON	off	ON
6	ON	ON	off
7	ON	ON	ON

Astute observers may note that this is the OCTAL equivallent of the digit.

CHECKING YOUR SYSTEM

Your QD is designed to offer extremely high performance and rugged reliability. In addition, the QD has an impressive list of automatic test functions that will detect and help isolate any problem that may occur.

When you turn power on your QD, the Green Ready LED should come on within 2 seconds. A quick glance at the LED displays will verify that the Sequence Switch and Screen Select Switch are set properly. In that short time, you are assured of the following:

1. power is on the projectors
2. the projector lamps are OK
3. the power supply in the QD is OK
4. the central processor in the QD is OK
5. the mag tape circuit in the QD is OK
6. the display circuit in the QD is OK
7. the QD switches are all set properly

You could then run a portion of your show, checking that the Mag Tape Status Green LED blinks appropriately, the Red LED stays off, and the show runs properly. Rewind the tape and push RESET on the QD, checking that the trays return Home. You now know the following:

1. the audio system is OK
2. the program track and connecting cable are OK
3. the projector control circuit in the QD is OK
4. the projector cables are properly connected
5. the projector advance and reverse mechanisms are OK
6. the projector trays are set properly

You now have a high degree of confidence that your Show will run flawlessly.

TROUBLE SHOOTING YOUR SYSTEM

And if your system doesn't check out, then what? Your QD will help you isolate the problem very rapidly. Check for the following symptoms:

ACTION	SYMPTOM	PROBLEM
Turn Power ON	Neither Sequence LED lights up to normal brightness	Power problem. Check the power cord, the fuse, the 115/230 switch

ACTION	SYMPTOM	PROBLEM
	Ready LED doesn't light, Screen Select Indicator Flashes the following character A b c d, E, or F	 problem with left projector problem with center projector problem with right projector Internal problem with QD Check with AVL Service
Run Show	Mag Tape Status Green LED doesn't light. Show doesn't run.	No signal from program track. Check audio output level, check audio cable.
	Mag Tape Status Red LED blinks occassionally. Show runs OK.	Marginal audio tape. Try a fresh tape.
	Mag Tape Status Red LED stays on. Show doesn't Run.	Bad program signal. Check tape deck, audio cable, audio tape.
	Show always fails at same point on the audio tape.	Bad spot on audio tape or bad projector tray.
	One projector doesn't respond properly. Others OK.	Problem with projector, projector cables, or projector control circuit. Check cable; Replace projector; replace QD in that order.

REPLACING A LAMP DURING A SHOW

Now that you know your QD works, let us take an example of a show problem, and see how to correct it:

You are in the middle of a show, and you notice that the show is not running properly. Looking at the QD, you see the Screen Select Indicator flashing an "A" instead of displaying the selected screen number. You quickly scan your trouble shooting guide and see that the QD has detected a problem with the left projector. You examine the left projector and find that the lamp has burned out. In some critical show conditions, you may wish to correct the problem while you are "on the air" and save the rest of the show.

Turn the left projector off and replace the bulb. Cover the Lens and restore power. The QD stops flashing the "A", indicating the projector is now OK. Push the STATUS CHECK button. The first two digits indicate where the left projector tray should be. Advance the projector to that position. Remove the Lens Cover. Fantastic! You and your QD have saved the show.

SPECIFICATIONS

AUXILIARY CHANNEL: QD3 – 2 channels, QD2 – 1 channel. Each channel is a momentary, normally open contact closure, 25 volt AC/DC, 1 amp maximum, pin 2 to pin 5 on Kodak compatible plugs, (pin 2 to pin 3 on IEC DIN plugs)

MAG TAPE: Line Level, RCA (phono) jack, balanced input, ground isolated, time division multiplex (digital), multiple pass with CRC for reliability.

CONTROL SOCKET: SEE SPECIFICATION DRAWING 19 99 002

ELECTRICAL: 115/230 VAC, 50/60 HZ, 1 amp max internal draw.

PROJECTOR LAMPS: 1500 watts max, 12 amp max

SIZE: H x W x D = 2½" x 11" x 11" (7 x 28 x 28 cm)

WEIGHT: 10 pounds (4.5 kg)

ORIGIN: Manufactured in U.S.A.

SPARE PARTS LIST

PRINTED WIRING BOARDS

AVL PART NO.	DESCRIPTION
19 33 010	Screen Control PWB Assembly
19 33 011	Magnetic Tape PWB Assembly
19 33 012	Central Processor PWB Assembly
19 33 013	Power Module PWB Assembly
19 33 014	Display Module PWB Assembly

MECHANICAL PARTS

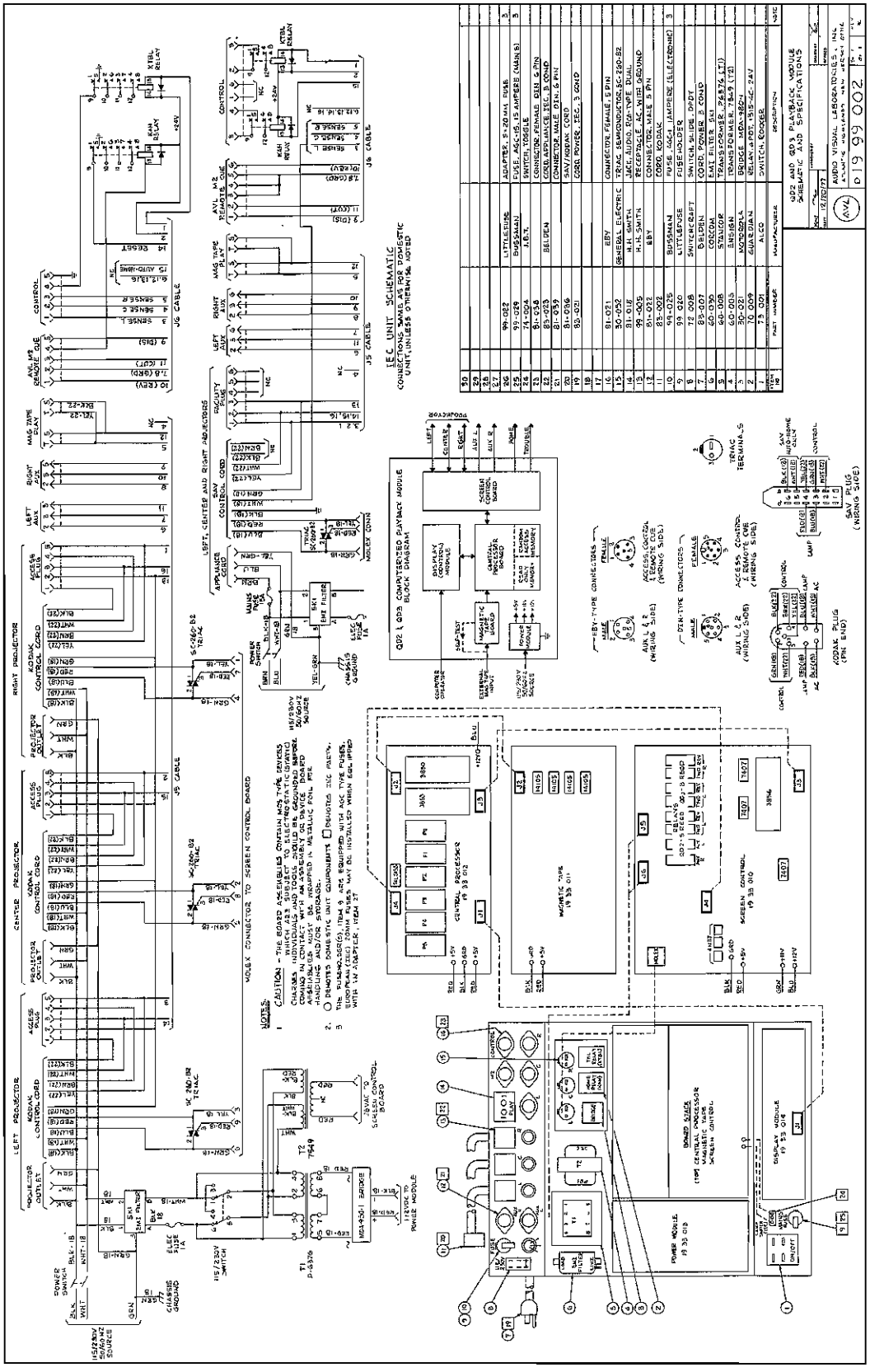
ITEM NO.	AVL PART NO.	DESCRIPTION
1	19 33 006	QD2 Heat Sink Assembly
2	19 33 007	QD3 Heat Sink Assembly
3	60-005	Transformer, 7549
4	60-008	Transformer, P-6376
5	60-030	Filter, 5K1
6	72-008	Slide Switch
7	73-001	Rocker Switch
8	81-018	Jack, Audio
9	81-021	EBY, Female
10	81-022	EBY, Male
11	83-001	Cord, Projector
12	83-007	Cord, Power
13	84-031	Strain Relief, Cord
14	99-001	Foot, Bumper

15	99-005	AC Outlet
16	99-010	Spacer, 88-4343 F/F
17	99-011	Spacer, 18-4343 M/F
18	99-021	Fuseholder
19	99-025	Fuse, AGC-1, 1AMP (Electronics)
20	70-009	Relay, 1315-4C-242
21	30-021	Bridge, MDA-980-1
22	30-054	Triac, SC-260-B2
23		Assorted Hardware Package

MECHANICAL PARTS (IEC UNITS ONLY)

ITEM NO.	AVL PART NO.	DESCRIPTION
1	74-004	Switch, Toggle, JMT-121
2	81-038	DIN Plug, Female
3	81-039	DIN Plug, Male
4	82-023	Terminal Strip, 3 Position
5	82-025	Terminal Strip, 5 Position
6	83-021	Cord, Power
7	83-023	Cord, Appliance
8	84-031	Strain Relief, Appliance Cord
9	99-029	Fuse, AGC-15, 15 AMP (for Mains)
10	99-022	Adapter Fuse, for use with 5 x 20 mm (IEC) fuses.

INTERCONNECTION DIAGRAM



Audio Visual Laboratories, Inc.

500 Hillside Avenue, Atlantic Highlands, New Jersey 07716 201-291-4400

Pocket Procall

VERSION 5 - POCKET PROCALL

THE PROFESSIONAL TEAM IN MULTI-IMAGE

PROGRAMMING COMMANDS

ENTER UNDER CODE HEADING

AT	ALTERNATE
FA	FAST ALTERNATE
1A	1 SECOND ALTERNATE
2A	2 SECOND ALTERNATE
3A	3 SECOND ALTERNATE
4A	4 SECOND ALTERNATE
6A	6 SECOND ALTERNATE
8A	8 SECOND ALTERNATE
16A	16 SECOND ALTERNATE
32A	32 SECOND ALTERNATE
CT	CUT
HC	HARD CUT
1D	1 SECOND DISSOLVE
2D	2 SECOND DISSOLVE
3D	3 SECOND DISSOLVE
4D	4 SECOND DISSOLVE
6D	6 SECOND DISSOLVE
8D	8 SECOND DISSOLVE
16D	16 SECOND DISSOLVE
32D	32 SECOND DISSOLVE

AX	AUXILIARY FOR DISSOLVES
BG	BLINK GO
BS	BLINK STOP
FZ	FREEZE
HOME	PROGRAMMABLE HOME
LD--	PROGRAMMABLE LOAD FILE xx
LG	LOOP GO
LL	LOAD LOOP
LS	LOOP STOP
N	NO OPERATION
PF	PROJECTOR FORWARD
PR	PROJECTOR REVERSE
PS	PRESET
RP0	REPEAT ZERO
RPX	REPEAT X (TO BE RESOLVED
RPxx	REPEATxx TIMES
S10	SPEED-10 CUES PER SECOND
S20	SPEED-20 CUES PER SECOND

SG	SMOOTH GO
SS	SMOOTH STOP
TBxx	TABxx
TMxx	TIME IN .01 SECOND STEPS
TX	TIME X (TO BE RESOLVED)
W.05-W10	WAIT IN .05 SECOND STEPS
WX	WAIT X (TO BE RESOLVED)

ENTER UNDER SCREEN HEADING

G	GO
S	STOP
P	PROCEED
12345	SCREEN NUMBERS ON OUT 1
67890	SCREEN NUMBERS ON OUT 2
ABC	A, B, C
LCR	LEFT, CENTER, RIGHT
TCB	TOP, CENTER, BOTTOM

CONTROL COMMAND FIELD ENTRIES

EDITING CONTROL COMMANDS

BPF	BEEPER OFF
BPN	BEEPER ON
BPN	BEEPER ON
CAC	CLEAR ALL CUES
CLN	CLEAR NOTES
CUES	DISPLAY TOTAL CUES
ESNx,y	EXCHANGE SCREEN NUMBERS
IAMxx	CHANGE OPERATORS NAME TO xx
KBF	KEYBOARD EDIT OFF
KBN	KEYBOARD EDIT ON
NEW	ESTABLISH NEW HOME POINT
NOTES	EXAMINE AND EDIT NOTES
PA	PROJECTOR ASSIGNMENT
PGMxx	CHANGE PROGRAM NAME TO xx
RCF	REMOTE CUE OFF
RCN	REMOTE CUE ON
RTCx,y	REPLACE TIMES CUES WITH TX
SEQ2	PROJECTOR SEQUENCE 2
SEQ3	PROJECTOR SEQUENCE 3
TOCx,y,±	TIME OFFSET CUES HH:MM:SS.FF
TPO	TRAY POSITION OFFSET
XSNx,y	EXPAND SCREEN NUMBERS

MEMORY/DISK DATA TRANSFER COMMANDS

APxx	APPEND FILExx
CNPxx	CLEAR NAME PROTECTxx
CWPxx	CLEAR WRITE PROTECTxx
DELxx	DELETE FILExx FROM DISK
DLCxx,yy	DELETE CUES xx TO yy
DSKx	USE DISKx
INSxx	INSERT FILE NAMEDxx
LDxx	LOAD FILE NAMEDxx
LIB	LIBRARY
NLDxx	NOTES LOADxx
NPRxx	NAME PROTECTxx
NSVxx	NOTES SAVExx
PACK	PACK DISK
RNMx,y	RENAME FILE x AS y
SV	SAVE
SVxx	SAVE WITHxx AS FILE NAME
SCxx, yy, nn	SAVE CUES xx TO yy AS nn
WPRxx	WRITE PROTECT FILExx

MAG TAPE CONTROL COMMANDS

CEM	CLOCK EDIT MODE
CIM	CLOCK INPUT MODE
COM	CLOCK OUTPUT MODE

COM HH: MM:SS.FF	CLOCK OUTPUT BEGINNING AT TIME HH:MM:SS.FF
MIF	MAG TAPE INPUT OFF
MIN	MAG TAPE INPUT ON
MLD	MAG TAPE LOAD
MOF	MAG TAPE OUTPUT OFF
MON	MAG TAPE OUTPUT ON
MSV	MAG TAPE SAVE
MTD	MAG TAPE DUMP (SP V)
PIF	POSITRAK INPUT OFF
PIN	POSITRAK INPUT ON
POF	POSITRAK OUTPUT OFF
PON	POSITRAK OUTPUT ON
STL	SET LEVELS
VER	VERIFY (MSV ONLY)

COMMANDS FOR PERIPHERAL EQUIPMENT

RAVEN PROGRAMMING COMMANDS

FFxx	FILM FWD @ xx FRAMES PER SECOND
FRxx	FILM REV @ xx FRAMES PER SECOND NOTE: 1, 2, 3, 4, 6, 8, 12, 18 OR 24 FPS
FFS	FWD STEP THE FILM ONE FRAME
FRS	REV STEP THE FILM ONE FRAME
FS	FILM STOP
FB	FILM BEGIN POINT
=	xxxxx (1-65535)
FE	FILM END POINT
=	xxxxx (1-65535)

