ORIGINATION - TRANSPARENCIES AND ARTWORK

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INTRODUCTION

The purpose of this paper is to highlight some of the problems encountered by the reproduction house and printer when working from originals of illustrations, whether they be color transparencies, black and white bromides, or artist's copy. Many of these problems are aggravated by a lack of communication along the path from photographer, artist, or designer via the photographer's client, publisher, etc to reproduction house and printer. Often the photographer or artist is not aware of the limitations of the printing process and of what the printer requires in an original. Similarly the reproduction house manager or printer may not be aware of the restrictions imposed on a photographer by certain limitations in his cameras and films. A better understanding between the creators of originals and those whose job it is to reproduce and print them would, we feel, permit the effects of many of the following problems to be minimised.

COLOR PROBLEMS

Excellent though the modern color film may be, it has certain limitations which may prevent it from faithfully recording all it sees.

It is generally accepted that reversal colour films, which produce a positive color transparency, are more suitable for purposes of reproduction than are color negative films, from which a color print must be made. Reversal films are available in two basic types - a 'daylight' type designed to give its most accurate results when exposed to light with a color temperature of 5500K, equivalent to daylight or electronic flash, and an 'artificial light' type, designed for

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use in light of 3200K as provided by certain tungsten lamps. If either film is used with illumination which is not exactly that specified then the color rendering of the subject will not be the optimum possible.

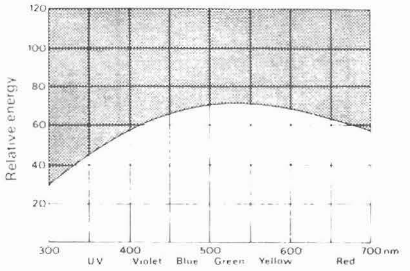


Fig 1

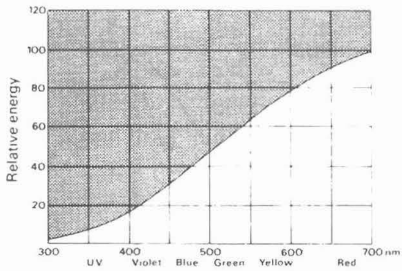


Fig 2

The spectral emission graphs of daylight (Fig 1) and of a tungsten filament lamp (Fig 2) show that daylight is much richer in blue light than is the light from a tungsten lamp, while the latter is much richer in red light than is daylight.

Because of the remarkable way in which the human eye adapts itself to changes in the color of the light by which we see, it is difficult for a photographer to be sure that the color of an illuminant agrees exactly with the requirement of the film he is using. When working in a church, for example, using just the available light from the windows it is not possible to detect whether the light has taken on any slight color cast as it passed through the window glass. Any coloration in the glass would result in a corresponding color cast on the resulting transparency. The color of most illuminants can be checked by using a color temperature meter, the better makes of which measure the relative intensities of the light at three points in the visible spectrum approximately corresponding to the peak sensitivities of the red-, green-, and blue-sensitive emulsions of the color film. Most meters of this type permit the photographer to read off the color filter or filters needed to correct for any color error in the light source.

