KEEPING PACE

A Monthly Newsletter Devoted to the art of Darkroom Photography

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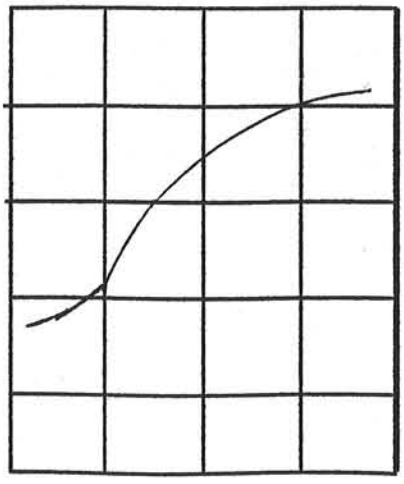
Curve shapes, what do they mean?

Understanding the curve shape.

What is a curve shape?
If a sheet of film is exposed to a step tablet (grey scale) all of the steps can be captured if the exposure and development are normal.
If these steps are plotted against the original steps, then a graph can be designed to show the actual loss occurring in the films capability to hold all of the steps in an accurate division.



All films have a specific curve shape after they have been developed.
What causes the curve shape?

The fact that the film is unable to process areas that are under exposed, such as a shadow in the image, and that the film is also unable to hold all of the detail in a dense area of the negative, (such as a white shirt) that the curve shape is almost impossible to capture as a perfect duplicate.

When a sheet or roll of film is exposed in a camera and processed, how do we know if the processing time and temperature is accurate?
The manufacturers know exactly what they are doing.
They determined that a reasonable gamma (degree of contrast) had to established in order to make an acceptable image.
They plotted curve shapes using one film and different kinds of developers, different times, and different temperatures.
However, they assumed accurately that most camera enthusiasts simply wanted to shoot a picture and let the lab (any lab) do the rest.
It just so happens that any time you bring a roll of black and white film to an outside lab for processing, you will be in serious trouble if you are expecting the best possible image.

The fact is this. The film can be processed in the same developer, but the difference in developing times and temperatures (not to mention agitation) can, and does, cause different results.
The same film in different developer dilutions can cause different results.

Different films in the same solutions can also produce different results.
Different films in different solutions will cause different results.
In otherwords, it's like comparing it to a crapshoot. The results will always be different.
Is it possible to control the processing time and temperature with specific films and have a repeatable result? Absolutely. This is the reason for plotting curve shapes.

How did the early black and white fine art photographers get away with curve shape problems?
Simply put, most of the early photographers like Mathew Brady and some others that followed him during the last years of the 1800's didn't even know about curve shapes as the discoverers of this phenomena (Hurter & Driffold) were still learning about it.
The original art photographers were artists. Their main concern was to capture an image.
They soon realized that much burning and dodging of the original negative was the only way to emphasize the light or dark tone of the image and make it a pleasant work of art.

It took the later generation of artists such as Weston, Adams, Strand, Steiglitz and others who were able to produce negatives that more clearly captured the range of light and dark.

A simple analogy is this:
The original pioneer pilots flew their planes by instinct. The same thing occurred within the photographic community.
The experience one photographer learned by doing, became the methodolgy of his future.

Is it possible to alter the curve shape?
Once the discovery of the curve shape was announced, scientific and curious photographers learned that it was possible to control the original scene on film by processing it to it's most useful end.
Whenever the sky was dull and grey, they discovered that if they slightly under exposed the sheet of film and slightly over developed it, the resultant print had better contrast and snap than it did previously.
On the other hand, they could now travel into the Grand Canyon on a very sunny day and by slightly over exposing the image and slightly under developing it, the results would be less contrasty and pleasing to the eye.
What a discovery.
Yet, most photographers would still bring their films to a lab that simply processed their films according to a book published by the manufacturers that simply gave developing times for "average" exposures and nothing else.
However, not long after this new method of controlling the films contrast was announced, Kodak began including a data sheet with their films that recommended specific developers to be used and displayed a time and temperature guide so that this too, could be controlled. The main item they included on this sheet was a gamma curve line that allowed one to place the contrast of the film where one thought it belonged.