FTN	FILM TRACKING ON
FTF	FILM TRACKING OFF
Fx	FILM SPD CHANGE ×x% (1-6)
F-x	FILM SPD CHANGE -x% (1-6)
F0	FILM SPEED NORMAL
MN	MOTOR ON
MF	MOTOR OFF
LN	LAMP ON
LF	LAMP OFF

RAVEN EDITING COMMANDS

AF	ASSIGN FILM SCREEN NUMBERS
FS(x)=	FILM FWD ONE FRAME
FS(x)-	FILM REV ONE FRAME (x) = SCREEN #
FOCx,y,=/-	FRAME OFFSET CUES × OR -

X-15 PROGRAMMING COMMANDS

XS	SHORT PULSE	**XN**	LATCH ON
XL	LONG PULSE	**XF**	LATCH OFF

PRINT COMMANDS

PRINT	PRINTS CUES AND NOTES
SPDxxx	SET BAUD RATE FOR PRINTER
PBH	PRINTER BUSY HIGH
PBL	PRINTER BUSY LOW
NPB	NO PRINTER BUSY
PLP	PARALLEL LINE PRINTER
SLP	SERIAL LINE PRINTER
PLB	PRINT LIBRARY

EDITING COMMANDS

CTRL/A	ADD-A-CUE
CTRL/B	REVERSE TO LAST TAB
CTRL/C	CONTROL COMMAND FIELD
CTRL/D	DELETE CUE
CTRL/F	FILM DISCONNECT/NORMAL
CTRL/G ENTER	HOME PROJECTORS
CTRL/G--	GOTO CUE--
CTRL/G,T,M	GOTO TIME HH:MM:SS.FF
CTRL/K	REVERSE TO PREVIOUS GO
CTRL/N	DISPLAY NOTES/NORMAL
CTRL/P	SLIDES DISCONNECT/NORMAL
CTRL/Q	STEP REVERSE CUE
CTRL/R	REPEAT PREVIOUS CUE
CTRL/S	STANDBY
CTRL/T	GOTO NEXT TAB
CTRL/T,xx	GOTO TABxx
CTRL/X	AUX DISCONNECT/NORMAL
CUE	CUE
ENTER	ENTER
ESC	ESCAPE
Q	STEP CUE
REPEAT	REPEAT DEPRESSED KEYS
RETURN	SAME AS ENTER
RUB OUT	CLEAR ENTRY
↑	REVERSE CUE
←	CURSOR LEFT
→	CURSOR RIGHT

SERIAL & PARALLEL PRINTER COMMANDS

PRINT MEMORY TRANSFER TO PRINTER. CAUSES A HARDCOPY PRINTOUT OF CUES CURRENTLY STORED IN MEMORY.

PLB PRINT ALL FILE NAMES OF THE PROGRAMS STORED ON THE DISK.

SERIAL PRINTER COMMANDS

SLP WILL DIRECT ALL PRINT OPERATIONS TO THE SERIAL LINE PRINTER PORT A.

SPD BAUD RATE (BITS/SEC) THE BIT SPEED EAGLE WILL OUTPUT TO A PRINTER. THE EAGLE CAN RESPOND TO THE FOLLOWING BAUD RATES 110, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200 AND 9600

NPB THIS COMMAND IS USED IF THE PRINTER THAT IS BEING INTERFACED TO THE EAGLE DOES NOT USE A PRINTER BUSY SIGNAL (No Printer Busy)

PBL THIS COMMAND IS USED IF THE PRINTER THAT IS BEING INTERFACED TO THE EAGLE GENERATES A LOW PRINTER BUSY SIGNAL (Printer Busy Low)

PBH THIS COMMAND IS USED IF THE PRINTER THAT IS BEING INTERFACED TO THE EAGLE GENERATES A HIGH PRINTER BUSY SIGNAL (Printer Busy High).

PARALLEL PRINTER COMMANDS

PLP WILL DIRECT ALL PRINT OPERATIONS TO THE PRINTER ON PARALLEL PORT B.

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Enhanced PROCALL

User's Manual

Audio Visual Laboratories

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Enhanced Procall User's Manual

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Enhanced Procall User's Manual

1. REVISIONS

02-20-91 Enhanced Procall Version 2.2

2. INTRODUCTION

2.1 GENERAL

AVL's Enhanced PROCALL provides total creative freedom for those of you creating multi-media productions. Enhanced PROCALL's rich vocabulary of commands allows you to integrate a variety of audio visual devices including:

- o Slide Projectors
- o VCR's
- o Laser Disc and CD players
- o Tape players
- o Lighting
- o Lasers
- o Motorized curtains and screens
- o *and many more....*

Precise synchronization of events to SMPTE/EBU/AVL time codes can be programmed simply and efficiently. Reliable performance is assured by Positrak, a feature pioneered by AVL which allows AVL systems to automatically recover from interruptions or communications errors. Like PROCALL 5 and X, the user interface provides mnemonic command abbreviations for easy programming.

2.2 HISTORICAL NOTE

The original implementations of Procall, Procalls 5 and X, are today the standards for Multi-image programming throughout the world. Enhanced Procall maintains the same user interface and cues as its predecessors, while providing some new cues and show editing features. The new cues provide more powerful control of slide projectors and equally important provide control for other devices which are used in conjunction with slide projectors to create Multi-Media extravaganzas.

Enhanced Procall is compatible with Procalls 5 and X. Procall 5 or X programs are automatically converted to Enhanced Procall when editing an old program for the first time. Some differences between Procalls 5, X, and Enhanced make it impossible to perform a 100% conversion of the older programs. However, once read in by Enhanced Procall, a Procall 5 or X program should require little or no further editing.

Since the introduction of Procall 5 for programming Multi-image shows controlled by Doves, AVL has expanded its line to include the controlling of:

- o lighting
- o motors
- o audio switching/volume
- o video switching/fading
- o RS-232 controllable devices

For this reason the descriptions of cues are intentionally generic and not directed solely at slide projector control.

2.3 ENHANCED PROCALL CUE (COMMAND) OVERVIEW

This section describes Enhanced PROCALL cues which apply when using the AVL's Genesis Computer system or DOS computers with AVL's Genesis hardware (Genesis Board or Super Genesis I/O) to create multi-media productions.

2.3.1 CONTROL CUES

Enhanced PROCALL control cues are built around six basic control parameters:

- o Rates -- 230 different speeds; 0.0 - 19.9 in 0.1 second increments and 20 - 60 in 1 second increments.
- o On/Off -- Both absolute and relative on/off operation
- o Ramps -- 5 different curves a rate change can follow; they are Normal, Sunrise, Pop, Rapid, Uniform.
- o Min/Max -- settings from 0 - 100%
- o Open/Close -- Both pulsed and latched Open/Close relay operation
- o Position -- 81 positions, 0 - 80

Cues using these parameters take on special meanings based upon the AVL controller receiving the cue. Table 1.1 lists AVL controllers along with their relation to the control parameters.

2.3.2 TIMING CUES

This set of cues allows for synchronization of control cues to each other and/or to external audio or time code.

- o Time -- specify time for next cue to execute
- o Wait -- specify delay before executing next cue

2.3.3 OTHER CUE TYPES

In addition to cues constructed using the five basic control parameters and the timing cues previously described, Enhanced Procall has two other cue types:

- o Repeat -- cues can be grouped and executed the number of times specified by the repeat
- o Loops -- cues can be grouped and loaded into AVL controllers for synchronized execution. By loading different cues into the different controllers, multitasking can be achieved.

	Rate	On/Off	Ramp	Min/Max	Open/Closed	Position
Dove* - Slide projector controller (also known as "dissolver")	duration for projector lamp on or off transition	toggle or set projector lamp	curve for projector lamp transitions to follow	levels to transition on or off to with the projector's lamp	relay to be pulsed	slide tray position
Room-Mate - Lighting controller	duration for lamp on or off transition	toggle or set lamp	curve for transitions to follow	levels to transition on or off to with the lamp	relay to be pulsed	not used
Super Switcher - Audio/Video switcher with volume control and video fading	duration for audio or video transition up or down	select mix or fade through black for video switching	curve for transitions to follow	not used	audio source and destination selections	audio volume level and Video source selections
Super X-15 - Controller for peripheral or auxiliary devices which operate from switch closures (GPI's).	not used	not used	not used	not used	relay to be pulsed or latched	not used
Super Fader - Video fader	duration for video transition up or down	toggle or set video output	curve for transitions to follow	levels to transition up or down to with the video	relay to be pulsed	not used
A-4 - Analog (0-10V) output unit (for light dimmers and other analog voltage controllable devices)	duration for voltage transition up or down	not used	curve for transitions to follow	not used	not used	voltage level
Stepper - Stepper motor controller (for zoom lens and other stepper motor driven devices	duration for movement	not used	curve for movement to follow	not used	not used	point for motor to step to

Table 1.1 Usage of six basic control parameters with AVL controllers

* Doves are available in 4 different versions:
1) Dove X^2
2) Super Dove
3) M-Dove
4) Pro Travler X^2

2.4 ADDED FEATURES WHEN USING SUPER GENESIS I/O

The Super Genesis I/O provides several extremely useful features for multi-media programming and playback. Enhanced PROCALL supports these features in conjunction with the Super Genesis I/O only.

2.4.1 SEND MESSAGE CUE

In addition to the cues described previously, the Super Genesis I/O also supports the send message cue. The **send message cue** provides the ability to send ascii or hexadecimal strings; the strings are sent via the Super Genesis I/O's keyboard port.

2.4.2 RAM CARTRIDGE

Ram Cartridge is a credit card sized memory which can be programmed and played back through the Super Genesis I/O. This feature provides the benefits of running from a computer without requiring the computer. Among these benefits are:

1) playback in sync with time code which means:
   - -last minute changes can be made without the time consuming and costly process of re-recording the audio.
   - -only one audio track required
   - -AVL controllers can be mixed with other controllers capable of running from SMPTE, EBU, or AVL time codes.
2) advanced speaker support capabilities.

PLEASE CONTACT AVL IF YOU REQUIRE THIS FEATURE. IT IS NOT PROVIDED IN THE STANDARD RELEASE.

2.4.3 TAPETRAK

Improves the efficiency and accuracy of editing and fine tuning shows. Like Positrak, which ensures that projectors and other devices connected to AVL controllers are always correctly synchronized to your show, Tapetrak automatically positions the tape deck in relation to your current position in the cue list (program).

2.4.4 TAPE REMOTE CONTROL

Function keys can be used to control the tape remotely from the computer's keyboard.

2.5 TIME CODES

2.5.1 AVL TIME CODE

AVL's time code is a digital time code which allows time-syncing of cues to the audio track. Enhanced Procall can generate AVL Clock information for recording on your show tape. Enhanced Procall can also read this Clock information and use it to synchronize cues.

2.5.2 SMPTE and EBU

Enhanced Procall also offers the options of being compatible with SMPTE or EBU timing codes.

Enhanced Procall will accept SMPTE input and generate SMPTE output. The SMPTE (Society of Motion Picture and Television Engineers) time code is the standard timing and control code used by the motion picture and television industries today. SMPTE is used to mark and drive video tape decks, audio tape decks, and other electronic devices that interface with video, and was primarily designed to control film and video editing. It provides for:

* Running shows at speeds based on 30 frames per second time codes.
* Running shows using video decks as well as the multi-image computer system.
* Running shows with all the components synchronized to one timing and control code.

SMPTE is like AVL's Clocktrak in that it is a digital timing code which can be used to time cues. All rules concerning AVL Clocktrak programming apply to SMPTE.

EBU (European Broadcast Union) is similar to SMPTE. The main difference is the frame rate. The EBU frame rate is 25 frames per second.

2.6 AVL POSITRAK

Positrak locks your program to the audio track, and will automatically resync your show if a tape error occurs. In addition, during editting and fine tuning, Positrak will cause the devices connected to AVL controllers to "catch up" following a tape fast forward or rewind.

3. ADDRESSES AND ASSIGNMENTS

Enhanced Procall supports the addressing of two basic device types. The first is capable of executing only Open/Close cues. The second is capable of executing any type of cue. The reasons for these types is historical and has been maintained for compatibility. The first AVL unit to execute Open/Close cues was the X-15, for this reason addresses for this device type are reffered to as X-15 addresses. The first unit to execute all other cues was the Dove, for this reason addresses for this device type are referred to as Dove addresses.

In all, Enhanced Procall supports upto 120 unique Dove addresses and 120 unique X-15 addresses. The 120 unique Dove addresses are A-O on 4 separate logical channels (channels A,B,C, and D) and 2 separate physical Banks (Outputs) (Out 1 and Out 2). Devices on different banks can be programmed on a single cue line.

> PLEASE CONTACT AVL IF YOUR PRODUCTION REQUIRES LOGICAL CHANNEL ADDRESSING (i.e., more than 30 Dove addresses or more than 30 X-15 addresses) IT IS NOT PROVIDED IN THE STANDARD RELEASE.

Table 2.1 summarizes the address structure of the different AVL controllers.

	Dove Addresses required	X-15 Addresses Required	Devices Controlled
Dove X²/Pro Travler X² - Slide projector controller (also know as "dissolver")	3	0	3 Slide Projectors
Super Dove - Slide projector controller (also known as "dissolver")	3	0	3 Slide Projectors
M-Dove - Slide projector controller (also known as "dissolver")	4	0	4 Slide Projectors
Room-Mate - Lighting controller	3	0	3 Incandescent lighting circuits
Super Switcher - Audio/Video switcher with volume control and video fading	3	15	8 stereo pairs of preamp audio, 4 stereo pairs of amplified audio and 4 NTSC/PAL Composite video inputs
Super X-15 - Controller for peripheral or auxiliary devices which operate from switch closures (GPI's).	0	15	15 low voltage relay controllable devices
Super Fader - Video fader	2	0	NTSC/PAL Composite or RGB video
A-4 - Analog (0-10V) output unit (for light dimmers and other analog voltage controllable devices)	4	0	4 devices controllable by 0-10 volt outputs.
Stepper - Stepper motor controller (for zoom lens and other stepper motor driven devices	4	0	4 stepper motors

Table 2.1 AVL Controller Address Usage

For specific applications, where devices are accessed in groups, a screen number address can be used in Enhanced Procall as with older versions of Procall. This screen number allows for multiple (up to six) Dove addresses to be assigned to any of 9 different screen numbers. This ability to configure Enhanced Procall's interface, while useful, is not essential and is described in further detail in the Appendix C.

4. GETTING STARTED

4.1 GENERAL

This chapter describes the Enhanced Procall programming panel (screen). This chapter should be reviewed while at your AVL Genesis computer (or DOS computer with AVL Genesis hardware).

4.2 PROGRAMMING PANEL

The Programming Panel consists of three areas: the Control Command Area, the Bank A and Bank B Status Display Area, and the Cue Area.

To get the programming panel up on the screen, displaying the standard format, follow the procedure outlined below.

a. Place the Enhanced PROCALL diskette into DRIVE A.
(The contents of the diskette can be copied onto the hard drive for direct execution from there; if this is not done, it is recommended that a backup copy of the diskette is made.)

b. Turn AVL Genesis on. When the DOS prompt appears type in:
ep<cr>

c. When the following prompt appears on the screen:

HELLO, I AM GENESIS FROM AVL. WHAT IS YOUR NAME?

Type your name and press the RETURN key. Or, if you do not wish to enter your name, merely press RETURN.

d. When the prompt:

HI THERE NAME. NICE TO MEET YOU.