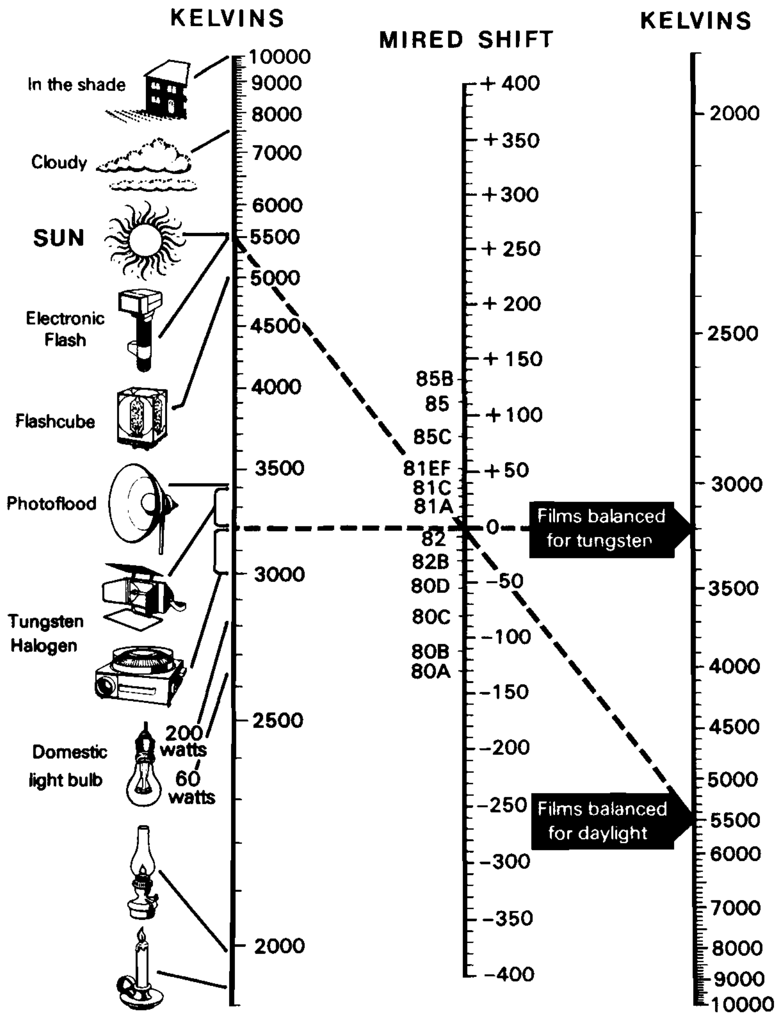


Fig 3. A Nomograph for finding the color conversion filter required for a particular light source/film combination.

A straight-edge placed between light source (left-hand scale) and film type (right-hand scale) indicates the color and type number or mired shift value of the required filter at the point at which it intersects the center scale. Two examples are given. The dotted line shows that when a film balanced for daylight is used in bright sunlight no filter is required, and the solid line shows that when a film balanced for tungsten lighting is used in sunlight an 85B filter is needed.

Some light sources, notably those gas discharge lamps which produce an entirely discontinuous spectrum, eg a mercury vapour lamp, are entirely unsuitable for color photography, and no amount of colour filtration will produce an acceptable result. (Fig 4). Some discharge lamps can be used for photography however. A particularly notable example is the xenon flash tubes used in electronic flash units, which produce light which is a good approximation to daylight.

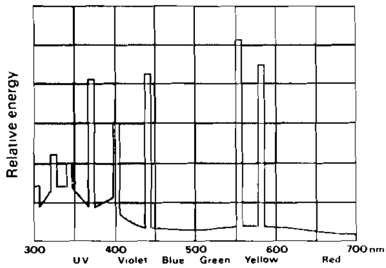


Fig 4. The spectral emmission graph of a mercury vapour lamp shows that its output consists mainly of intense but disconnected peaks, which makes it unsuitable for color photography.

Certain fluorescent tubes can be used for photography, although fairly heavy color filtration may be necessary. Results are often unpredictable, the effective color temperature quoted by the lamp manufacturer providing little guidance as to the filtration required, and test exposures must be made when using a new lamp/film combination.

The Northlight tube (Fig 5) gives good color accuracy when used with Ektachrome Daylight film. The Whitelight tube (Fig 6) gives a strong green cast when used with Ektachrome Daylight film. This green cast is corrected when the exposure is made through a CC40M filter. However, any areas of the scene lit with daylight, will then reproduce with a magenta cast. Therefore, in such an instance, the photographer would have to photographer the interior after dark and use only the Whitelight fluorescent tubes to make his exposure.

If the spectral emission graphs of these two fluorescent tubes are studied it will be seen that the Northlight (Fig 5) has a fairly even distribution of Blue, Green, and Red light, whereas the Whitelight tube (Fig 6) shows a heavy emission in the Green, Yellow, and Red area, and it is this which the color film picks up.

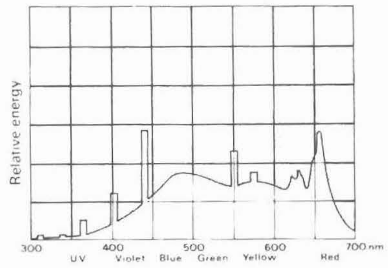


Fig 5. The spectral emission graph of a 'Northlight' fluorescent tube.

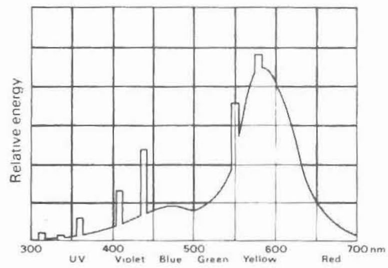


Fig 6. The spectral emission graph of a 'White' fluorescent tube.

Films from different manufacturers may require different filtration when used with the same fluorescent lamp, even though the films are balanced for the same color temperature light. This is because the peak spectral sensitivities of the red-, green- and blue-sensitive emulsions of the films may not coincide and will therefore relate differently to the peak spectral emissions of the fluorescent lamp (Fig 7).