How was this done?
A small book, part of the "Little Technical Library" series printed in the early 1940's by Ziff-Davis, one was called "The Manual of Correct Exposure." Itv was written by H.P.Rockwell. Part of his information included this system.

The use of a light meter (The Weston Meter)
enabled one to scribe numbers on the exposure scale. The trick was to first read the shadow, set it to zero, place the arrow on the correct number (zero) and then read the highlight area.

Remember, the shadow was always zero.

The number of the highlight area was the key to determining the gamma of development.
A photographer could go out on a shoot and capture an image deep in the woods, that had little light and even less contrast. After the readings were made, the exposure determined, the gamma number was written on the holder, and back at the lab, the developing time was revealed and the film was processed with much more accuracy than simply putting it in a hanger and following the written instructions for the "average" exposure.
This was the beginning of the "Zone" system that was later the main system expounded by Ansel Adams.

What does the curve shape do to the image captured on film?
If the image has good contrast through the middle portions of the negative, the highlight and shadow areas are usually flatter in contrast. In the early days, this wasn't considered a detriment, but just the way things were in photography.

How about color film? Is there a method of processing films so that the overall contrast can be lowered? There may be, but I wouldn't chance trying to make a home made chemical solution that could possibly ruin your efforts.
No manufacturer has developed a chemical remedy for correcting curve shapes.
Usually, the color image is full of color, and has a limited range of contrast that is greater then the normal black and white film.
All color films have a specific speed and color balance, and must be processed accurately.
Recently, color films are able to be pushed or pulled in processing without the threat of a major color change.

The eye takes all of this into account and does not really see the curve distortion. The manufacture of color films and their eventual processing (especially Kodachrome film) is very complicated. All three layers of color must be the same speed and developed to the same contrast. If this were not done, then the films would be off balance and possibly display pink highlights and green shadows.
The use of color negatives has a similar problem. A certain degree of processing pushing and pulling can take place as long as it is in the boundary of the process.

Does copying the image, whether it is a print or transparency, change the curve shape? It most certainly does.

Has the photographic industry developed techniques or films that can repeat the original curve shape?
Kodak, and others have developed a color film to be used exclusively for duplicating other original transparencies.
These films has a somewhat straighter curve shape and almost reproduce the original image as the eye sees it. This has been a boon to the reproduction field.
Even here, the process is not perfect.
For instance, in a black and white system, a print is received for copying.
It is placed in front of a copy camera. Lights are played on the original, and an exposure is made and the film is processed.
Immediately there is a change in the negative caused by a curve shape distortion. This is called a "generation loss."
If you kept repeating the copying by copying each new copy, the results would be disastrous. The highlights and the shadows would have been compromised and lost most of their detail and sharpness.
The shadows will keep climbing up higher and higher, while the highlights will keep dropping lower and lower. Evebtually, the curve shape will have lost it's traditional "S" shape and almost look like a straight line.

In making reproductions via the graphic arts printing system, or if making separation negatives from transparencies and eventually prints, is there a method of capturing the image accurately without the curve shape distorting it? To some degree, yes.
Remember, the graphic arts continuous tone films film are no different than the films you would normally use. (Except for litho film.) A set of separation negatives, (continuous tone) would have similar problems unless you did something about it. Masking is one of the best remedies for curve shape control.
This includes contrast masking, highlight restoration masking, color correction masking, and other techniques.

If we begin with a transparency, our aim is to make a print that by eye, looks close to the original transparency. If the shadows are blocked up or if the highlight areas are blank, then the curve shape distortion has done it's work. We must understand how to control most of the curve shape.

Even though the image on the transparency has been diminished slightly, when compared with the original scene because of the curve shape, it is usually ignored. The transparency still looks great and that is all it has to be.
Who among us has had the strong urge to go back to the original site of the photograph, and carrying along a portable light box, compare the original scene to the transparency? I am certain the answer is "no one."