WOULD YOU LIKE TO:

(1) CONTINUE WITH THE STANDARD FORMAT

(2) CREATE YOUR OWN FORMAT
(Custom formats described in Appendix)

(3) USE A FORMAT PREVIOUSLY CREATED

appears on the screen, hit the 1 key.

e. When the prompt:

PLEASE NAME YOUR PROGRAM AND WE CAN BEGIN

is displayed on the screen, type the name of the program and press RETURN.

NOTE: If you do not want to name the program, press RETURN and the program will be named DEMO1. However, if you save the program it will write over any DEMO1 program already existing on the disk.

4.2.1 THE COMMAND AREA

A LINE-BY-LINE description of the programming panel follows.

TOP LINE

This line contains the program name and the name of the operator. The space provided for the program title is 8 characters long and the operator name space is 25 characters long. If you skip over the "HELLO" sequence using the RETURN key, the program title will default to DEMO1, and the operator name will be blank.

The far right side of the top line indicates the Enhanced Procall version number.

SECOND LINE

This line contains the Programming MODE selection. The possibilities are MT BYPASS (magnetic Tape Bypass), CLOCK EDIT (Clock Edit Mode), CLOCK INPUT (Clock Input Mode), CLOCK OUTPUT (Clock Output Mode), MT SAVE (Mag-Tape Save), and VERIFY (Verify MT SAVE).

The space to the right of the MODE selection is reserved for cue output mode. Where the displays are:
- o PD (projector disconnect)
- o AD (Auxiliary disconnect)
- o SBY (Standby mode)

The space to the right of MODE selection is reserved for incoming data display. When the system receives cue information from either magnetic tape or another AVL programmer, this line will display the word AMP if the data is of sufficient amplitude. MT POOR is displayed if the incoming data has some distortion in it, but the system is still be able to decode the cue. If the data is so distorted as to be unreadable by the system, MT BAD and the cue number of the distorted cue will be displayed. When no data is received by the system the display will remain blank.

CLOCK DISPLAY

The Clock Display is located on the right hand side of the screen on the second line. This clock acts as a free running timer as well as a display for Clocktrak from magnetic tape in either CLOCK EDIT or CLOCK INPUT mode.

CUE SPEED DISPLAY

When running at 20 cues per second the area to the right of the CLOCK DISPLAY will indicate 20 CPS.

THIRD LINE

This is the CONTROL COMMAND field and the command types entered in this field are described in Chapter 5.

This also indicates the Genesis hardware configuration (i.e, a Genesis Board or a Super Genesis I/O). If a Genesis board is being used this area will display BOARD. If a Super Genesis I/O is being used this area will display COM1 or COM2 and TTOFF or TTON, for indications of which com port is connected to the Super Genesis I/O and whether Tapetrak is on or off, respectively.

FOURTH LINE

This line is the Status line. When certain normal features have been disabled by the user, it will be indicated on this line, e.g. RCF (Remote Cue Off) or KBF (Keyboard Output Off). This line also functions as a display for AVL Genesis system comments such as "STANDBY FOR GOTO".

4.2.2 BANK A/BANK B STATUS DISPLAY AREA

This area is used to give you a constant display of status. Its shows the current position of each Dove address. If the position is displayed in reverse video, then the corresponding Dove address is in the up or on state. The status area contains two sections referred to as BANK A (OUT 1) and BANK B (OUT 2). Each bank can have up to 15 Dove addresses, a maximum of 9 groups, and a possibility of 6 Dove addresses per group depending on how the Dove addresses were configured (see the Appendix for information on custom configurations). The default configuration has 5 groups with 3 Dove addresses per group on each bank.

4.2.3 THE CUE AREA

This area contains the cue number, cue code, cue description, ramp type, and the BANK A (OUT 1) and BANK B (OUT 2) addresses.

CUE NUMBER

Each cue has a number which can be used an address for Goto commands.

CUE CODE

This area is for the various programming codes, as described in Chapter 5.

CUE DESCRIPTION

After the code is entered, the system will use this area to feed back to you a more complete statement describing the cue. This serves as a check on the code entry process and makes the program more legible.

CUE RAMP PARAMETER

This area is used for one of the five transition ramps described in Chapter five.

BANK A (OUT 1) and BANK B (OUT 2) ADDRESSES

This area is used to specify more of the 15 addresses A-O for the cue.

RUN

This is used to indicate that the program in the system is executing. While a program is executing the RUN heading will appear as reverse video (black characters against a green background).

4.3 DOS BATCH FILES

Enhanced PROCALL programs can be automatically loaded and run from DOS batch files. Doing this requires that a few simple steps be followed.

1) Configuration file named "c#show.asg" must exist. The contents of this file describe the configuration to be used. A "c#show.asg" with the standard configuration is provided with Enhanced PROCALL. Custom configurations can also be used (see Appendix C).

2) Program must be named "showtime".

3) batch file must change working directory to directory containing the Enhanced PROCALL executable "ep.exe", the "c#show.asg", and the "showtime.eue" files

5. ENHANCED PROCALL COMMANDS

5.1 GENERAL

This chapter details all the commands that are valid under Enhanced PROCALL. A summary of these same commands is contained in Appendix A.

5.2 GETTING HELP DURING PROGRAMMING

A special HELP key (F1) can be used at any time during programming by simply pressing the key. POCKET PROCALL will be displayed one page at a time. To move on to the next page, press Return. At the end of the help file, Return will bring you back to your program.

If you are not interested in seeing each page, ESC can be pressed at any time to return you back to the programming field.

5.3 PROGRAMMING COMMANDS

5.4 COMMANDS ENTERED UNDER THE CODE HEADING --"CUES"

5.4.1 DISSOLVE CUES (TRANSITION CUES)

These cues specify a transition from one state to another. For example, in a multi-image show a transition cue may specify fading down one slide projector and at the same time fading up another projector. In performing this type of action the following parameters are specified:

- o rate
- o ramp
- o position step

ALTERNATE DISSOLVES

These cues are used to toggle from one state to another at a defined rate and according to one of five ramps.

xx.xA XX.X sec toggle transition, where XX.X can be any value in the following ranges:

- -- 00.0 - 19.9 in 0.1 second increments
- -- 20 - 60 in 1 second increments

Example usage: Control of slide projectors in Multi-Image shows

Initial state--slide projector A on and B off

4.2A 4.2 SEC ALTERNATE NORMAL AB

Next state--slide projector A transitions off and B transitions on in 4.2 seconds.

DISSOLVES

These cues are used to toggle from one state to another at a defined rate and according to one of five ramps. Unlike ALTERNATE DISSOLVES which do not affect the position parameter, DISSOLVE cues also increment the position parameter down/off going device.

xx.xD XX.X sec toggle transition with an increment of position, where XX.X can be any value in the following ranges:

-- 00.0 - 19.9 in 0.1 second increments
-- 20 - 60 in 1 second increments

Example usage: Control of slide projectors in Multi-Image shows

Initial state--slide projector A on and at tray position 20 and B off and at tray position 19.

19.9A 19.9 SEC DISSOLVE NORMAL AB

Next state--slide projector A transitions off and B transitions on in 19.9 seconds. Once projector A's lamp reaches its minimum level, its tray position is incremented.

For compatibility with older version of PROCALL six predefined ALTERNATES and DISSOLVES are included in Enhanced PROCALL. They are:

CUE	Description	Equivalent
FA	FAST ALTERNATE	.0A
AT	ALTERNATE	.5A
SA	SOFT ALTERNATE	.7A
HC	HARD CUT	.0D
CT	CUT	.5D
SC	SOFT CUT	.7D

ON/OFF

These cues define transitions to the on(up) or off(down) state.

xx.xN Transition to the up level in XX.X seconds.

Example Usage: Control of room lighting with AVL's Room-Mate

Initial state -- room lighting state not known and it is desired to turn the lights on.

4.3N 4.3 SEC LAMP ON A

Next state -- room lighting transitions on in 4.3 seconds. NOTE: if lights were on nothing happens.

xx.xF Transition to the down level in XX.X seconds.

5.4.1.1 DISSOLVE OPTIONS

Three transition options are provided in Enhanced Procall.

RAMPS

The first, is part of every transition cue and it defines the transition ramp curve. The Mnemonic for the ramp curve is entered after the transition cue. The ramp curves allowed are:

Ramps	Mnemonic
NORMAL	N
SUNRISE	S
POP	P
RAPID	R
UNIFORM	U

MIN/MAX

The second and third transition options are the minimum and maximum levels for a transition to reach. These variables are set using the MIN and MAX cues. Once set, they remain in effect until they are reset. The default values are 0% for MIN and 100 % for MAX.

Example usage: Control of slide projectors in Multi-Image shows

Initial state--slide projector A on and B off

```
MI20 MINIMUM 20%              A
MA80 MAXIMUM 80%               B
4.2A 4.2 SEC ALTERNATE  UNIFORM  AB
```

Next state--slide projector A transitions to the 20% level and B transitions to the 80% level in 4.2 seconds. The ramp curve selected is UNIFORM.

5.4.2 POSITION CUES

These cues update the position parameter. In multi-image shows these cues are used to position the slide tray.

PF (PROJECTOR FORWARD)

This cue increments the position parameter by one.

Example usage: Slide projector control in multi-image shows

Initial State -- Projector A on position 23 and Projector b on position 24

```
PF  PROJ FORWARD       AB
```

Next state -- Projector A on position 24 and projector b on position 25.

PR (PROJECTOR REVERSE)

This cue decrements the position parameter by one.

TPXX (TRAY POSITION)

This cue sets a new tray position.

Example usage: Slide projector control in multi-image shows

Initial State -- Projector A on position 23 and Projector b on position 24

```
TP40  TRAY POSITION      A
TP42  TRAY POSITION       B
```

Next state -- Projector A on position 40 and projector b on position 42.

5.4.3 RELAY CUES (OPEN/CLOSE)

These cues update the OPEN/CLOSE parameter of X-15 device types and Dove device types.

XN

This cue sets the OPEN/CLOSE parameter to CLOSE.

Example Usage: Close relays ABC on the Super X-15

XN LATCH ON ABC

XF

This cue set the OPEN/CLOSE parameter to OPEN.

Example usage: Open relays ABC on the Super X-15

XF LATCH OFF ABC

XS

This cue toggles the OPEN/CLOSE parameter for 0.25 seconds.

Example usage: Pulse relays ABC on the Super X-15

Initial state -- relays ABC are closed

XS SHORT PULSE ABC

Next State -- relays ABC will open for 0.5 seconds and then close. Had the relays been in the open state initially, the relays would have closed for 0.5 seconds in response to the XS cue.

XL

This cue toggles the OPEN/CLOSE parameter for 0.5 seconds.

AX

This cue sets the OPEN/CLOSE to closed parameter on Dove type devices for 0.25 seconds.

Example usage: pulse the A,B, and C relays on a Super Dove

AX AUX ABC

5.4.4 TIMING CUES

This set of cues allows for synchronization of the control cues to each other and/or to external audio or time code.

W##.##

This cue causes a wait of ##.## seconds, where ##.## can be any value in the range from 0.05 to 10.00 seconds in 0.05 increments.

TMhh:mm:ss:ff

This cue causes the a pause in the cue execution until the Clock (can be internal or External--AVL/SMPTE/EBU) matches the time specified by HH:MM:SS.FF. The range for HH:MM:SS.FF when using internal clock or external AVL clock is 00:00:00.01 - 23:59:59.99 in .01 second increments. The range for HH:MM:SS.FF when using SMPTE clock is 00:00:00.00 - 23:59:59.29 in increments of 1 frame (the ".ff" is the frame number from 00 to 29). The range for HH:MM:SS.FF when using EBU clock is 00:00:00.00 - 23:59:59.24 in increments of 1 frame (the ".ff" is the frame number from 00 to 24).

WX

This cue causes a pause in the cue execution until the F10 key is entered or until the time reaches 10 seconds (which ever comes first). The time in between starting the wait and hitting the F10 key is recorded. A wait with this value is used to replace the original WX. NOTE: WX's can be resolved in this manner only when the program is in thr RUN mode.

TX

This cue causes a pause in the cue execution until the F10 key is hit. The time when the F10 key is hit recorded. A TM with this value is used to replace the original TX. This feature allows for synchronization of the program to an external time code.

Example usage: Control of slide projectors in Multi-Image shows

```
2.0D  2.0 SEC DISSOLVE   NORMAL  AB    ;toggle A and B lamps and increments the down
                                        projectors tray position
W2.50 WAIT 2.50 SEC                     ;wait 2.5 seconds
2.0D  2.0 SEC DISSOLVE   NORMAL  AB    ;toggle A and B lamps and increments the down
                                        projectors tray position
WX    WAIT X SEC                        ;pause until F10 is hit, then replace WX with
                                        W##.# corresponding to time between WX cue
                                        and hitting the F10 key.
2.0D  2.0 SEC DISSOLVE   NORMAL  AB    ;toggle A and B lamps and increments the down
                                        projectors tray position
TIME  1:35.05                           ;pause until income time code equals 1:35.05
2.0D  2.0 SEC DISSOLVE   NORMAL  AB    ;toggle A and B lamps and increments the down
                                        projectors tray position
TX                                      ;pause until F10 key is hit, then replace TX with
                                        TM corresponding to time
2.0D  2.0 SEC DISSOLVE   NORMAL  AB    ;toggle A and B lamps and increments the down
                                        projectors tray position when F10 was hit
```

After resolving the WX and TX using the F10 key, the cue list will appear as follows:

```
2.0D  2.0 SEC DISSOLVE   NORMAL  AB
W2.50 WAIT 2.50 SEC
2.0D  2.0 SEC DISSOLVE   NORMAL  AB
W3.50 WAIT 3.50                  ; assuming F10 hit 3.5 seconds after entering wait
2.0D  2.0 SEC DISSOLVE   NORMAL  AB
TIME  1:35.05
2.0D  2.0 SEC DISSOLVE   NORMAL  AB
TIME  2:30.00                    ; assuming F10 hit at time equal to 2:30.00
2.0D  2.0 SEC DISSOLVE   NORMAL  AB
```

5.4.5 CUE FLOW CONTROL

ST

The ST cue marks the beginning of a run sequence. When a run sequence is entered, the program will continue to run until a STOP, WX, or TX is encountered. The ST cue is also used to mark the beginning of a REPEAT loop.

SP

The SP cue marks the end of a run sequence and forces a halt of the program execution.

N (NO OPERATION)

This has no effect on the screen action. Equals a .1 second wait at 10 cues per second and a .05 second wait at 20 cues per second.

S10 (SPEED = 10 CUES PER SECOND)

S10 is used to shift speed from 20 cues per second to 10 cues per second. Enhanced Procall defaults to 10 cues per second when the system is first LOADED, when you CLEAR ALL CUES from the control command mode, or when you perform a HOME. At 10 cues per second each cue requires .1 seconds before proceeding to the next cue.

S20 (SPEED = 20 CUES PER SECOND)

S20 is used to increase the running speed to 20 cues per second. At 20 cues per second each cue requires .05 seconds before proceeding to the next cue.

RPxx (REPEAT xx)

This command is used to repeat a series of cues that begin with a START cue. The number (xx) of times to be repeated can be from 1-255. Up to 10 consecutive (nested) RP commands are allowed.

NOTE: When you repeat a sequence 23 times the sequence will actually take place 24 times. The sequence will take place once and then be repeated 23 times.

With the use of nesting, it is possible to create a sequence that has billions of cues. Use nesting with extreme care.

RP0 (REPEAT UNTIL TERMINATED)

This cue is used if an undetermined number of REPEATS is desired. The RP0 can be terminated by pressing the CUE (F10) key. This command is of use when you are doing the "live" portions of your programs and the length of a sequence has not been predetermined.