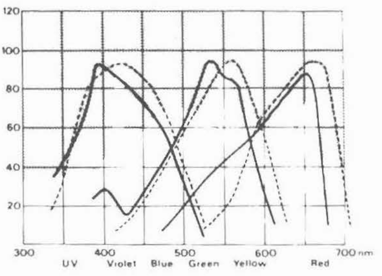


Fig 7. The dotted lines show the spectral sensitivity graph of one particular make of color film. The solid lines show the graph for another make of film. In both cases the graph consists of the distinct but overlapping curves of the blue-sensitive, green-sensitive and red-sensitive layers of the film. The graphs are shown here superimposed on a spectral emission graph of a typical fluorescent lamp. Because the individual curves for each film fall in slightly different positions relative to the peak emissions of the fluorescent lamp, the two films will give a different color rendering when exposed to the light from the lamp.

Even when the color of an illuminant exactly fulfils the requirements of the color film, color fidelity will not be perfect. No color film reproduces all colors equally well. Each make of film has its own 'difficult' colors which it does not record as accurately as it does others. The difficult colors for one make of film may be entirely different from those for another. Because of this and the difficulty in exactly matching color of illuminant to sensitivity of the film the transparencies supplied by a photographer to his client may not provide an accurate representation of the colors of the original subject. For many illustrations the only demand is for a pleasing result and any minor color inaccuracies are of little consequence. When color accuracy is vital, as in certain advertising photography where the illustration is intended to show the exact color of the product, it is imperitive that the photographer or his client provides the printer with some indication of the true color of the subject. In some instances the customer could supply the printer with a sample of the subject itself, eg a small piece of dress fabric or shoe leather. When this is not possible the color could be indicated by comparing the subject with a printers' color chart and noting the color which yields the nearest match.

The choice of which color film to use is complicated by the fact that not all makes are available in a full range of sizes. A photographer who uses more than one size of film may find his choice of material restricted if he wishes to obtain some degree of consistency in his work by standardising on one make of film.

PROBLEMS OF CONTRAST

For a reversal color film the exposure range which will produce maximum contrast in the processed image is typically 300:1. If all the detail of the subject is to be satisfactorily recorded, from the brightest highlight to the darkest shadow, the brightness range of the subject must fall within this value. If it does not, some subject detail will be lost. Depending on the level of exposure given, the loss will occur either in the highlights or in the shadows, or in both. Normally, however, the loss will be confined to the shadows, as the exposure for a reversal film is usually selected to just retain important detail in the highlights.

In many photographic situation the photographer has sufficient control over subject and lighting to ensure that the maximum acceptable brightness range is not exceeded. In studio photography he can adjust the position and balance of his lights. Outdoors in sunshine, where the brightness range can be as great as 1,000:1, he can use reflectors or fill-in flash to illuminate the shadow areas of subjects small enough to allow it. When the subject is of larger proportions, such as a building or landscape, the photographer will have no such control. In bright sunshine, particularly with side-lighting there may be large areas of unlit shadow. Because the exposure for a reversal film is normally chosen to just retain important detail in the highlights, detail in such shadow areas will be outside the range of the film and will be lost. If the shadow detail is of importance the photographer must return either when the sun is in such a position that the important areas are not in shadow or on an overcast day when there are no shadows.

The human eye can handle a brightness range much greater than can a film. Because of this it is difficult to visually assess whether or not the brightness range of a subject is too great for a satisfactory result to be obtained. Consequently the photographer may not be aware that his subject was excessively contrasty until he sees his processed film, with the result that the printer is subsequently asked to do the best he can with a very contrasty transparency.

In the last decade most camera manufacturers have improved the effectiveness of the anti-reflection coating applied to the glass surfaces of their lenses. Instead of the previously standard single coating, which reduced reflection at each air/glass surface from about 5 percent to about 2 percent, most lenses are now 'multi-coated', reducing surface reflections to as little as 0.2 percent. While this improvement has virtually eliminated optical flare, it may have aggravated the contrast problem. Except when the subject is back-lit, the flare introduced by a single-coated lens is not likely to be sufficient to be noticeably detrimental to image quality. It may even be beneficial, as the effect of flare is to reduce the contrast of the image falling on the film, thus allowing the film a better chance of satisfactorily recording the entire brightness range of the subject.

Contrast problems can also be evident in black-and-white photographs supplied for reproduction. Photographers and publishers are often unaware of the problems and limitations of the graphic reproduction process. Often highlight or shadow detail present on the negative is nearly or entirely missing from the bromide print, making a satisfactory reproduction of the original subject impossible. An expert bromide printer who is aware of the requirements for reproduction will take steps to ensure that his prints contain as much as possible of the tonal information on the negative. He will select the contrast grade of bromide paper which gives a satisfactory overall appearance, and will then help difficult shadow and highlight areas by 'shading' and 'burning in'. Shading involves the use of the hands or suitably shaped pieces of black card so positioned between enlarger lens and bromide paper as to hold back light from the shadow areas during part of the exposure. Burning-in involves using hands or pieces of card to shield light from all areas except the highlights during an exposure which is additional to the main exposure, so that the bromide paper receives additional exposure in the highlight areas. Shading and burning-in require considerable skill, however, and even the most proficient printer will have difficulty in producing several identical prints from the same negative if a larger amount of shading or burning-in is required.

