Color Television Film Printing Practices

CBS Television Network Engineering Department

"Color
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Film Printing
Practices"

In producing a print from a given *black and white* film negative, a reasonable degree of freedom is enjoyed insofar as minimum and maximum densities and over-all gamma of the finished print are concerned. This stems from the ability in the printing process to vary the exposure time, the development time and/or even the developing solution itself.

In the production of *color* prints, an equal amount of latitude is not available. The maximum *or* the minimum density of the finished print can be regulated by controlling the exposure of the print stock, but both densities cannot be independently determined without running the hazard of upsetting color tracking. Without getting into the technicalities involved, let it suffice to note that, for all practical purposes, the density range and gamma of the finished print will be largely determined by the characteristics of the original negative. Although this may not be a desirable state of affairs, from a television viewpoint, this is the situation at the present state of the art.

There *are* two aspects of color print production that lend themselves to modification (within certain limits) during printing, namely,

the correction (a) of over-all density differences and (b) of small color imbalances. The need for these corrections may stem from differences in various runs of a given emulsion, from improper exposure of the negative, from outdoor exposures made under changing lighting conditions, from some unusual condition existing in the scene that was photographed and from differences in processing laboratories. In any event, when all the editing and optical effects have been completed and the various scenes have been assembled in the order in which they will appear in the final production, the film as a whole is usually reviewed visually by a "timer" in the film laboratory.

The timer's responsibility is twofold. First, he determines the exposure required by each scene in order to achieve the density uniformity desired in the final print. Second, he endeavors to correct for any scene-to-scene differences in color balance.

It should be recognized that any color correction that is undertaken affects the scene as a whole and not a particular portion of it. For example, if facial tones alone are used as the sole criterion for color balancing then other parts of the set, such as commercial products and backgrounds, may suffer color distortions. Thus, very little reliance should be placed upon color correction of the final print to achieve a desired color balance. Rather, every effort should be made to produce as correct an original negative as possible.

It is also important to realize that the eye has a tremendous ability to adapt to large differences in brightness and color values. Further, it does this involuntarily. Inevitably, the brightness and predominant hue of a given scene affects the observer's judgment of a subsequent scene. Thus, the density and color timing is largely a subjective matter that does not lend it-

self to instrumentation. Also, the final timing of a scene can only be done precisely when all the scenes are assembled and viewed in the order in which they will be presented. From a television viewpoint this fact has a twofold implication, neither one of which is particularly palatable from a technical standpoint.

First, it is obvious that the timing of prints can be no better than the skill and judgment of the timing operator. Second, in television much of the program material is presented in what amounts to a random sequence and, thus, there is no opportunity to achieve correct timing by viewing the prints in their final order of presentation. There is a solution to the first problem, namely, to send the work only to those laboratories that *understand television requirements* and who have adequate controls to insure consistent work both throughout the working day, as well as day after day. However, there is no equally good solution to the second problem.

The second problem manifests itself particularly at station breaks where it becomes necessary to handle, one after another, all kinds of announcements, commercials and station identification film clips or slides. Although each piece of film may, in its own right, be perfectly acceptable from a color and density viewpoint, when several clips or slides are presented in a particular order, the end result may be less than optimum because of color and brightness adaptation of the eye. The solution to this dilemma does not concern us here since it is basically an operating problem. It does serve, however, to point up the fact that no matter what standards are established for the production of color film prints, and regardless of how rigorously they are enforced, subjective judgment will be necessary in dealing with the presentation of color film clips or slides in the sequence called for by programming needs.

Standard practices

With the foregoing in mind, and considering the current state of the art, the following criteria are set forth for the production of color film prints for television use:

Minimum density—The density of the highlights of the finished print should be as low as possible consistent with obtaining good flesh tones and retaining significant highlight detail. Glint lights and specular reflection from jewelry, musical instruments and other highly polished objects should not be considered as "significant" highlights in determining highlight density.