RPX (REPEAT X)

RPX allows Enhanced PROCALL to determine the number of times the sequence has to repeat. It is used while you are in the RUN mode and actually viewing the sequence. Enter the RPX into the program and start the sequence running, when the desired number of repeats have taken place, press the F10 (CUE) key to move on to the next part of your program. Enhanced PROCALL will resolve the "X" to the number of times the sequence has been repeated.

NOTE: When you press the CUE (F10) key to resolve the RPX, the system will finish the system will complete the sequence in progress before moving on to the cue following the REPEAT cue.

HOME (PROGRAMMABLE RETURN TO BEGINNING OF PROGRAM)

Home is used as a program function to return the program to cue #1. In addition, HOME also resets all devices to their initial states. For example projectors are sent to tray position 0 or 1 and their lamps are turned off.

NOTE: When Home is part of a Run Sequence in the program, the program will assume it is to continue to run. The program will execute cue #1 and all subsequent cues in memory until encounters a STOP command.

TBxx (TAB xx)

This is a label which may be nested in the program to mark different sections of the show, where xx may be any two characters. TAB's can be referenced by GOTO's to make jumping to different program segments easier. GOTO's are described later in this chapter.

LOOPS

Loops allow cue segments to be loaded into the memory of the AVL controllers listed below:

- Doves
- Pro Travler X^2
- Room-Mate
- Super Fader

NOTE: For Dove X^2 and Pro Travler X^2 it may be necessary to download loops support. This is performed by invoking Enhanced PROCALL with the -l option, i.e, typing "ep -l".

The following list contains the cue types which may be included in a loop load:

- ALTERNATE DISSOLVE
- BLINK ALTERNATE
- MIN/MAX
- WAIT
- S10/S20
- NOP

This is a powerful tool that gives the ability to have several different tasks (cue lists) running in parallel. Enhanced PROCALL outputs a continuous clock tick which keeps these independent tasks in sync.

LL (LOAD LOOP)

LL is used to instruct units to store a series of cues in their memory as a routine that will be repeated.

LG (LOOP GO)

LG will cause all specified LOOPS to be repeated until told to STOP.

LPxx (LOOP REPEAT xx TIMES)

This command specifies the number (xx) of times a loop is to be repeated. It acts much like a RPxx but the units can be executing different loops. In addition, they execute the loops independent of the current cues Enhanced PROCALL is sending.

LS (LOOP STOP)

LS will cause all LOOPS in progress on the designated units to stop.

NOTE: Loop commands LL, LG, LS must designate Device Address, not Group Addresses, to participate within a particular loop. Group Addresses (Screen numbers) are invalid.

5.4.6 SPECIAL PURPOSE CUES

CHx

This cue is used to switch the cue output logical address channel, where x can be A,B,C, or D. This features multiplexes the cue output and in doing so provides four times the addressing capability.

PLEASE CONTACT AVL IF YOU REQUIRE THIS FEATURE. IT IS NOT PROVIDED IN THE STANDARD RELEASE.

SM "XXXX" and SM $HHHH$ (SEND MESSAGE CUE)

This cue is used to communicate with devices having serial (RS-232) control ports, such as VCR's, laser disk players, computers, lighting boards etc.. The serial data strings are transmitted through the Super Genesis I/O's "keyboard port". The strings can be entered as four bytes of ascii data (XXXX) or four nibbles of HEX data (HHHH). No address is entered for this cue. The default transmission parameters are as follows:

- 4800 baud
- data bits
- start bits
- stop bits
- parity

BA (BLINK ALTERNATE)

If the projector status states that the lamp is ON or executing a transition, a BLINK ALT command turn the lamp OFF instantaneously. Another BA will return the lamp to where it would have reached if the first BA did not occur.

FZ (FREEZE)

Allows you to stop a transition while it is in progress and hold the level. This cue also allows you to continue the transition in the same direction at the same rate.

To maintain compatibility with older versions of Procall the FREEZE cue is part of Enhanced Procall. However, there are more effective ways of achieving the effects realized using the FREEZE cue. With Enhanced Procall, MIN/MAX cues can be used instead of the FREEZE cue.

SG (SMOOTH G0)

SG is a transition command which allows direction change at any point during the transition. This feature enables the programmer to produce a rippling effect by cuing other transitions before the completion of the previous transition. If this procedure were done without SMOOTH GO, the previous transition would move to its ending state when another transition is cued in, giving a popping effect.

SS (SMOOTH STOP)

SS is used to return all units to normal from SMOOTH state.

LDxx (PROGRAMMABLE LOAD OF FILE xx)

This cue executes load from the disk into memory. When the LOAD FILE cue is executed in a run mode, the system will load the file xx. The program file system will then reset itself to cue number one and continue to run from that point. The tray and lamp status of the projectors will stay exactly the way they were before the load. Keep in mind that while the system is loading the file it is totally occupied. Pick a convenient slow period when no projector action is needed such as a wait or long dissolve.

5.5 COMMANDS FOR EDITING PROGRAMS

Editing is a very important part of programming. The commands described below will assist you in editing your program quickly and easily.

Certain keys have dual functions and some keys are used in conjunction with the Ctrl key. For purposes of notation, to indicate that two keys are to be pressed simultaneously, a slash (\) is inserted between the names of the keys, e.g: CTRL\A. The program editing functions are described in table 5.5.1.

Editing Function (listed alphabetically)	Description	Keystrokes
Control Command mode, switch to for one command	Enter a single control command	CTRL/C
Cursor right	move cursor to the right one field in programming mode	<space>
Cursor left	move cursor to left one field in programming mode	<backspace>
Delete a cue		CTRL/D
Disable all but relay cues		CTRL/P
Disable relay cues		CTRL/X
Display Dove assignments	display dove addresses which have been grouped	CTRL/V
Enable relay type cues	Re-enables relay cues;	CTRL/X
Enable all but relay type cues	Re-enables all but relay cues; if relay cues are already enabled they will remain enabled.	CTRL/P
Forward to next cue	step forward to next cue	q
Forward to next tab	Move to the next tab in the cues list	CTRL/T<cr> or <tab>
Goto to cue #1		CTRL/G<enter>
Goto to cue xx		CTRL/Gxx<enter>
Goto time cue HH:MM:SS.FF		CTRL/GHH:MM:SS.FF<enter>
Insert a cue		CTRL/A or "ins" key
Mode, change	allows you to change assignments to different locations while creating a screen format.	CTRL/U
Notes, display		CTRL/N
Programming mode	enter programming mode from control command mode	<esc>
Repeat previous cue		CTRL/R
Reverse Run ("Cue")	Step back one cue, or to previous START or time cue (which ever comes first), or to previous LL if in LOOP mode.	F9 or <up arrow>
Reverse step one cue		CTRL/Q
Reverse to previous tab		CTRL/B
Run ("Cue")	step one cue or if in RUN mode, execute until STOP, WX, or TX cue encountered	F10 or <down arrow>
Search for tabxx	repositions cursor to tabxx	CTRL/T,xx
Standby mode, enter	bring all lamps down but continue executing tray position cues	CTRL/S
Standby mode, exit	resume normal operation after being in standby mode	CTRL/S

Table 5.5.1 COMMANDS FOR EDITING PROGRAMS

5.6 CONTROL COMMAND ENTRIES

This section describes the following Control Command field entries.

* Editing Control Commands
* Memory/Disk Data Transfer Commands
* Magnetic Tape Control Commands
* Serial and Parallel Print Commands

5.6.1 EDITING CONTROL COMMANDS

Editing Function (listed alphabetically)	Description	Keystrokes
Beeper off	turn computer's beeper off	BPF
Beeper on	turn computer's beeper on	BPN
Clear all cues	clear all cues currently displayed	CAC
Clear notes	clears a note currently stored in the note buffer	CLN
Delete cues	delete cues from xx to yy inclusively	DLCxx,yy
Disable cue edits	Disable cue edits from keyboard	KBF
Enable cue edits	Enable cue edits from keyboard disabled	KBN
Exit/return to DOS	Exits Procall; SAVE YOUR PROGRAM FIRST or it will be lost forever	QUIT<cr>
Home, new	Establish new home point	NEW
Notes, display and edit	display or edit notes; notes can be 11 lines of 45 characters	NOTES
Operator name	change operators name to xx (up to 25 characters)	IAMxx
Program name	change program name to xx (up to 8 characters)	PGMxx
Remote cue off	disables remote cue (hand control) inputs	RCF
Remote cue on	enables remote cue (hand control) inputs	RCN
Replace time cues	replace time cues with TX, beginning with cue x and ending with cue y	RTC x.y
Space	Displays total cue memory space and amount of space already used	CUES
Screen numbers, exchange	Exchange Group addresses and device addresses; where v = current dove address, x = current bank (A or B), y = new dove address, and z = new bank	ESN vx,yz
Time offset	Offset all time cues beginning at cue xx and ending at cue yy by hh:mm:ss.ff	TOCxx,yy+/-hh:mm:ss.ff
Tray position offset	Set a new starting tray position for status display (x can be from 0 - 80)	TPOx

5.6.2 TIMING CONTROL COMMANDS

Timing Function	Description	Keystrokes
AVL timing codes, enable	enable AVL time codes	AVL
SMPTE timing codes, enable	enable SMPTE time codes	SMPTE
EBU timing codes, enable	enable EBU time codes	EBU

5.6.3 MEMORY/DISK DATA TRANSFER COMMANDS

Function	Description	Keystrokes
Append file	add file xx to end of program currently in cue memory	APxx
Delete file	delete file xx from disk	DELxx
Disk drive selection	select working disk drive x (A,B,C,D..)	DSKx
Clear notes	clears a note currently stored in the note buffer	CLN
Insert cues	insert cues from file xx before cursor	INSxx
Load cues	load cues from file xx in place of cues already in memory	LDxx
Load notes	load notes from file xx into the note buffer memory	NLDxx
Library	display cue files in current directory	LIB
Name Protect, clear	allows file xx to be renamed	CNPxx
Name Protect	protects file xx from being renamed	NPRxx
Operator name	change operators name to xx (up to 25 characters)	IAMxx
Program name	change program name to xx (up to 8 characters)	PGMxx
Rename file	rename file x as file y	RNMx,y
Save Notes	save notes to file xx	NSVxx
Save	save the program with the name shown in the program name field	SV
Save under new name	save program in file xx	SVxx
Save block of cues	save block of cues from xx to yy, inclusively, in file zz; when used in conjunction with INS or AP, SV provides an efficient way to copy or move blocks of cues between or within programs.	SVxx,yy,zz
Write protect, clear	allows file xx to be overwritten or deleted used	CWPxx
Write protect	write protect file xx	WPRxx

5.6.4 MAGNETIC TAPE CONTROL COMMANDS

Function	Description	Keystrokes
Clock edit mode	run from tape time codes; if tape stops program stops	CEM
Clock input mode	run from tape time codes; if tape stops program continues from internal clock	CIM
Clock output mode	sends time codes, starting at time = 0, on OUT1 for recording onto tape	COM
Clock output mode at time x	sends time codes, starting at time = HH:MM:SS.ff for recording onto tape	COM HH:MM:SS.FF
Mag tape input off	disables mag tape input	MIF
Mag tape input on	enables mag tape input	MIN
Mag tape load	load program from mag tape into memory through mag tape input jack; no command entry is required. The mag tape load will take place automatically when information resulting from an MSV is received on Data in.	
Mag tape output off	disable cue transmission on OUT1 and OUT2	MOF
Mag tape output on	enable cue transmission on OUT1 and OUT2	MON
Mag tape save	save cues in memory to mag tape through OUT1	MSV
Positrak output off	disables positrak output when not in the RUN mode; Positrak output when in the RUN mode cannot be disabled.	POF
Positrak output on	enables positrak output when not in the RUN mode	PON
Set levels	output continuous tone to set levels on recorder	STL
Verify	compares program residing in memory with tape MSV	VER

5.6.5 TAPE TRANSPORT CONTROL WITH SUPER GENESIS I/O

Function	Description	Keystrokes
Fast forward	Fast forward tape	CTL/F4 (F4 is F4 function key)
Play	Play tape	CTL/F3 (F3 is F# function key)
Rewind	Rewind tape	F4
Stop	Stop tape	F3
Tapetrak	enable tapetraking if currently disabled and disable if currently enabled.	CTL/E

5.6.6 PRINTING CONTROL COMMANDS

Function	Description	Keystrokes
Parallel printer select	select parallel printer port	PLP
Print	print program name, operator name, and cue list	PRINT
Serial Printer select	select serial printer port. This is default. (COM1 is used)	SLP
Speed select	set baud rate to xx for external printer. 300 baud is default. Rates from 300 to 9600 are allowed.	SPDss

A. APPENDIX PROGRAMMING EXAMPLES

This chapter provides an explanation of some sample programs. The example programs are provided on your diskette. It is suggested that these examples be loaded and studied in detail for a full understanding of the commands and their usage.

e.g. # 1 "realtime"

(once in ENHANCED PROCALL load "realtime" by typing CTR/C to enter the control command mode. Then type LDREALTIME<cr>, to begin the program load)

This program does not contain any timing or flow control cues. Programs of this type can be used for simple speaker support applications.

To follow the speaker simply press the "F10" when you want to execute the current cue.

If the speaker desires sequencing the program, this can be done with a remote control (if using Kodak hand control press Forward button) connected to the Remote cue input of the Genesis board or Super Genesis I/O.

e.g. # 2 "runstop"

This program is slightly more sophisticated example of speaker support. Here cue segments, in addition to single cues, can be executed in response to the "F10" key or a Remote cue input (if using Kodak hand control, press Forward button)

Note that cue segments are marked by using the ST and SP cues.

e.g. # 3 "sequence"

Here time codes are introduced as a way of automatically synchronizing to a time code. The example shows how to specify when a cue or cue segment should started in relation to incoming time code.

e.g. # 4 "timex"

This is a more sophisticated example of time code synchronization. It shows a commonly used technique to create a show with precise synchronization to the soundtrack. Upon loading "timex" you'll see only time cues and tabs. This program is run while receiving time codes. Each time the audio dictates moving to a new segment the F10 key is pressed and the current TIME X will mark the beginning of this segment. If you go to the end of this program cue (F10) the last cue (LD 06) you can see what the program might like after resolving the TIME X's and then inserting the cues which should follow the TIME X's.

A.1 RECORDING CUES AND TIME CODE ON TAPE

e.g. # 1 Recording Time code

Step 1 -- Enter the control command mode by typing:

CTL/C

Then disable Positrak output by typing:

CTL/CPOF<cr>

Step 2 -- select clock type by entering:

AVL<cr> for AVL clock (default)
or
SMPTE<cr> for SMPTE clock
or
EBU<cr> for EBU clock

Step 3 -- Place deck in record and pause at position where you desire to begin recording time codes (we suggest leaving a minimum of 5 seconds of leader).

Step 4 -- adjust tape signal level to 0 to -3db in response to test output. Test output signal is generated on OUT 1 in response to:

STL<cr>

Normally, track 3 is used for time codes.

Step 5 -- send time code and record by typing:

COM

or, if it is desired that the time code begins a time not equal to 0:00:00.00, type:

COM HH:MM:SS.FF

then releasing pause and pressing return key. Time codes are now being recorded in real-time. It is recommended that the time code track creates a window around the show in case the show needs to start sooner or end later than anticipated.

Step 6 -- End recording and resume normal Positrak output by stopping the deck and typing <esc> followed by:

PON<cr>

e.g. # 2 -- Recording Cues in Real-time

With cue list loaded and cursor on cue #1 perform following steps.

Step 1 -- Place deck in record, play, and pause mode at position for recording

Step 2 -- adjust tape signal level to 0 to -3db in response to test output. Test output signal is generated on OUT 1 and OUT2 in response to:

STL<cr>

Step 3 -- Type <esc><esc> then start deck

Step 4 -- Press F10 each time you want to record next cue(s)

e.g. # 3 -- Recording Cues in sync with time codes already on tape

With cue list loaded and cursor on cue #1 (must be a time cue)perform following steps.