In the early 1950's EMI developed an enlarger which provided automatic shading. The equipment was expensive and not very many were sold. Recently, however, there has been a renewed interest and several firms manufacture their own versions, the basic principle of which is the same as that of the EMI original (Fig 8). Instead of the tungsten lamp used in a conventional enlarger, the 'electronic' enlarger has a cathode ray tube (CRT) as the light source. The negative is held as close as possible to the face of this tube. By using suitable scanning circuitry the electron beam is deflected back and forth within the tube, giving a spot of light which scans ıe negative area, tracing out a raster on the screen of the tube in much the same way as in a television. Between the negative and the enlarging lens is a beam splitter, usually simply a sheet of thin glass, which directs a small percentage of the light passing through the negative towards a sensitive photocell or photo multiplier (PM). The electrical signal from the photocell at any time is dependent on the density of the very small part of the negative which is illuminated by the scanning spot at that particular moment. The signal is fed into that part of the circuitry which controls the brightness of the spot, in such a way that the spot becomes less bright when it is illuminating a shadow area of the negative and brighter when it is illuminating a highlight area, thus automatically performing the functions of both shading and burning-in. The equipment can also be fitted with a photocell beneath the bromide paper. When this photocell is connected the enlarger can be used as a light source for contact printing from large negatives while still retaining automatic shading and burning-in.

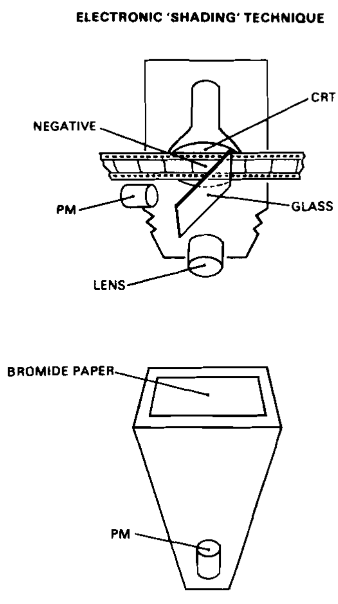


Fig 8

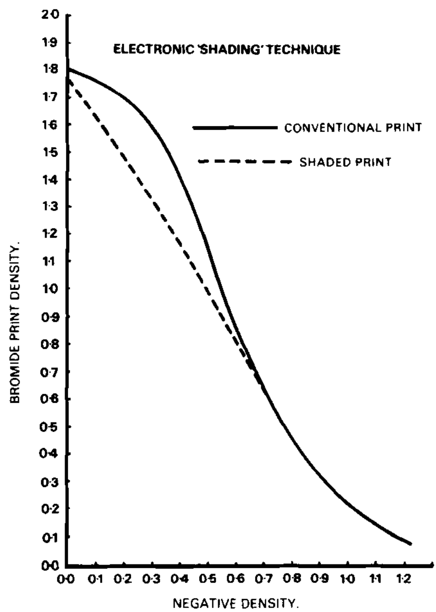


Fig 9

Fig 9 shows the graph of a conventionally made bromide print (solid line) with its normal shadow loss, compared to an electronically shaded print (dashed line) with its excellent straight line shadow position.

While we acknowledge that a publisher compiling a book often has to buy in black-and-white photographs from many different sources, and that in such instances he will have little or no control over the quality of the originals supplied, there are occasions when he does have more influence, such as when photographs are taken specially for the purpose of illustrating a particular book. We suggest that a higher quality in the final printed result will be achieved if the publisher requests, whenever possible, that the photographer supplies prints which have been electronically shaded. Even if the photographer does not have access to the equipment himself, there are several firms who offer electronic shading as a service. The reproduction house and printer can assist here by advising the publisher of the amount of shadow 'pull-out' required (the shadows would need to be lighter on the bromide print if the job is to be printed on an inferior quality uncoated paper than they would for a good quality coated stock). Photographs of dark oil paintings can often benefit from the use of the electronic enlarger, even when they are to be printed on a good quality art paper. Details almost hidden in the darkest areas of the painting can usually be enhanced to a level which enables them to be easily retained at the subsequent reproduction stage.