In the Dye Transfer process, we have learned how to make most of the transparency fit the contrast range of the printing material. The same can be said for making prints using the Cibachrome process. We recognize the fact that the print material has it's own limitations and we make contrast masks to enable us to make the transparency fit it.

When I began in the print business, I made Carbro prints. The loss of any part of the image was negligible, because we all accepted the negatives as they were. The curve shape never interfered with our judgment because we were used to looking at other images made from straight negatives, such as great black and white images.
The problem arose when a **transparency** had to converted to separation negatives.
We had something to compare the image to, the transparency. The difference in contrast between the transparency and any normal negative was enormous. However, when we made Carbro prints, they were made from separation negatives shot in the camera. They were actually black and white negatives shot through color filters.
The first thing we checked out when making a color print from separation negatives was the contrast, then the density, next was the detail in the shadows, and the structure in the highlights, and finally, the color balance.
This system of preparing an image for printing has been my main objective when producing prints.

The original Carbro prints that I worked on had great contrast and did not exhibit any curve shape problems. However, the colors were not as bright, nor was the Carbro process as manipulative as the Dye Transfer process.
It really is a trade off. On the one hand, with the Carbro separations we have more readily accepted curve shapes but little control, and the Dye Transfer process that requires masking to bring the contrast levels where they belong, the curve shapes a bit more out of line, while still being manageable to a high degree of accuracy.

The invasion by the scanners and workstations have resolved this problem about curve shapes. The problem does not exist unless you want it to.
The high end rotary scanners can capture all of the image in extremely fine detail.
The work station allows you to make any kind of correction you can dream of, and the final stage of this three part system (the film recorder) can produce a fine transparency or color negative that is being considered original art.

These final sheets of film are produced using an electronic method of exposure, and that the duplicate's curve shape ends up being a straight line reproduction of the original.**This can not be done with the standard method used for continuous tone imagery.**

For those of you who want to get into the field of image manipulation using a computer, there is a method to do this without going broke. Purchase the Macintosh, II C I and a Sharp scanner. Get the optional transparency scanning device that will also allow you to scan a transparency.

Or better yet, send your art work out to a professional separation house that owns a high end rotary scanner.

Which ever method of original scanning that you use, the image saved on the disc can now be turned into a viable image. This image can be placed on a disc, which is sent back to you for further manipulation. When this is done, the disc is sent back to the separation house and you will have the option of receiving either a set of screened separation negatives, (for the new UltraStable process,) a new transparency, or a new color negative.

If you desire to work from screened separation negatives you can either use them to be run in a printing press for inserts, ads, or prints.
If you receive a transparency, this can be used for graphic art reproduction, positive prints such as type R or Cibachrome.
If a color negative is delivered, this can be used to produce large back-lit Duratrans for point of purchase display or for prints of any size.

The lab market today is aimed at the amateur market to the advanced group of photographers.

How about the serious photographer who is interested in making high quality prints and having them exhibited in galleries or museums?

The job of shooting a high quality picture is only half of the battle. It takes a great deal of concentration to capture all of the elements needed for a fine photograph.
Composition, color balance , and eye appeal are the ingredients that make a fine image.
Almost every adult person in the modern world owns a camera.
The job of film manufacturers is to get their film exposed. The little throw away cameras indicate the attitude of the manufacturer about the photographers in our midst.
Serious photographers that would like to further their education are at a loss.
Books about professional printing or darkroom work is almost nonexistent. I hope I am an exception.
Any book that deals with printing strategies should be as complete as possible.
As an example, the books written by Galen Rowell are full of his own thoughts about how a scene should be captured. It's as if he were speaking out loud while examining a location. This is done by others as well, but they are hard to find.

The series of books written by Ansel Adams are a perfect example of how instructions should be explained to a reader.

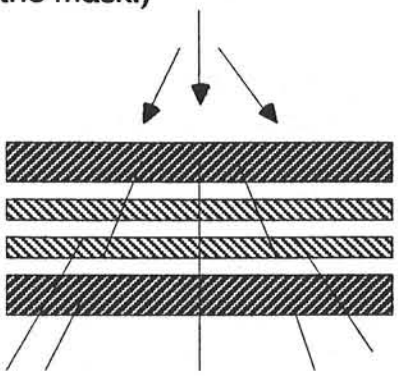
Some books are cold and unemotional and give the reader little to hang on to.