Step 1 -- Place deck in record, play, and pause mode at position for recording

Step 2 -- adjust tape signal level to 0 to -3db in response to test output. Test output signal is generated on OUT 1 in response to:

STL<cr>

Step 3 -- type <esc><esc>, then start deck (cues will be sent in sync with time codes)

B. AUXILIARY CUES FOR DOVES

Enhanced PROCALL supports 15 Dove auxiliaries. The letters A thru O are used instead of, for example, 1l and 1R. The following table shows the Enhanced PROCALL commands as compared to the PROCALL 5 and X commands.

NOTE: We are using the Dove number rather than screen number as our auxiliary reference.

DOVE #	Enhanced PROCALL	PROCALL X	PROCALL 5
1	AX A	AX A	AX 1 L
	AX C	AX B	AX 1 R
	AX B		
2	AX D	AX C	AX 2 L
	AX F	AX D	AX 2 R
	AX E		
3	AX G	AX E	AX 3 L
	AX I	AX F	AX 3 R
	AX H		
4	AX J	AX F	AX 4 L
	AX L	AX H	AX 4 R
	AX K		
5	AX M	AX I	AX 5 L
	AX O	AX J	AX 5 R
	AX N		

C. CREATING CUSTOM CONFIGURATIONS

C.1 GENERAL

The following guidelines must be followed when defining custom configurations.

a. 15 Dove addresses per bank per bank.

b. 9 groups (screens) per bank

c. Max of 6 Dove addresses per group, e.g. group 1 can be Dove addresses ABCDEF

C.2 CREATING A NEW CONFIGURATION

To create a new configuration, follow the procedure outlined below.

a. Start Enhanced Procall as you normally would.

b. When the prompt:

HI THERE NAME. NICE TO MEET YOU.

WOULD YOU LIKE TO:

(1) CONTINUE WITH THE STANDARD FORMAT

(2) CREATE YOUR OWN FORMAT

(3) USE A FORMAT PREVIOUSLY CREATED

appeared on the screen, press the 2 key.

f. When the configuration table appears you ready to create a custom configuration. The table contains a 9 x 6 matrix for each bank. The nine columns per bank correspond to the group numbers 1-9 (screen numbers 1-9). The six cells in each column can correspond to up to 6 Dove addresses.

Any 15 physical Dove addresses can be entered in any 15 of the 54 cells. These entries will be assigned logical addresses according to their position in the matrix. This is done by traversing the matrix starting at the top of the left column, proceeding to the bottom of that column, then proceeding to the top of the next column to the right and proceeding to the bottom of that column, and continuing through the remaining 4 columns in this manner. During this traversal, each time an entry is encountered in a cell it is assigned the next sequential logical address, beginning A and ending with O (15 in all).

For historical reasons the Dove addresses entered in the cells are assigned by 2 character designations. Below is the relationship between these two character designations and the 15 physical dove addresses A-O

```
2 Character Designation -->   1A 1B 1C 2A 2B 2C  ... 5A 5B 5C
                              || || || || || ||     || || ||
Physical Dove address         A  B  C  D  E  F      M  N  O
```

e.g. 9 slide projectors and 2 video projectors distributed over 4 separate screen areas.

The show will have 2 slide projectors on the left most screen, 2 slide projectors and a video projector on the next screen to the right, 2 slide projectors and a video projector on the next screen to the right, and 3 slide projectors on the right most screen.

To create this format enter the following:

1a
<down arrow>
1b
<right arrow><up arrow>
1c
<down arrow>
2c
<right arrow><up arrow>
2b
<down arrow>
2a
<right arrow><up arrow>
3a
<down arrow>
3b
<down arrow>
3c

g. After the new format is configured, press the ESC key.

h. When the following prompt comes on the screen:

DO YOU WANT TO SAVE THIS FORMAT?

enter Y for yes, press RETURN.

i. When the prompt:

WHAT NAME DO YOU WANT TO USE?

c#

comes on the screen, type the name of the program and press the RETURN key. (The system name for the will be C#NAME, where NAME is the name you enter here.)

j. When the GENESIS asks:

WHAT DISK DO YOU WANT TO USE:

type <drive letter>

k. When the following prompt comes on the screen:

DO YOU WANT TO SAVE THIS FORMAT?

enter N (unless you want to save this format onto another diskette), press RETURN.

l. When the prompt:

PLEASE NAME YOUR PROGRAM AND WE CAN BEGIN

is displayed on the screen, type the name of the program and press RETURN.

L. To program the show using the format created above the equipment must be configured as described below.

Screen 1	Screen 1's slide projectors should be connected to a Dove set to screen 1 on ports A and B
Screen 2	Screen 2's slide projectors should be connected to a Dove set to screen 1 on port C and a Dove set to screen 2 on port C.
Screen 3	Screen 3's slide projectors should be connected to a Dove set to screen 2 on ports B and A.
Screen 4	Screen 4's slide projectors should be connected to a Dove set to screen 3 on ports A,B, and C.

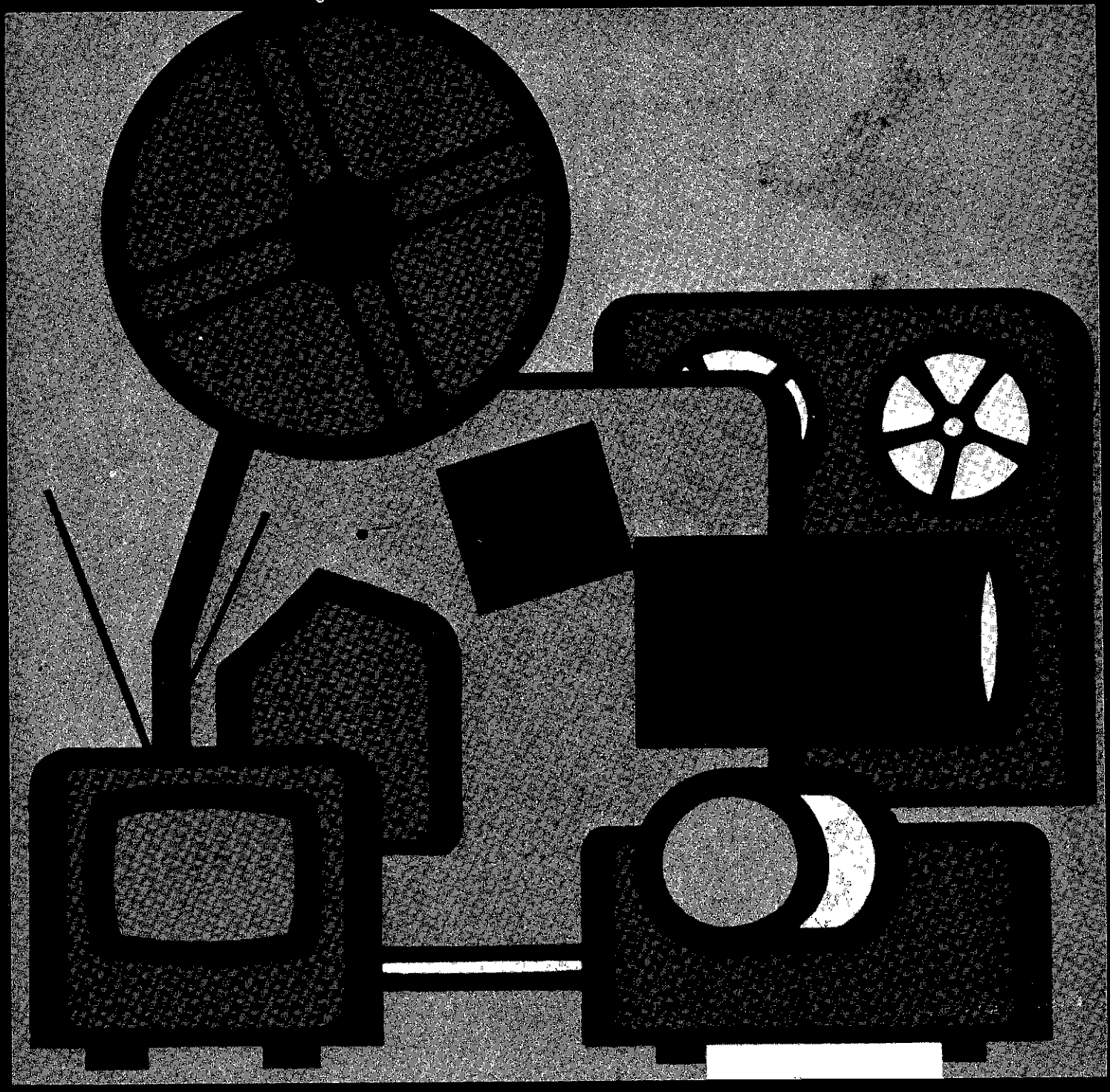
M. The logical addresses which must now be used to control the equipment are shown below in parenthesis.

Screen 1	Screen 1's slide projectors should be connected to a Dove set to screen 1 on ports A(A) and B(B)

Screen 2	Screen 2's slide projectors should be connected to a Dove set to screen 1 on port C(C) and a Dove set to screen 2 on port C(D).
Screen 3	Screen 3's slide projectors should be connected to a Dove set to screen 2 on ports B(E) and A(F).
Screen 4	Screen 4's slide projectors should be connected to a Dove set to screen 3 on ports A(G),B(H), and C(I).

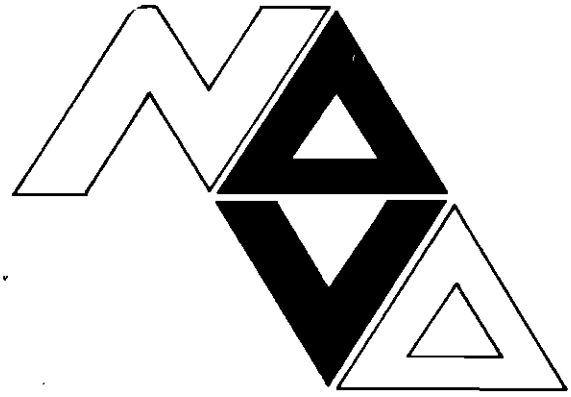
Reliance Audio Visual Corp.
Rental Equipment Catalog

550 West 43rd Street, New York, N.Y. 10036 / (212) 736-0700



Reliance Audio Visual Corp.

This is the symbol of a professional audio-visual specialist



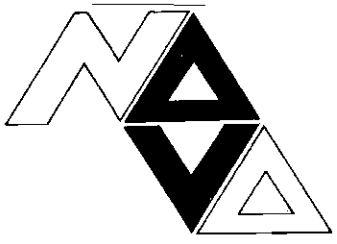
Go to the Pro!

Our firm is proud to display this symbol as a NAVA member. But more important to you, it is your assurance of our firm's reliability and competence.

NAVA helps its members become and remain the best trained and best informed audio-visual specialists in the business, through membership services, dealer and user training institutes and a yearly convention.

Our company does much more than just sell A-V equipment. We can render many valuable services to you, some of which include:

1. Consultation and advice on your employment of A-V equipment and materials.
2. Demonstration of new A-V items as they become available.
3. Installation of new equipment and training of your operators to ensure proper functioning and effective creative usage.
4. Reliable repair service — repairs made by trained technicians, with adequate stocks of replacement parts.
5. Equipment rentals and projection service for special occasions.



NAVA, the trade association of the audio-visual industry.

Reliance Audio Visual Corp.

Why Rent... from RELIANCE

FAST DELIVERY

RAV Delivers fast. We have the most extensive AV stock available anywhere. And, not just one item but dozens of every item listed in this catalog, fully maintained and ready to go. This equipment is better than new as it is checked out before it leaves our shop . . . . available now when you want it putting an end to the weeks and months of waiting for equipment.

LESS EXPENSIVE

Even the most extensive AV budget goes just so far. When you rent from us you eliminate any large cash outlay. You pay only for the time you have the equipment so you don't have to pay for idle time. Further more RAV rentals are fully tax deductable classified as an operating expense. You can economize and still get the job done.

INCREASED FLEXIBILITY

Now with an RAV AV reantal you are not limited to what you buy. You can utilize any state of the art technology which suits your purpose and need. Obsolescence is completely eliminated as you rent the very latest equipment with the most modern capabilities.

NO MORE BREAKDOWNS

Reliance checks every piece of equipment twice before you get it. Further, that equipment is backed up by our capability to replace down equipment within hours should it ever become necessary. Every item in our inventory is subjected to a very detailed maintenance schedule and is replaced with new equipment periodically.

BACKUP

Remember any piece of equipment is only as good as the people behind it. RAV-AV Rentals provide you with the kind of professional knowhow that makes the difference. We're with you throughout the rental providing the counseling to help you make the right choice, the expertise to put it all together and the wherewithal to insure superior backup.

That's Why!

RELIANCE AUDIO VISUAL CORP. 550 West 43rd Street, New York, N.Y. 10036 / (212) 736-0700

INTRODUCTION

In the quarter century of its existence, Reliance-Audio Visual Corporation has served all facets of the advertising, institutional, and sales promotion world.

SCOPE

Now, however, the services are so broad in scope that only the all-encompassing term—AUDIO-VISUAL—can best describe the operations of our company. Supplying a simple motion picture projector or a complex sound-synchronized animated display is a routine function of our company.

Our clients, because of their problems, forced us to widen our scope of knowledge in order to best serve them. We therefore found it important to dig deeply into untapped sources of audio-visual information not generally available. While accomplishing this, Reliance gained a reputation as "pros" among professionals. We have been called upon to modify and adapt to special purposes equipment seemingly inapplicable; to assess the feasibility of special optical problems and to unearth little known data on lenses and related items.

GROWTH

We have grown, through patience and application in the field to which we are dedicated, to be the largest audio-visual rental company in New York.

That is why now, having arrived at this point of established and recognized leadership, we invite you to acquaint yourself with the vast reservoir of our equipment and the broad scope of our consulting services.

One of the reasons we can offer you better services, better equipment and a more extensive background in handling projection, sound reinforcement, and special projects is that we are essentially a technically-oriented company. We have a staff of skilled technicians to keep our equipment in excellent condition and to provide special equipment and facilities whenever needed. Our engineers have had many years of experience in providing the finest in sound and projection for sales meetings and conventions, large and small.

SERVICE

Service is the lifeblood of our company; to us it is the assistance of our trained personnel in solving technical problems and selecting equipment that will best suit our customer's requirements.

For many of those important meetings, you will prefer to assume no responsibility yourself for handling the equipment. Our operators are experienced, personable, and helpful. They are skilled engineers, who realize the importance of a good show and know how to give it to you.

We are proud of our reputation in the convention and trade show field. We realize that a great deal of your meetings' success may depend on us and the quality of the equipment we supply you.

Call on us for the most complete professionalized service. Our staff includes sound engineers, A-V servicemen, and skilled projectionists.

With thousands of shows and years of experience behind us, we consider our personnel our most important asset. The man from Reliance brings with him a knowledge of our complete stock of audio-visual aids, and how they can best be utilized to solve your problems.

There is no charge or obligation for our suggestions on how you can use visuals to enliven your convention proceedings, increase the retention of information, and plan your convention to appeal to the eye as well as the ear.

PROCEDURE

General Renting Procedure: To assure you of the best possible service and equipment every time you rent, we suggest you follow these guidelines.