A particular application of the electronic enlarger is to be found in the reproduction of medical X-ray pictures. The original photographs usually have a very large density range, typically 3.6 to 4.0, due to the X-ray film being coated on both sides to reduce the exposure required by the film - and therefore the patient - to the potentially harmful X-rays. Unless equipped with an electronic graphic arts scanner, the reproduction house usually will be unable to contain this range, and detail present in the original will be lost in the reproduction. An electronic enlarger can be used to make an automatically shaded copy from the original X-ray picture. This copy can be either a negative bromide print (in which case the tonal values of the original will be reversed) or an intermediate negative on film. The film negative can be used to produce a positive bromide print in which the tones are not reversed. By suitably adjusting the amount of shading and burning-in, the range of the original can be so compressed that all the detail on the original is recorded on the bromide print well within the maximum tonal range which the subsequent reproduction process can handle.

If the original X-ray picture is too large (more than 9" x 9" - full chest X-rays are about 17" x 14") to be copied using the electronic enlarger, a reduced size intermediate negative must be made by conventional means eg by photographing the original with a 5" x 4" camera. A bromide print can be made from this negative using the electronic enlarger to preserve all the detail present in the negative, but because there can be no tonal compression when the negative is made, the bromide print may only just contain all the detail of the original, and there may be a slight loss during the subsequent reproduction stages (Fig 10).

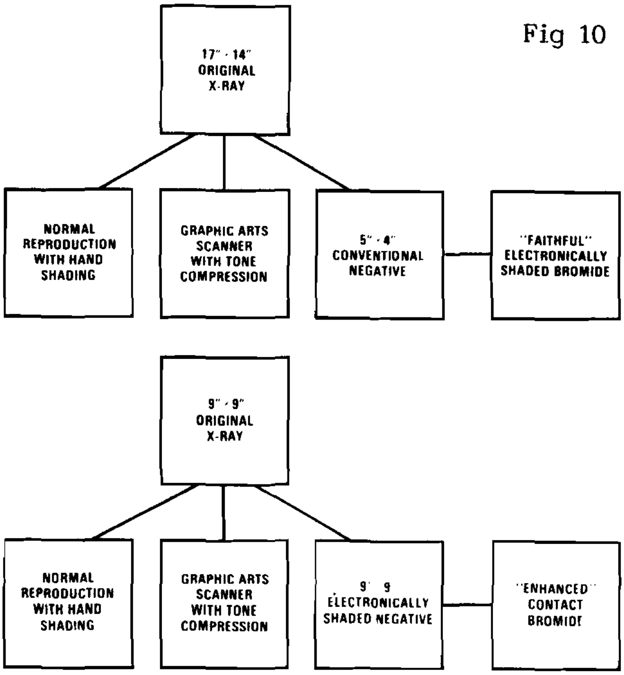


Fig 10

The smaller sized X-rays (9" x 9") can be copied by contact on the electronic shading equipment and a contact bromide from this shows "enhanced" separation.

Note : Although the tonal compression of X-ray photographs for reproduction purposes is often desirable, the reproduction house should always refer back to the publisher/author before proceeding. Sometimes the information which makes medical diagnosis possible is represented by only a very small tonal change on the X-ray picture. In such an instance compression of the entire tonal range of the picture may render this vital detail indiscernible.

PROBLEMS OF RESOLUTION AND GRAIN

All conventional films, whether black-and-white or color, rely for the production of an image on the photo-sensitive characteristics of the silver salts which are present in the emulsion as a suspension of crystals. The physical size of these crystals - or grains - limits a film's resolving power and hence its ability to record fine detail. The sensitivity of the film to light is also partly dependent on the grain size, faster films having larger grains and lower resolving powers than slow films. For most photographic illustrations it is desirable that the grain structure of the image is as inconspicuous as possible (although grain is sometimes intentionally emphasised for artistic effect). The degree to which grain is apparent on the final printed result is determined by the grain size on the original transparency, and on the enlargement ratio between transparency and final print. To minimise the prominence of grain on the final print the original transparency should be as large as possible and taken on a fine-grain film. Ideally a large-format camera, say a 10" x 8", should be used. This is often possible for studio photography and many of the transparencies supplied to us as copy for advertisements are taken on just such a camera. For outdoor photography, however, the use of a large and bulky camera is often impractical. The members of our own photographic team photograph a wide variety of subjects, ranging from stately homes, cathedrals, and museums, to holiday beaches, general landscapes, close-ups of flowers and animals etc. Although some of these subjects could be taken on a large format camera, many demand the convenience and speed of a smaller hand-held camera. The camera our photographers prefer from the handling aspect is the 35mm single lens reflex, of which there are several models suitable for professional use (we use both Canon and Nikon equipment). The results obtained when using a slow reversal color film such as Kodachrome are capable of enlargement to about 14" x 11" before the grain becomes obvious and apparent sharpness begins to suffer.