Maximum density—Since there is a finite contrast range that can be handled by a color television system, it is desirable to keep the contrast ratio of color prints within reasonable limits (e.g. 45 to 1). However, where the release print is made from a color negative and the minimum density is determined as above, the maximum density is essentially a function of the density range of the original color negative. Thus, it is more or less meaningless to prescribe both a maximum and a minimum color print density unless it is possible to completely control the staging, lighting and photographic processes.

There is one exception to this general situation. In those instances where separation films (corresponding to the red, green and blue components in the original scene) are prepared, a degree of contrast control in the release print may be obtained. It should be realized, however, that this control is achieved usually at the expense of changes in color saturation.

Gamma—Over-all print gamma is a function of the inherent characteristics of the negative and the print stocks and the processing thereof.

Since, in color, there is only a limited number of color film stocks available, and since their processing for technical reasons must necessarily be standardized, there is little, if anything, that can be done to change the over-all gamma obtainable with present-day color films. Thus, the film laboratory may simply be instructed to process color film in accordance with existing standard procedures for the type of film used.

Incandescent vs. arc lighting balancing—It is standard practice in this country to balance 16mm and 35mm color prints for projection with incandescent and arc light sources, respectively. Television chains, however, employ incandescent lighting for both 16mm and 35mm projection. Thus, everything else being equal, a 16mm print (originally balanced for an incandescent light source) will usually appear "colder" when transmitted over a television system than would an identical 35mm print (originally balanced for arc light projection).

This situation may be corrected in multiplexed film chains by the placement of a suitable filter over either the 16mm or the 35mm projector lens (yellow in one case, blue in the other). This method of operation is to be preferred to attempting to obtain what is essentially a non-standard 35mm color print, namely one that is balanced for other than arc lighting. A print of this type would require the film processing laboratory to adapt itself to an unfamiliar procedure and this is not likely to be conducive to good results. Equally important, the print would not lend itself to direct projection on a screen by the usual arc or xenon equipped 35mm projector.

Thus, insofar as color balance is concerned, the processing laboratory may be instructed to follow its normal procedure of balancing 16mm prints for incandescent light and 35 mm prints

for arc light projection. This will avoid the need for the film timers to acclimate themselves to a new and unfamiliar procedure.

Special effects—Whenever possible special optical effects (lap dissolves, wipes, montages, etc.) should be made by using the so-called A and B roll method. This procedure eliminates the need for making a color master positive (or separation master positives) and a color dupe negative for each special effect. The avoidance of these extra positive and negative steps eliminates the degradation that inevitably accompanies any additional steps in a reproduction process.

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Color Television Film Shooting Practices

CBS Television Network Engineering Department

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In making motion pictures for color television, it should be recognized that the requirements of film for television differ appreciably from those of film for theatre projection. For some time to come color film on television will be viewed in both color and monochrome, depending upon the kind of receiver in the viewer's home. Also, as experienced television film producers have learned, television film should have a considerably lower density range than theatre film. For these reasons alone, unless the techniques used in shooting film for the theatre are modified, the resulting film is not likely to be of optimum quality for television use. On the other hand, if these techniques *are* modified, they can produce color film for television containing all the artistry, creative expression and novel effects that may be desired.

There is one facet of color film production that cannot be overstressed, namely, the relative inflexibility of color film developing and printing processes, as compared to black and white film production. This places a great premium on proper staging, lighting, and camera practices, since errors made in the shooting process seldom lend themselves to satisfactory

correction in the film processing or the television transmission process. It is for this reason that this booklet contains recommendations concerning staging, lighting, cameras, film and sound recording. A properly exposed color film negative is a prerequisite to good color television film transmission.

In a field offering as many opportunities for development as color television, it would be unwise to present these suggestions as final. Nevertheless, they are based on considerable experience in both the film and television fields. While further experience will doubtless produce some changes, the present recommendations currently provide a satisfactory guide to filming methods for color television applications.