1. RESERVE: your equipment as far in advance as possible.
2. PURCHASE ORDERS: or letters of requisition written on company letterhead are required for all rentals.
3. TO ESTABLISH AN OPEN ACCOUNT: we require a bank credit check plus two business credit references. It takes three days.
4. DEPOSITS: are required, equal to full value of equipment, unless an open account has been established with our credit department.
5. CHECK: your equipment contents against our packing list before signing for it.
6. FOR YOUR OWN PROTECTION: we recommend that you insure all equipment before it leaves our premises. You are responsible for any loss.
7. THERE IS NO ADDITIONAL CHARGE: for packing cases and material used with our rental equipment.
8. OUT-OF-TOWN: rentals are allowed two days travel time, with a two (2) day minimum rental on all orders. We suggest shipping via air freight.
9. OUT-OF-COUNTRY: rentals require customer registration of all equipment leaving and entering the United States. No allowance will be made for time lost due improper documentation (unless previous arrangements have been made).
10. DELIVERY DEADLINES: cannot be guaranteed unless we receive four (4) hours notice.
11. RENTALS TERMINATE AT 10 A.M.: equipment returned after 10 a.m. or held for more than 24 hours will be charged for an additional day's rental.
12. PICKUP AND DELIVERY: may be arranged at an additional charge.
13. RENTAL REGULATIONS: will be found on the back of each rental contract.
14. BACK-UP EQUIPMENT: is recommended for your insurance of a successful show.
15. ALL PRICES AND/OR SPECIFICATIONS: in this catalog are subject to change without notice.

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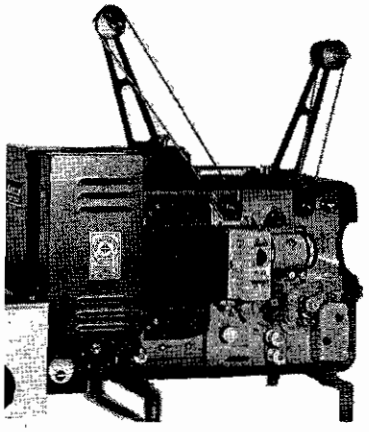
16MM MOTION PICTURE PROJECTORS—Sound

NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
Optical Radn.	1600 watt Xenon—4000' reels—optical radiation lamp,	275.00	825.00
B & H Jan	Optical/magnetic sound—synchronous motor with 600 watt Xenon.	110.00	330.00
B & H Jan	1000 watt Xenon.	125.00	375.00
B & H Jan	600 or 1000 watt with Selsyn interlock—remote console.	250.00	750.00
B & H	Model 566—Marc 300 quartz arc lamp with remote start-stop.	80.00	240.00
B & H	Model 302—magnetic/optical sound.	30.00	90.00
B & H	Model 385—Hi-speed 40 frames per second—optical sound.	30.00	90.00
B & H	500 Series—manual threading.	25.00	75.00
B & H	500 Series—automatic threading.	30.00	90.00
B & H	500 Series—automatic threading—with remote start-stop.	35.00	105.00
B & H	Model 385—1000 watt incandescent—optical sound.	25.00	75.00
Siemens	Portable interlock—magnetic/optical—edge track—synchronous motor.	75.00	225.00



16MM MOTION PICTURE PROJECTORS—Continuous Sound

Triangle	B & H 500 Series—optical—1200' magazine capacity—screen size: 12½"x 17½"	50.00	150.00
	1600' capacity.	60.00	180.00
Kalart	Model STM-18—screen size: 10" x 14".	40.00	120.00
Kalart	Model TM-3—screen size: 8½" x 10½".	35.00	105.00
B & H	Marc 300 quartz arc lamp—1000' magazine.	90.00	270.00

16MM MOTION PICTURE PROJECTORS—Silent

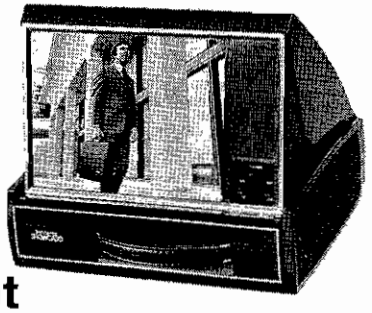
B & H	Analyst time & study—single frames—forward/reverse & remote control.	20.00	60.00

8MM MOTION PICTURE PROJECTORS—Sound

Eumig	Super 8mm Magnetic Sound—Playback/Recording.	22.50	67.50
Kodak	Supermatic 60/70 Cassette—Project or use built-in screen — record your own soundtrack.	40.00	120.00
Bolex	Super 8mm Magnetic Sound—Playback/Recording.	25.00	75.00
EL 140	Super 8m Magnetic Sound—Playback/Recording—Heavy Duty.	25.00	75.00

8MM MOTION PICTURE PROJECTORS—Continuous Sound

Technocolor	Cartridge load 2000M	27.00	81.00
Fairchild	Mark IVS Continuous. Magnetic Sound — Cartridge load.	20.00	60.00
Fairchild	007 Suitcase, 8½ x 11½ screen 17 lbs.	27.00	81.00
Bohn Benton	Institor Suitcase, 9 x 12 screen 17 lbs.	15.00	45.00
MPO	Videotronic Portable, 9 x 12 screen 16 lbs.	27.00	81.00
Kodak	VIDEOPLAYER. Super 8mm. Playback thru any TV set. Uses 8mm cartridge as supermatic.	100.00	300.00



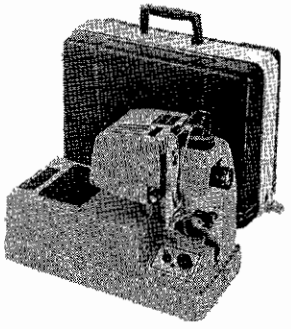
8MM MOTION PICTURE PROJECTORS—Silent

Keystone	Auto-load—Super 8mm Silent.	12.00	36.00
B & H	500 watt. Silent.	10.00	30.00

35MM MOTION PICTURE PROJECTORS—Sound

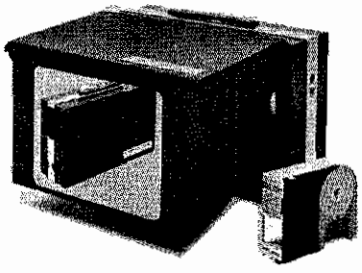
NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
AVE	Portable—1500 watt.	90.00	270.00
AVE	As above with interlock.	110.00	330.00
Portable projection	Single: 4'W x 6'D x 7'H	60.00	180.00
	Double: 8'W x 6'D x 7'H	80.00	240.00

35MM FILMSTRIP PROJECTORS—Sound



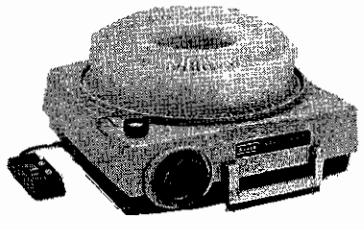
DuKane	Super Micromatic—600 watt quartz lamp—remote or automatic (uses) record.	20.00	60.00
DuKane	1200 watt Auditorium—remote or automatic complete with phono sound system (uses record).	30.00	90.00
DuKane	100 watt—Fliptop—33-1/3 & 45 speeds.	10.00	30.00
DuKane	Cassette tape—quartz lamp.	20.00	60.00
Beseler	Salesmate—cartridge load	15.00	45.00
LaBelle	Courier—battery or A.C.	20.00	60.00
ELCO	Mastermatic optisonic—cartridge load.	20.00	60.00

SLIDE PROJECTORS—2 X 2



Strong	Slide Arc—manual.	125.00	375.00
Optical Radiation	500 watt Xenon—modified Ektagraphic carousel—80 slides.	125.00	375.00
Kodak	600 watt Xenon—modified Ektagraphic carousel—80 slides.	100.00	300.00
Kodak	1000 watt Xenon—modified Ektagraphic carousel—80 slides.	115.00	345.00
Kodak	Model AV331—Marc 300—Ektagraphic carousel—80 slides.	80.00	240.00
Buhl	1200 watt incandescent—modified Ektagraphic carousel—3000 lumens output.	60.00	180.00
Kodak	Model 960 carousel—random access 1 to 80 slides.	50.00	150.00
Kodak	Model 550R/AF2 Carousel 50-60 cycles (overseas use).	30.00	90.00
	Transformer (220v) for above.	15.00	45.00
Kodak	Model 850 & AF—with automatic focusing.	17.50	52.50
Kodak	Models AV-900, 550, B carousels with zoom lens.	15.00	45.00
Sawyers	Quartz lamp—100-slide capacity—automatic focusing—remote operation.	12.50	37.50
Selectroslide	Spindler & Sauppe 1000 watt—48 slides—Anniversary Model.	15.00	45.00
Selectroslide	Spindler & Sauppe—1200 watt—48 slides—forward/reverse.	20.00	60.00

SLIDE PROJECTORS—3¼ X 4



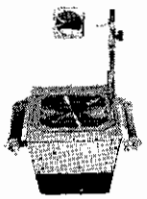
Genarco	3000 watt -additional accessories with manual changer—projection lamp extra charge.	100.00	200.00
Genarco	3000 watt—additional accessories with forward or reverse changer—lamp extra charge.	125.00	250.00
Telepro	5000 watt mazda—automatic changer—lamp extra charge.	150.00	300.00
Strong	Slide Arc—manual changer.	125.00	375.00
Beseler	750 watt—manual.	20.00	60.00
A.O.	750 watt—manual.	20.00	60.00

SLIDE PROJECTORS—4 X 5

Genarco	Roto holder—3000 watts—slide can be projected at any angle.	100.00	200.00

OVERHEAD PROJECTORS—10" X 10" (projects transparencies & acetate rolls)

NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
Buhl	600 watt 10 x 10	20.00	60.00
Buhl	1000 watt 10 x 10	25.00	75.00
Beseler	1000 watt 10 x 10"	25.00	75.00
Beseler	Porta-scribe 10" x 10" portable—folds up for carrying.	20.00	60.00
A.O.	1000 watt—10" x 10"	25.00	75.00
A.O.	Apollo-Portable—600 watt Halogen lamp.	20.00	60.00

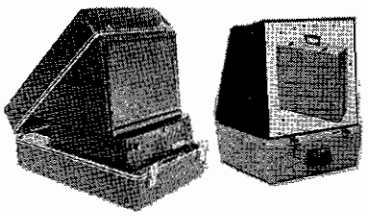


OPAQUE PROJECTORS—10" X 10" COPY (projects books, charts, etc.)

Beseler	1000 watt.	25.00	75.00
A.O.	1000 watt.	25.00	75.00
Buhl	1000 watt.	25.00	75.00

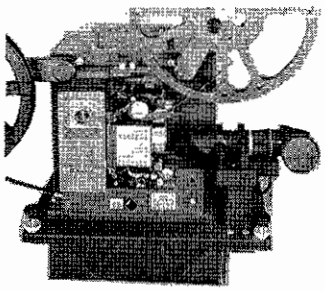
REAR SCREEN CABINETS

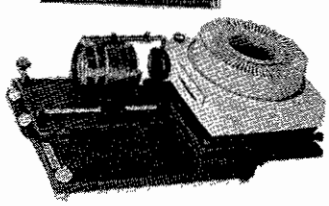
A.V.	Rear screen cabinet—screen size: 21.5" x 28"	25.00	75.00
Motiva	Cabinet—screen size: 18" x 18".	30.00	90.00
Motiva	Double cabinet—screen size: 18" x 27" (holds 2 slide projectors; can be used with dissolve & Cousino tape synchronizer/sound unit.	40.00	120.00
Table screen	30 x 40 rear—folding.	10.00	30.00
Gavi	Sharpshooter, portable slide show, no sound 8 x 12 screen.	20.00	60.00
Gavi	Sharpshooter, portable slide show w/cassette sound, 8 x 12 screen.	30.00	90.00
Spectra 220	Portable rear screen theatre, no sound, 20 x20 screen.	30.00	90.00
Spectra 220	Portable rear screen theatre w/Ello Soundmatic.	50.00	150.00



PROJECTION LENSES

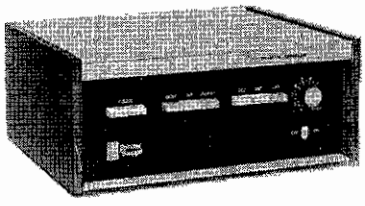
Anamorphic	Fits all 16mm sound projectors supplied with bracket.	15.00	45.00
Buhl	ECU-RP lens system—for all 16mm projectors—gives equivalent of ½" focal length and reversal.	12.00	36.00
Buhl	4" diameter auditorium lenses and carriages for use with Kodak carousel slide projectors—sizes: 8½" to 15½".	12.00	36.00
Buhl	Lenses for Kodak carousel—1.4" to 9½"—fits directly in lens barrel.	7.50	22.50
Buhl	Hi-speed—1.4" to 2".	12.00	36.00
16mm lenses	Bell & Howell, RCA, Filmovara, Jan, etc.	7.50	22.50
35mm lenses	Simplex, DeVry, A.V.E. & Century—all sizes 2" to 8".	15.00	45.00

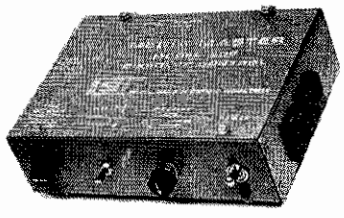




DISSOLVE CONTROLS

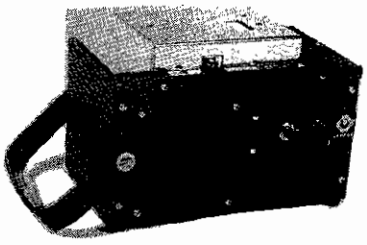
NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
AVL Mark VII	Professional 1200 watt, Dissolve used with Kodak Carousels or Buhl Hi Lites, Lap Dissolves - Quick Cuts Reverse - Fast, Medium variable dissolves.	80.00	240.00
AVL Mark IV Freeze Frame	Prefessional 1200 watt dissolve used with Kodak Carousels or Buhl Hi Lites, Lap Dissolves - Quick Cuts -Freeze Frame - Reverse - Fast, Medium variable slow dissolves.	60.00	180.00
Spindler & Sauppe	Professional 1200 watt dissolve - Used with 2 Kodak Carousel Projectors - Lap Dissolves Fast Cuts - Animation. Fast, Medium or variable slow dissolve, etc.	50.00	150.00
AVL Mark II	Professional 1200 watt dissolve used with Kodak Carousels or Buhl Hi Lites - Lap Dissolves - Quick Cuts - Reverse - Fast, Medium or variable slow dissolves etc.	35.00	105.00
Wollensak AV 33	3 fixed rates of dissolves. Fast: 0.5 seconds, Medium: 2.6 seconds, Slow: 6.8 seconds.	35.00	105.00
CSI-405A	Rate dissolve 500 watts, quick cut or lap.	25.00	75.00
Kodak	Dissolve — Used with two 500 watt Carousels.	20.00	60.00





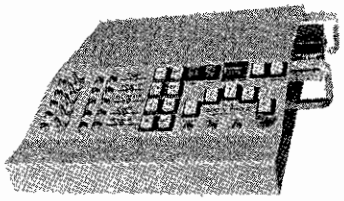
SYNCHRONIZERS AND REPEATERS

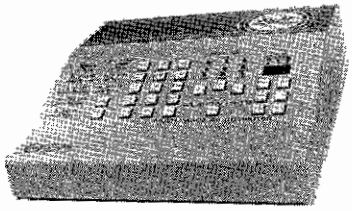
Labelle	Playmatic 83. ½ Track—3¾ Speed—Plays back & records trip signal.	20.00	60.00
Cousino	Model SR-7341—½ track—3¾ speed—plays back & records trip signal.	20.00	60.00
AV Dynamics	Son-a-Mate 3. Stereo continuous loop tape player-recorder w/built in amp & sunchronizer & a third track for additional cueing.	40.00	120.00
AV Dynamics	Son-a-Mate 4. Stereo continuous loop tape player-recorder w/built in amp & synchronizer & 2 additional tracks for cueing.	50.00	150.00
Kodak	Programmer—used with stereo tape recorder to record & play back trip signals.	10.00	30.00
Norelco	A.C. or battery—records & plays back trip signals.	7.50	22.50
Mark-O-Matic	Uses graphite pencil—records & plays back trip signals.	7.50	22.50
Philips	Synchronizer—used with mono tape recorder to record & play back trip signals.	10.00	30.00
Kodak	Sound synchronizer—model 2—records & plays back trip signals.	10.00	30.00