Unfortunately, since the introduction of Kodachrome 25 and Kodachrome 64 we have experienced difficulties which were not evident with the old Kodachrome 11. We have found inconsistencies in both color balance and film speed. Kodachrome 25 often exhibits a green cast and has an effective film speed which may be as one stop slower than the specified speed, while Kodachrome 64 often goes magenta. Because of these variations our photographers feel they can no longer rely on Kodachrome and have changed to Ektachrome, which they find much more consistent in quality. There is the additional advantage that Ektachrome can be processed by the local lab, who offer a very quick, same-day service. At peak holiday periods Kodachrome can take as long as two weeks to be processed. This is too long for a professional to wait and if he needs quicker processing he has to pay extra for a speedier service. However, because of differences in the way that the colored dye image is formed in Kodachrome and Ektachrome, the latter is more grainy and has a lower resolving power than Kodachrome. Consequently pictures which would have been adequately sharp and grain-free when taken on Kodachrome are not so good when taken on Ektachrome. To compensate for this loss of quality we have found it necessary to use a camera format larger than 35mm. After looking closely at all the alternatives available we have finally decided on the 6 x 4.5cm format (15 frames on 120 film), giving a transparency with an area almost 3x larger than that of a 35mm transparency. The cameras available for this format, while considerably larger than a 35mm camera, are sufficiently compact and light in weight to allow easy handling and carrying. Our first purchase was the Zenza Bronica ETR-S body with lenses of 150, 75, 55 and 40mm focal length. The 40mm lens has the shortest focal length available for this particular camera, and, because many of our interior pictures of cathedrals etc require the widest possible angle of view, we have also purchased a Mamiya 645 body with a lens of 35mm focal length.

The grain structure of a transparency can be particularly troublesome when color separations are made with the aid of a graphic arts scanner. Scanners incorporate an electronic and optical system which detects and exaggerates any sudden density change in the original, and thus enhances the edges of fine details, giving an appearance of increased sharpness in the final result. This system, usually referred to as the 'unsharp masking' or 'fine detail' facility, is adjusted by the operator to provide just the right amount of detail enhancement to suit the particular subject. Too much enhancement gives a result which looks false, while too little gives a result which is slightly 'woolly' and lacks crispness. The unsharp masking system is unable to differentiate between density changes caused by the grain structure of the image. Consequently any unsharp masking applied to enhance wanted detail will also render the grain structure more apparent. For certain subjects this is totally unacceptable. An example is the typical women's magazine cover which includes a close-up of a model's face. Usually the customer will require the flesh tones to be reproduced as smoothly as possible, with no uneveness or blotchiness. This is often difficult to achieve with the modern scanner which may incorporate a certain amount of detail enhancement even when the unsharp masking control is at its minimum position. Because of this we reproduce such pictures by more conventional means, using a graphic arts camera with camera-back masking.

From time to time we have experienced an apparent misregister problem with certain transparencies. The effect is that the separations do not fit each other, and no amount of lateral movement of the films relative to each other will encourage them to do so. Further study of the problem shows that the image on each separation of a color set is a different size to that on the others. Examination of the transparency through a microscope reveals that the mis-register is in fact present on the transparency, showing as coloured fringes around any tonal changes of high contrast, The effect becoming more apparent towards the edges of the transparency. The problem is caused by chromatic aberration present in the photographer's camera lens, and is frequently apparent in transparencies taken using very wide angle lenses. These lenses are often of retrofocus design, which allows a greater displacement between lens and film than the focal length would suggest. This design is necessary with single lens reflex cameras to allow sufficient space behind the lens for correct operation of the viewing mirror, which has to flip out of the optical path immediately prior to an exposure being made. Unfortunately, however, the retrofocus design seems to always introduce chromatic aberration to a greater or lesser extent. The problem is also evident with many zoom lenses, the chromatic aberration usually being most apparent at the extreme ends of the zooming range and disappearing in the middle of the range.

While mentioning lenses it should be noted that the theoretical resolving power of a lens decreases as the lens aperture is reduced in size (Fig 11). This is due to the effects of diffraction which occurs around the edges of the lens iris. Consequently a perfect lens would give its best resolution when used at maximum aperture. No lens is perfect, however, and the resolving power at very large apertures is

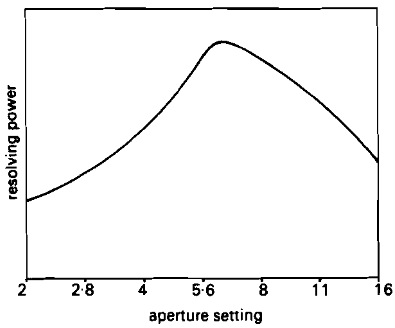


Fig 11. A typical lens gives its optimum resolution at about three stops down from its maximum aperature. At aperture settings larger than the optimum the resolution is limited by residual lens aberrations, at smaller settings it is limited by diffraction.

usually less than the theoretical maximum. In practice most camera lenses give their best performance when the aperture is set to about 2 or 3 stops down from the maximum.