Actually, the goal of the serious photographer is to produce a piece of art. It is as simple as that.

The Cibachrome process is still alive and well. The biggest concern about the Cibachrome is the material's speed.
I have written about my experience with a unit called Xenomega.
This was a pulsed xenon light source, conveniently built into the light head for an Omega D2.
It produced 1500 watts of condensed 5000°K light and enabled one to make large prints from 35mm originals with very short exposures.

Remember, the culprit concerning the Cibachrome print process is reciprosity. The shorter the exposure, the less trouble.
This unit has been out of existence for many years, but a few of them have survived.
If you should ever find one, take it to an electical technician and have him produce a few.
The unit had to have an 85B filter added to the light source to bring it back to 3200°K.
However, this didn't affect the exposure time as the difference was insignificant.

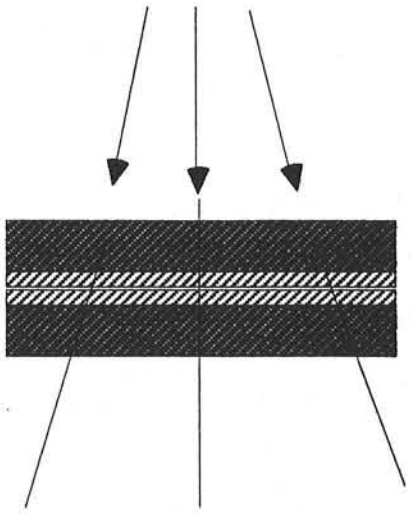
The biggest problem when printing from 35mm was **refraction.**
The light source created a rainbow effect towards the edges of the transparency, because the light had to pass through 4 surfaces of glass (2 sheets) and 4 more surfaces of film and emulsion. (The original slide and the mask.)



To get rid of this annoying phenomina, some sort of immersion oil had to be used in order to get rid of the rainbows.
Have you ever looked at the edge of a mirror and seen the rainbow images towards the edge of the glass?

It is possible to eliminate this refraction by the use of an immersion oil.
Some simple oils work fine, such as Castor Oil, Mineral Oil, Immersion oil used in microscopes, and a dry cleaning chemistry known as Perchloric Acid, commonly called "Perk" by those in the dry cleaning business.
The key ingredient in these different "oils" was to get close to the refraction index of the glass.

I investigated for a few months and found a liquid silicon that works without damaging the originals. It is "Dow Corning, # 200, Viscosity 100."
It is totaly inert and just happens to have same refraction index as the glass in the carrier.
As a result, it was possible to make large blow-ups of small originals without this refraction problem.
Here is what it does.



The image is free from refraction "rainbows" and is free from Newton's rings, abrasions, scratches, while it also lays flat and produces a much more accurate image.

Many of the prints we made professionally from small originals were eventually used on large billboards.

This a method that I would recommend to all serious printers that work from small originals, from 35mm to 2 1/4 films.

There was supposed to be a possible arrangement where the UltraStabe process would have small processing units throughout the country that could make the new Carbon process prints. However, this is still not a fact and more time may be needed to make this happen.

I am particulary interested in working with the new Kodak 35mm scanner. From what I have seen in a professional lab, the scans are great for making small prints up to 8x10.
However, for making large prints, I still think the right way to approach this process is to have your original scanned by a high end scanner (such as a Scitex or Crossfield) and if you have the hardware, make your corrections, send the disc back to the separation house, have a match print made, then make your Carbon print and see how close it comes up to the match print.
There has to be a way to the end results match between you and the separation house.
Th Di-Comed company claims to be able to do this. This is called color control between you and your separator.

The next step is to get all of the equipment needed to make your own prints.