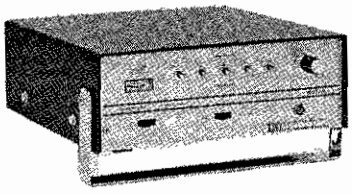


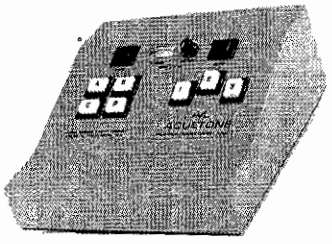
PROGRAMMERS

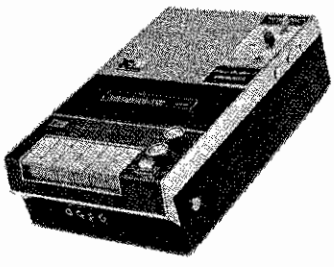
NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
AVL	Model: SHOW PRO II Electronic Programmer (Uses paper punch tape) Designed for 5 screens, 6 functions per screen. Preview your next screen action. Can be used with 5 AVL Mark IV dissolves. Built-in synchronizer.	175.00	525.00
AVL	Model: SHOW PRO III Computerized Programmer. Dissolve system used w/stereo recorder. Designed for 6 projectors on dissolve w/4 rates of dissolve speed.	375.00	1075.00
AVL	Model: SHOW PRO V Computerized Programmer. Dissolve system used w/stereo recorder. Designed for 15 projectors on dissolve w/8 rates of dissolve speed.	625.00	1875.00
DuKane	Model 9A1070 — Electronic Programmer. (Uses paper punch tape) Can program up to 8 channels.	100.00	300.00
AVL	Model: Electric Tape Punch Punches program tapes quickly. Verify duplicate and correct tapes. To be used with AVL Show Pro I and Show Pro II.	75.00	225.00
AVL	Model: Exhibit Master. 40 channel read only programmer. Fully compatible with tapes punches with AVL Show I or Show Pro II.	150.00	450.00
CSI	Model 375 Tone Programmer. Used w/stereo recorder. Designed for 4 functions.	50.00	150.00
AVL	Model: Acuetone. Tone programmer (Used with stereo recorder). Designed for 3 Screens, 4 functions per screen. Can be used with 3 AVL Mark II dissolves.	60.00	180.00
Spindler Sauppe	Model: Quadra Que I. Tone programmer (Used with stereo recorder). Designed for 4 Carousels, or 4 functions of a Spindler Sauppe dissolve.	60.00	180.00
ELCO	Model: Sound-o-Matic I. Cassette recorder to program 1 function, Either 1 Carousel or 1 Dissolve control. Built-in cue control. (Sound-o-Matic II play-back only).	20.00	60.00
ELCO	Model: Sound-o-Matic V. Cassette recorder to program 2 functions, either 2 Carousels or 2 Dissolve controls. Built-in cue control. (Sound-o-Matic VI play-back only).	25.00	75.00
Wollensak	Model: 2551. Cassette recorder to program 1 function, either 1 Carousel or 1 Dissolve.	30.00	90.00
Wollensak	Model: 2573AV. Cassette recorder to program 2 functions, either 2 Carousels or 2 Dissolves.	40.00	120.00











SCREENS—Tripod & Wall

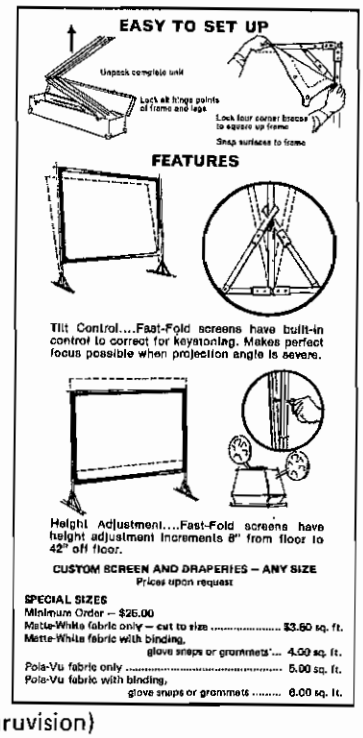
NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
Tripod	40" x 40"—50" x 50".	8.00	24.00
Tripod	60" x 60"—70" x 70".	10.00	30.00
Tripod	84" x 84".	12.50	37.50
Tripod	72" x 96".	17.50	52.50
Wall	50" x 50".	5.00	15.00
Wall	60" x 60".	6.00	18.00
Wall	70" x 70".	7.00	21.00
Wall	10' x 10'.	15.00	45.00
Wall Screen	12' x 30' Lenticular minimum weekly rental		250.00
WE CAN CUSTOMIZE A SCREEN FOR ANY PROJECTION NEED'			

DRAPES FOR FAST FOLD SCREENS

Blue velour lower drape for use with 5' x 7' or 6' x 8'.	15.00	45.00
Blue velour full drapes for 6' x 8'.	25.00	105.00
Blue velour full drapes for 7½' x 10' or 9' x 12'.	50.00	150.00
Velour full drapes for 10½' x 14'.	70.00	210.00
Miscellaneous full drapes for other size screens available.		

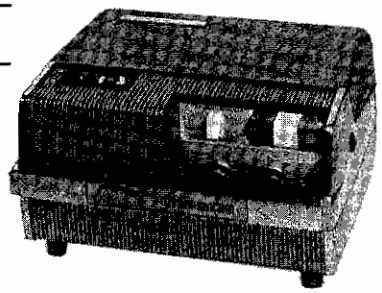
SCREENS

	FRONT SCREEN DAY	FRONT SCREEN WEEK	REAR SCREEN DAY	REAR SCREEN WEEK
4½' x 6'	15.00	45.00	17.50	52.50
5' x 7'	15.00	45.00	22.50	67.50
6' x 6'	15.00	45.00	22.50	67.50
6' x 8'	25.00	75.00	30.00	90.00
6' x 9'	25.00	75.00	35.00	105.00
8' x 8'	25.00	75.00	35.00	105.00
9' x 9'	25.00	75.00	35.00	105.00
10' x 10'	35.00	105.00	45.00	135.00
8' x 10'	25.00	75.50	40.00	120.00
9' x 12'	35.00	105.00	50.00	150.00
12' x 12'	50.00	150.00	65.00	195.00
10½' x 14'	55.00	165.00	70.00	210.00
5' x 15'	75.00	225.00	100.00	300.00
6' x 16'	75.00	225.00	100.00	300.00
12' x 16'	75.00	225.00	100.00	300.00
8' x 20'	100.00	300.00	150.00	450.00
10' x 20'	100.00	300.00	150.00	450.00
15' x 20'	100.00	300.00	150.00	450.00
6' x 24'	100.00	300.00		
9' x 24'	100.00	300.00	150.00	450.00
10' x 30'	125.00	375.00	150.00	450.00 (thruvision)
20' x 40'			Minimum	525.00



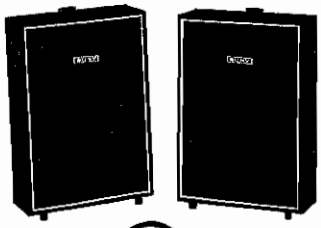
TAPE RECORDERS—Monaural

NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
Ampex	Professional—7½ & 15 speeds—full track.	35.00	105.00
Ampex	Professional—3¾ & 7½ speeds—½ track.	35.00	105.00
Ampex	Speaker amplifier companion for above.	20.00	60.00
Wollensak	Models T-1500 & T-1500SS—2 speeds.	17.00	51.00



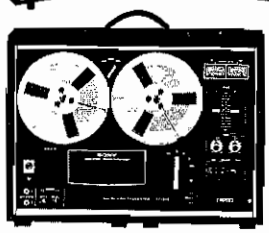
TAPE RECORDERS—Stereo

Sony	Model TC270—4 track stereo.	25.00	75.00
Wollensak	Model 6250—4 track stereo	30.00	40.00



TAPE RECORDERS—Quadraphonic

Teac	Model 3340—4 channel quad deck for record & playback.	80.00	240.00
JVC	Model 4 channel quad deck for playback only.	40.00	120.00

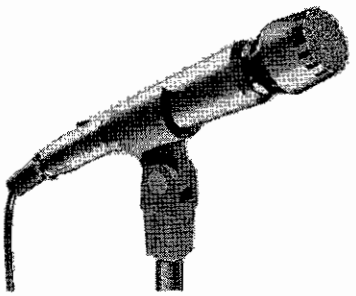


PORTABLE RECORD PLAYERS—Monaural-Stereo

Califone	3 speed—12" capacity.	10.00	30.00
Califone	Model 12V-9.	10.00	30.00
Audio-Master	3 speed—12" capacity.	10.00	30.00
AMC	Stereo.	15.00	45.00

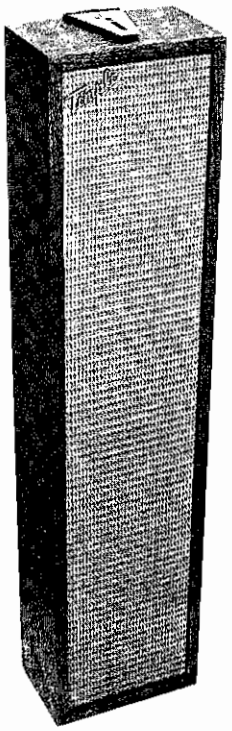
SOUND SYSTEMS—Professional

NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
Altec	4 Channel Mixer/Amplifier—35 watt.	40.00	120.00
Altec	5 Channel — Transistorized Mixer.	25.00	75.00
Altec	4 Channel—Tube Mixer.	20.00	60.00
Altec	40 Watt—Tube Amplifier.	20.00	60.00
Altec	100 Watt Transistorized Amplifier.	20.00	75.00
Shure	M-67 Mixer.	20.00	60.00
Shure	M-68 Mixer.	15.00	45.00
Altec	A7-500 Speaker	35.00	105.00
Altec	Model 844 A Speaker.	25.00	75.00
Norelco AKG	Model D 190 ES Microphone with floor or table stand.	10.00	30.00
Norelco AKG	Model 109 Lavalier Microphone.	10.00	30.00
RCA	Model 12A—subminiature lavalier microphone.	7.50	22.50
Senheisser	Spot microphone.	35.00	105.00
Senheisser	Wireless—battery powered microphones—w/a.c. receiver	50.00	150.00
Vega	Wireless—Battery powered neck microphone w/a.c. receiver.	50.00	150.00



SOUND SYSTEMS—Commercial

Bogen	100 watt P.A. with 4 Trumpet speakers—microphone.	40.00	120.00
Bogen	30 watt P.A. with 2½" speakers & microphone.	25.00	75.00
Bogen	100 watt P.A.	20.00	60.00
Bogen	30 watt P.A.	15.00	45.00
RCA	20 watt P.A. with 2-8" speakers & microphone.	20.00	60.00
Ampli-vox	Roving Rostrum—battery or A.C.—amplifier, speaker & microphone.	20.00	60.00
Ampli-vox	Commando megaphone with microphone, amplifier & speaker.	10.00	30.00
Ampli-vox	Battery—small portable P.A. system complete.	10.50	31.50
B & H	25 watt power amplifier/speaker.	10.00	30.00
B & H	12" speaker in carrying case.	10.00	30.00
RCA	10" speaker in carrying case.	10.00	30.00
RCA	Column—(6-6" speakers).	15.00	45.00
Temple	Column—(6-8" speakers).	25.00	75.00
Electrovoice	Models 666, 664, 648, & 643 microphones.	10.00	30.00
Electrovoice	Model 646 Lavalier microphone.	12.50	37.50
Electrovoice	Model 642—Cardiline—microphone.	12.50	37.50
Shure	Model SM 51—Lavalier microphone.	12.50	37.50
Shure	Models 545 & 546 microphones.	10.00	30.00
University	Model 5020—super cardiod microphone.	10.00	30.00
Tentone	B & O microphone.	10.00	30.00



LECTERNS

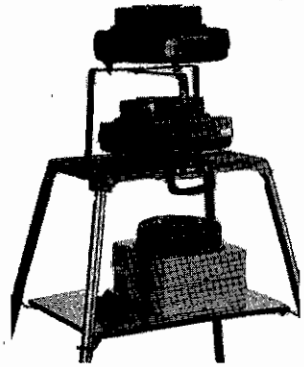
NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
Ampli-vox	Portable—battery or A.C.—table with amplifier, speaker & microphone.	20.00	60.00
Ampli-vox	Floor—adjustable—with amplifier, speaker & microphone, reading light—battery or A.C.	50.00	150.00
Porta sound	Portable table top podium w/A.C. or battery.	35.00	105.00
RCA	Portable—sound with microphone—A.C. or battery.	25.00	75.00
Oravisual	Adjustable floor model—with sound system.	32.50	97.50
Oravisual	Table model with sound.	27.50	81.00
Oravisual	Adjustable floor model—without sound.	20.00	60.00
Oravisual	Table model without sound.	10.00	30.00

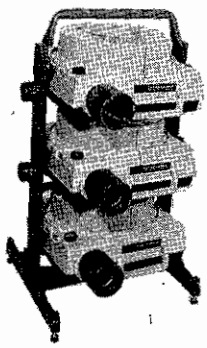
COMMUNICATION SYSTEMS

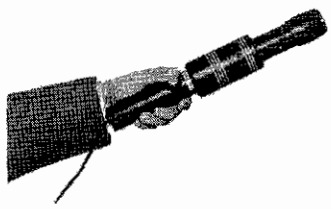
Round Hill Associates	Wireless intercom—1 transistor, 3 receivers.	25.00	75.00
Claricon	High efficiency "Walkie-Talkies" that both transmit & receive.	10.00 ea	30.00 ea
Allen-Western Electric	Professional headset—industrial show equipment, 2 to 10 headsets. (minimum rental two headsets)	10.00 ea	30.00 ea
Hearphones	Compact, attractive, listening devices that can be used with all types of displays where individual listening posts are required.	5.00 ea	15.00 ea

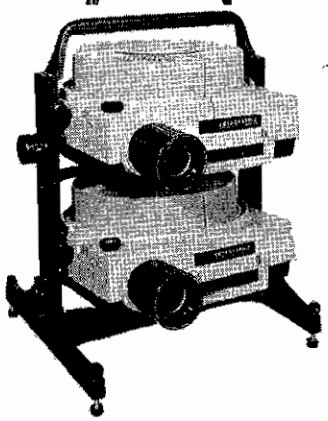
DISPLAY AIDS

Advance	Easels—accessories available.	7.50	22.50
Advance	Easels—large sizes.	10.50	30.50
Oravisual	Easels—accessories available.	7.50	22.50
Wood/Easel	For posters & signs.	10.00	30.00
Limitimer	Automatically signals a green "talk," an amber "3-minute sum-up" and a red "close (stop)" sequence of signal lights to keep your presentations running "on time".	25.00	75.00
Safelock	Portable projection stands—adjustable 32" to 56"—collapsable.	5.00	15.00
Safelock	P1664 back strap for stacking projectors.	5.00	15.00
CSI	2 Tier Strap for stacking projectors.	15.00	45.00
CSI	3 Tier Strap for stacking projectors.	25.00	75.00
Splicers	Standard/super 8mm, 16mm, 35mm.	5.00	15.00
Cue Box	Cue light with remote push button.	10.00	30.00
S.T.A.R. Unit	Used on Kodak carousel trays from 2 to 80 slides for continuous operation.	7.50	22.50
Ednalite	Electric pointer.	10.00	30.00
Control Boxes	Built to specifications.	PRICE ON REQUEST	