PROBLEMS WITH ARTISTS' COPY

A common problem when reproducing in color from artists' copy is that of exactly matching the colors of the original artwork. The range of colored paints available to the artist or designer includes some colors, such as certain oranges, greens and violets, which cannot be matched by the normal 4-color printing process, ie by the subtractive color mixing of the three process colors - cyan, magenta and yellow. It often happens that a piece of original artwork has been enthusiastically approved by the customer yet the printer is unable to make an accurate reproduction of it. It is important, therefore, that designer and customer are aware of the color limitations of the 4-color process in order that colors outside the range available to the printer may be avoided. It should be noted that a similar problem may arise when a customer requires a photographic color print. The cyan, magenta, and yellow dyes which form the image on a color print, like printing inks, may be unable to match certain colors of the original subject.

Another problem frequently encountered in reproducing from artists' copy is that of separating areas of very pale, pastel colors from the white background of the board on which the artwork has been prepared. Usually these white background areas are required to appear in the reproduction as unprinted white paper with no hint of a dot. For the reproduction house to achieve this at the camera stage sufficient exposure must be given to ensure that these areas record as photo-solid on the negative. Such an exposure will almost certainly cause very light tones of the artwork also to appear completely or very nearly photo-solid on the negative and to be reproduced on the final print either with too small a dot or with no dot at all.

This problem would be overcome if designers producing artwork specially for reproduction would use colors darker than actually required. The reproduction house could then expose sufficiently to lighten the reproduction to give the desired result. This would ensure that the white background areas receive sufficient exposure to give a satisfactory photo-solid on the negative.

Unfortunately designers are understandably reluctant to adopt this technique, as their customers usually like to see the completed artwork as it is to appear in the final reproduction. The normal method of overcoming the above problem is to produce, photographically, a 'white paper mask'. This is achieved at the camera stage by making an additional and separate exposure onto lith film without a screen. The exposure given should be just sufficient to give a dense image of the white background areas on the resulting negative. Provided there is sufficient contrast in the artwork between the white background areas and the lightest painted areas, the latter will appear as clear film on the negative. This negative now becomes the 'white paper mask'. A set of screened separation negatives of the artwork is made in the conventional manner. The 'white paper mask' is positioned in register with each separation in turn during the contact exposure stage to produce final separation positives.

We would like to suggest an alternative method of generating a white paper mask photographically which may be used with certain combinations of designers' board and colors. The surface of most designers' board fluoresces when illuminated with ultra-violet radiation, ie the surface absorbs the ultra-violet radiation and re-emits it as visible light. Opaque designers' colors, such as gouache or acrylic paints, do not fluoresce. When artwork prepared using opaque, non-fluorescing paints on a board which does fluoresce is illuminated with ultra-violet light the unpainted areas of board will glow brightly while the painted areas, even extremely light tones, will appear very dark by comparison. It is possible to exploit this phenomenon to produce an acceptable white paper mask from otherwise difficult artwork. Ultra-violet emitting lamps should be mounted next to the normal caerma lights. These lamps should be fluorescent tubes of the 'Blacklight Blue' type, which emit ultra-violet radiation but very little visible light.

The white paper mask is made using the ultra-violet lamps, with the normal camera lamps turned off. The optimum exposure must be found by trial and error. An ultra-violet absorbing filter, such as a 2B, should be positioned over the camera lens to prevent any reflected ultra-violet light, to which the film is also sensitive, from entering the lens. The camera operator must inspect the artwork carefully to ensure that the designer has not used white paint to touch up any errors. If this is found to be the case the resulting mask must be retouched accordingly.

The separation negatives themselves are made in the conventional manner using the normal camera lights and with the ultra-violet lamps turned off.