When you boil it all down. the simplest priinting process to set up is the Carbon process.
No enlarger is needed. A sink, a dryer, an exposing system, and a simple registration system is all that is really necessary.

Compare that to the Dye Transfer process, beginning with the densitometer, enlarger, registration equipment, lenses, trays, sinks, and so on.
The Ciba process requires little more than a quality enlarger, with the necessary registration equipment, and a good processor.

Here is one advantage of using the new high end digitizing equipment.
Suppose that you receive a transparency from a client. The client wants specific color corrections made as well as some retouching, such as removing a reflection or a tree.
So far, so good.
The work is done and a new transparency is generated.
If this were done with the conventional systems, the dupe may be accepted or possibly not.
However, if it is accepted, fine.

Now 6 months go by,and the client has lost the new duplicate transparency, with all of the retouching (electronic or manual) and needs a new transparency and sends you the original again.
If you worked with the conventional system, you would have to re-expose again, and retouch again, and hope that the resultant dupe transparency would match the result obtained the first time.
You know it wouldn't.
After some time with a trial and error approach, the job would be finished. On time? Who knows.
However, if the job that was done 6 months ago was filed electronically, all that had to be done was to call it up and expose a new transparency. Period. Finished.

This is a great advantage because of the time saved and of the accuracy of the duplicate.
There are significant advantages with the new digitizing systems.

However, most of my subscribers are interested in making high quality prints from their own original transparencies.
This is where I come in. I have written about all forms of color printing, beginning with Carbro and ending with the new Carbro.
It is amazing to see this old process being brought back to life.

Bill Nordstom is making high quailty Carbon prints that will last for at least 500 years.

There are a number of schools that teach the Dye Transfer process, however they do not get deep enough into the process but just skim the highlights.
In order to understand how any process works, one must first find out what their own equipment will do.

When I first made "Wash Off" color prints in 1946, there was nothing written about the process except what was in a leaflet packed with the matrix film.
We made exposures onto the matrix film from negatives that were obviously out of balance and proceeded to run prints with bad dyes, badly processed matrix films, and extremely poor seperation negatives. What did we know?
We all though that if we could at least get an image that looked real, then we were on the right track.
We made test images on matrix film by placing a paper clip in a white area, and when the print was run, we had to able to see the image of the paper clip.

I can't believe that I fell for this kind of wrong information.
I worked for a firm who's name indicated that they were "color masters" but since only one person was the lab, (besides me) this was an overstatement.

Even more bizarre was the fact that we placed a sheet of window pane glass over the matrix to keep it flat.
No one, at that time, seemed to know anything about vacuum.
It was when I joined the firm of "Evans & Peterson" that some semblance of rationality existed.
We measured our own separation negatives with a densitometer that was considered the state of the art produced by Marshall.
The fact that "Evans & Peterson" was primarilly a Carbro house, meant that we made black and white prints called "bromides" that we used for the combining of the color pigments.
These same prints were also used to determine a color balance and density level.
We used the same bromide technique when preparing to make matrices for the Dye Transfer process.
It worked. We used this same system for 25 years.

This method enabled us to become creative in our print making efforts. We became so adept at being able to "read" the results of a set of bromides, that we could easily alter the color balance and density to achieve a specific effect.

This system began in 1947 and it still can work.
We never owned a densitometer at that time.

For those of you engaged in producing Cibachrome prints make sure that you understand the reciprosity problems associated with long exposures.
The longer the exposure (such as 60 seconds) the colder the print will become in color.
If you suddenly change the exposure from 60 sec. to 120 sec. don't expect to achieve a one stop increase in brightness. Expect to receive about 60% increase instead. And the print will become even colder.
A test with your own light source wil point out the differences in reciprosity

A student recently asked again about the feasibility of using the 45A light source produced by Beseler for making Ciba prints.
It works fine, but is a little slow for this particular process.
Be careful of long exposures. Instead make more than one short exposure in order to fill the requirements of the exposure. In this way the bulbs will last longer and not burn out suddenly.
The light source is certainly smooth as siilk and very convenient. Especially when combimned with the new easel meter.
Good Luck,
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