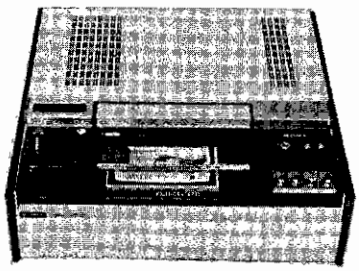


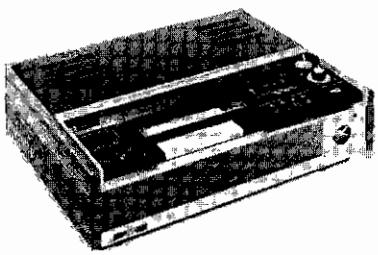


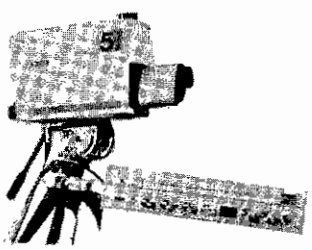


VIDEO EQUIPMENT

NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
Video Tape Playback Units			
Concord	EIAJ ½ inch B & W Portable (only 28 lbs.) Still frame Monitoring.	40.00	120.00
Concord	EIAJ ½ inch Color. Portable seven inch reel with sixty minute capacity and still Frame Monitoring.	55.00	165.00
Sony	Cassette Player-Color. Use with any cassette made for Sony, JVC, Panasonic, Concord or Wollensak.	80.00	240.00
Video Tape Recorders			
Concord	EIAJ ½ inch B & W Portable with audio dubbing and still frame monitoring records off (only 33 lbs.) any video monitor, video and audio AGC.	55.00	165.00
Norelco	LDL-1000, B & W Portable.	48.00	144.00
Shibaden	EIAJ ½ inch B & W unit with Capstan servo, slow and stop motion-audio manual override (30 lbs.)	55.00	165.00
AKAI	B & W unit with 2 hour record play capability. Uses ¼ inch tape.	75.00	225.00
JVC	CR 6100 ¾ inch cassette unit. COLOR - electronic editing - automatic repeat - search control - built-in tuner and timer.	125.00	375.00
Sony	Cassette unit-COLOR-records with built-in tuner off-the-air and plays back on any TV set. ¾ inch cassette.	125.00	375.00
Concord	EIAJ #2 standard ½ inch COLOR Portable. Unit has Electronic Editing, Capstan Servo, Stop Action and Slow Motion, Video and Audio AGC.	100.00	300.00
Complete Systems			
Concord	Portable, battery operated VTR and camera ensemble. Features viewfinder play-back, video and audio AGC, still frame monitoring, EIAJ standard, color and AC adaptability, directional microphone (only 15 pounds).	115.00	345.00
AKAI	COLOR portable VTR system includes complete VTR/ Editing - AKAI color camera with zoom and built-in microphone.	360.00	1080.00
Cameras and Lenses —Large			
Black & White Cameras			
Concord	Standard camera with 16mm F1.6 lens, wide band video amp, automatic light compensation, Tripod.	30.00	90.00
Sanyo	Low Light level camera capable of recording in almost total darkness at 0.4 footcandle. 2/3 separate mesh vidicon. Tripod.	40.00	120.00
Sanyo	Low Light level viewfinder camera. 3 inch screen, tally light 2:1 interlace (8½ lbs.) Tripod.	55.00	165.00
Concord	Studio type camera with built in 4½ inch viewfinder, intercom jack tally light. (14 lbs.) Tripod.	55.00	165.00
Sony	AVC-4600 Professional B/W studio camera with remote cam control, tally lite, intercom, electron finder, aperture correction. Superior resolution.	65.00	195.00
	With 10:1 zoom.	120.00	360.00







VIDEO EQUIPMENT

Optional Canon Lenses—Large

NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
Manual Zoom	5 to 1 (15-75mm) or 8 to 1 (11.5-90mm)	30.00	90.00
Rear Ctl Zoom	5 to 1, 8 to 1, 10 to 1, as available.	48.00	144.00
Remote Ctl	5 to 1 or 8 to 1.	73.00	219.00
Wide Angle Lens		15.00	45.00

Color Cameras

Panasonic	Portable type lightweight Color Camera with Viewfinder, built-in Microphone — 6-1 Zoom Lens — includes Lighting Kit and Tripod with Dolly.	250.00	750.00

Color Television Production Center

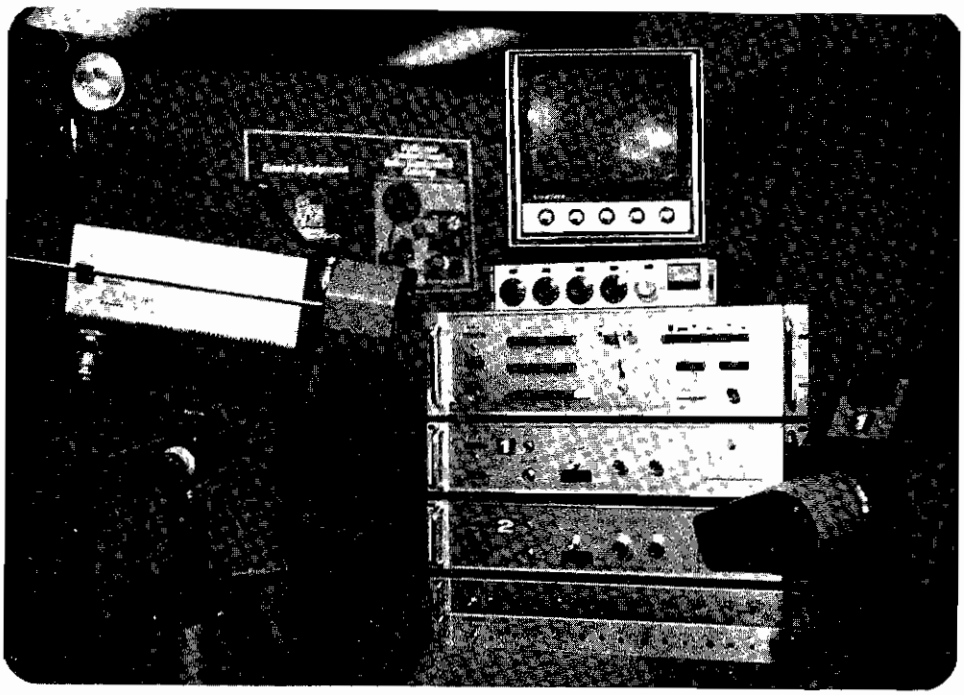
Panasonic — A new full professional and portable color TV production center. The package includes two (2) Panasonic color cameras with rear control zoom lenses, lighting kit, 9" monitor, audio mixer, three (3) microphones, special effect generator, camera control unit and sync generator. Camera may be hand held on the supplied tripod with dollies. Inquire on prices.

Monitors, Receivers and Large Screen Projectors

	B & W 9 inch.	20.00	60.00
	B & W 17 inch and above	25.00	75.00
	Color 12 to 15 inch.	40.00	120.00
	Color 16 to 19 inch.	50.00	150.00
	Color 23 to 25 inch.	60.00	180.00
	FOR CCTV — ALL B & W (monitor only)		
	5½ inch.	12.00	36.00
	Three 5½ inch in cabinet.	45.00	135.00
	9 inch.	15.00	45.00
	19 inch.	20.00	60.00
	23 inch.	30.00	90.00
	LARGE SCREEN		
Kalaat	Black and white 6 x 8'.	300.00	900.00
	To 15' x 20'. (screen extra)	400.00	1200.00
Advent	Color Videobeam with 4½ x 6' screen.	350.00	1050.00
	To 6' x 8'. (screen included)	425.00	1275.00

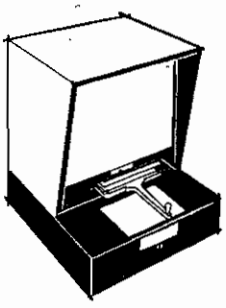
VIDEO EQUIPMENT

NAME	DESCRIPTION	RENTAL DAY	RENTAL WEEK
Special TV Consoles			
Concord	Portable console with two camera inputs, two mic inputs, three 5½ inch monitors, intercom input, special effects generator, split screen, superimpose, fade, blank screen, corner insert, Horz and Vertical wipes.	150.00	450.00
Concord	TV Control Panel, three camera inputs with video looping, intercom input, fade, dissolve, Horz and Vertical wipe two corner inset effects, built in random interlace sync generator.	60.00	180.00
General Accessories—Large			
Lighting Kit.		25.00	75.00
Basic Camera Switcher.		10.00	30.00
Rolling Carts.		15.00	45.00
B & W Adapter Channel 5 or 6.		10.00	30.00
Color RF Adapter Channel 7 or 8.		15.00	45.00
Video/Audio Dubbing amp, 3 outputs.		25.00	75.00
Video/Audio Distribution amp, 3 outputs.		25.00	75.00
Tripods-light duty with dolly.		15.00	45.00
Tripods-heavy duty with dolly.		20.00	60.00
(CABLE ON REQUEST)			



MICROFILM READERS AND CAMERAS

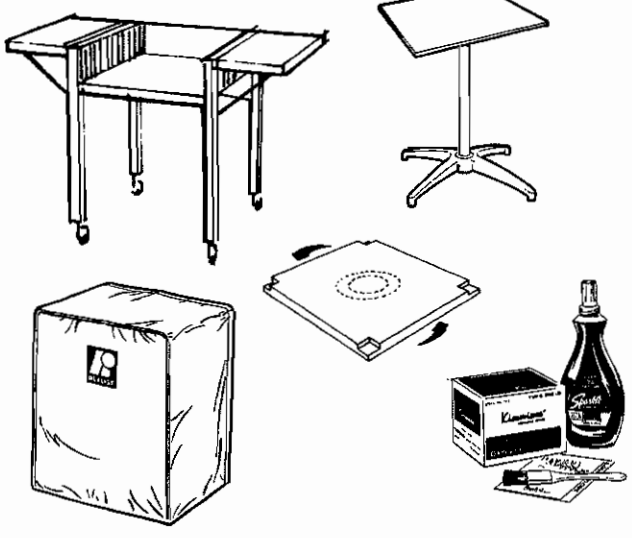
	DAILY	WEEKLY
READERS: 16MM		
Kodak P V A 20x and 40x lens. Roll film only. Manuel film transport with image rotation.	$10.00	$30.00
Kodak Starlet-24x lens. Motorized film transport with fixed image.	$12.00	$35.00
Reader's Fiche-24x and 48x lens.	$10.00	$30.00
READER PRINTERS:		
Kodak PE 1A 18x to 38x. High quality silver prints, accepts roll film, Kodak cartridge or microfiche.	$25.00	$65.00
CAMERAS		
Kodak RV2 Starfile-Plantery Camera with 27x lens. Accepts documents up to 11 by 14.	$25.00	$75.00
Kodak 600 Rotary camera with 32x and 40x lens, Films documents up to 11" wide, both sides at once.	$35.00	$100.00
Kodak 600 Rotary Camera with 24x lens. Films documents up to 11" wide, on one side only.	$50.00	$150.00

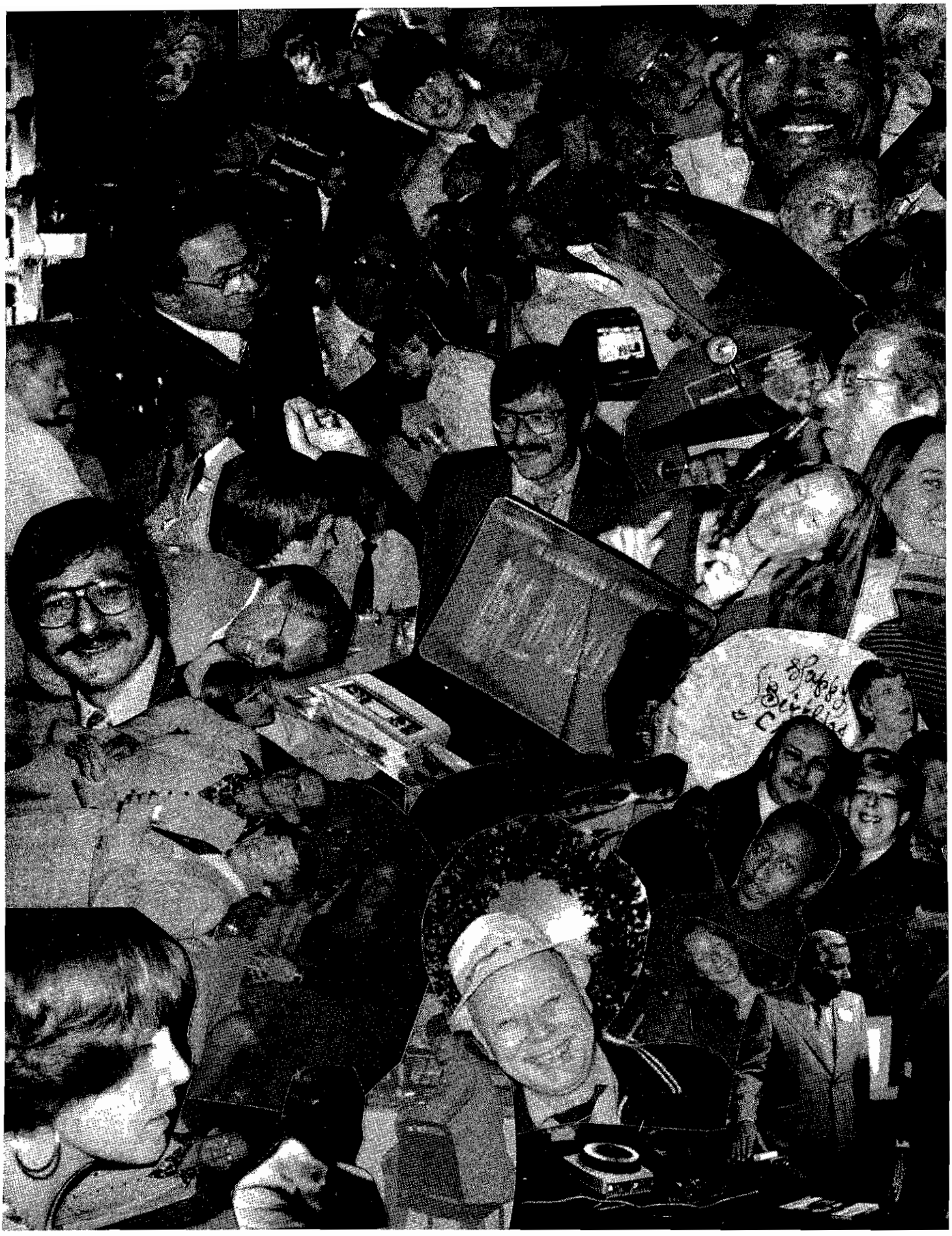


Film is available with processing at $6.50 per roll.

Microfilm consulting also available. We are associated with one of New Yorks largest microfilm service bureaus.

Vangard **ACCESSORIES**





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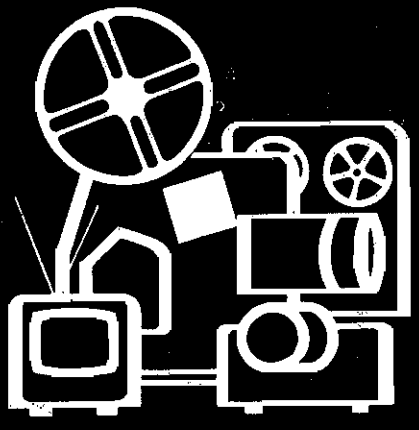

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