METALLIC COLORS

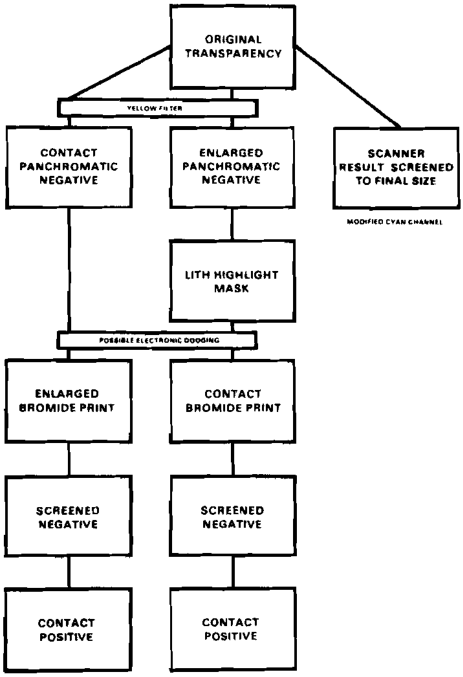
A printer may be asked to reproduce, using only the four process colors, an original which includes metallic colors. A recent example was a set of postage stamps printed in several colors including silver and gold. The metallic inks exhibited an excellent metallic lustre on the original stamps, but when a 4-color reproduction was made using the reflection copy facility of a graphic arts scanner this sheen was lost, and the metallic inks reproduced as dull, muddy colors which gave no suggestion of the silver and gold of the original. This was because the reflection copy light sources of the scanner are positioned at approximately 45 degrees to the lens axis to prevent specular reflections from the surface of reflection copy originals. This lighting angle is similar to that used on a graphic arts camera, but whereas the lighting angle cannot easily be altered on a scanner it can be changed at will on the camera. It was found that the required sheen from the metallic inks of the stamps could be obtained only by illuminating the stamps from a position as close as possible to the lens axis. Using this lighting the stamps were photographed on color reversal film to provide a color transparency which was subsequently reproduced via the scanner. With the lights so close to the lens axis it was not possible to place the stamps behind glass to photograph them as the lights themselves would appear reflected in the glass. Because of this the stamps were mounted on stiff card which was taped over the glass of the camera copy holder.

CONVERSIONS FROM COLOR TO BLACK AND WHITE

With more and more photo agencies ceasing to carry black and white originals it is becoming increasingly common for black and white illustrations to be derived from color transparencies.

The simplest technique for producing a black and white-from -color conversion is to make a continuous tone black and white negative by a contact exposure on to a panchromatic material (often this exposure is made through a yellow or green filter to provide improved separation of clouds from blue sky). A bromide print can then be made for subsequent screening in the conventional manner. Sufficient exposure must be given when making the negative to retain detail in the shadow areas, with the result that the exposure received in highlight areas is often so great that it is off the straight-line portion of the negative material's characteristic curve. This results in severe compression of the tonal range in highlight areas, which appear flat and lacking in tonal separation. An improved result in terms of tonal gradation may be achieved by making a highlight mask which is registered to the negative prior to making the bromide print. To facilitate registration when working with small-format transparencies the negative and mask can be made to an enlarged size, say 5 x 4 inches or larger. The highlight mask can be made on an orthochromatic lith material which can be processed in the same developer as the negative proper. Exposure for making the mask should be such that an image appears only in extreme highlight areas.

An alternative to the 'conventional' methods above is to use a graphic arts scanner. Our experiments have shown that a very acceptable result in terms of improved sharpness and tonal gradation can be achieved. We used the scanner's cyan channel with the color correction modified to give a panchromatic response. As Fig 12 shows, the conventional methods use several pieces of film to arrive at the final screened positive whereas the scanner method can achieve an improved result using only one single sheet of film.



SUGGESTED FLOW DIAGRAM FOR BLACK & WHITE CONVERSION

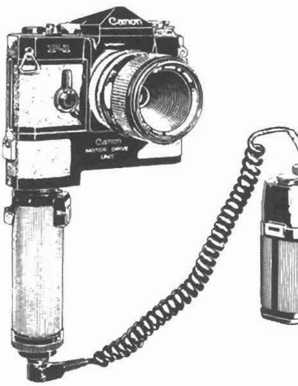
Fig 12

THE USE OF PHOTOGRAPHY TO AID THE DESIGNER

In many instances a carefully prepared drawing can convey more information to the reader than can a photograph.

In the course of preparing a book on photography we required small illustrations of cameras and other photographic equipment. Most of this equipment was black, and if we had relied on photographs important detail would have been lost at the reproduction and printing stages. Because of the complexity of the equipment, drawings of the workings of cameras, lenses, and shutters, etc would have been very detailed and consequently extremely time consuming to prepare. Because of this we decided to use photographs as the basis of the illustrations, producing high contrast prints and touching up and reinforcing difficult areas of detail with additional drawing.

The technique calls for fairly hard lighting of the subject matter, which was photographed on FP4 film. Liberal exposure was given to retain as much detail as possible with extended development giving a lively continuous tone negative. Enlargements were made on high contrast Kodagraph P84 paper. By carefully 'shading' and 'burning-in' the best possible 'line' print was made. Where the contrast was lacking extra work was added using white and/ or black body color to define important detail. The resulting 'line diagram' was thus basically a high contrast photograph enhanced with additional hand drawing giving a crisp, detailed line illustration which printed much more 'open' than would a black and white halftone of the same subject (Fig 13).



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