Staging

The idiosyncrasies of color television and color film systems require that certain precautions be observed in staging practices when making color motion pictures for television use. As already indicated, staging (and lighting) practices must be designed from the viewpoint of satisfactory reproduction on both color and monochrome receivers. The following staging recommendations were formulated with the foregoing considerations in mind:

1. In shooting successive scenes at different angles and, more particularly, at different times, great care must be taken to see that the colors of costumes, backgrounds, and make-up are identical to those photographed in earlier takes. The probabilities of having inconsistencies between takes is much greater when color is used.

2. Skin tones of a performer's shoulders, arms or other exposed skin should match facial make-up. In addition, an effort should be made to reduce the relatively wide differences in flesh tones that are normally encountered, excepting, of course, where differences are obviously intended.

3. Make-up should be specifically chosen for the production of pleasing skin tones with the color film stocks currently in use. Panchromatic make-up, often used for black and white photography, is generally unsuitable for color photography.

4. Costumes and backgrounds of the same hue or luminance* as flesh tones result in loss of perspective, particularly on monochrome receivers;

*For the benefit of the non-technical reader, "luminance" may be considered a term for the brightness of any object seen by the camera. It depends on the reflectance of the object and the amount of illumination; e.g. a dark overcoat in bright light or a white cloth in dim light could both have low luminance.

the performers will not stand out from the background of the picture.

5. Backgrounds low in color saturation, matte surfaced and of medium luminance will help avoid reflection of colored light onto other parts of the scene being photographed with consequent color contamination. In addition, such backgrounds provide better contrast between foreground and background objects as seen on both color and monochrome receivers.

6. Subject-to-background luminance ratios lower than 1½ to 1 will destroy all illusion of depth, particularly for monochrome viewers.

7. Busy backgrounds, long shots, small detail, suffer even more in the color television system than they do in black and white. It is recommended that they be used sparingly and primarily to establish locales and then only for short periods of time.

8. High luminance, highly saturated yellows (i.e., "very bright" yellows) should be avoided since, under some circumstances, they can create transmission problems in the television system.

9. Close-ups should be emphasized and all essential action maintained within the "safe action" area as defined by SMPTE Recommended Practice RP-13. Titles should be maintained within the safe title area as defined by SMPTE Recommended Practice RP-8.

10. Areas in each scene corresponding to reference white and reference black are very helpful from a video transmission viewpoint. This objective can be accomplished by including, in fully illuminated areas, neutral materials having reflectances of say 60% and 3%, respectively.

Lighting

As is well known, the hue, saturation and luminance (brightness) of any surface depends not only upon the reflectance characteristics of the surface itself, but also upon the nature of the light striking the surface. Whereas in monochrome photography the color of the light has only secondary effects on gray-tone rendition, in color photography variations in the color of the illumination can seriously affect the fidelity of color reproduction. Thus, particular attention must be paid to the color of lighting sources.

Effective lighting is a valuable aid in preserving an illusion of three-dimensionality on a two-dimensional viewing surface. Where the final result is viewed only in color, color contrasts may be relied upon to achieve the desired result. However, in television, where monochrome viewing of color film is also involved, consideration must also be given to achieving perspective with luminance (brightness) contrasts alone.

Finally, since both color film and color television systems can accommodate only a finite contrast range, it is important that measurable factors (light levels, set and costume reflectance, film exposure, etc.) be accurately determined and precisely maintained within the proper operating range in order to insure satisfactory and consistent results. Such latitude as is available should be relied upon to offset normal variations in shooting and processing rather than to permit careless work.

1. Color temperature of all lighting sources should be checked and maintained at the specified value (usually 3200°K) for color film intended for indoor shooting. Light sources should have a smooth spectral distribution (i.e., incandescent lamps and color-corrected arcs should be used).

2. Light sources of different types may be intermixed provided they have similar energy distribution spectrums and are color corrected to within 100°K of the standard value. Variations beyond the 100° limit result in noticeable color shifts as the subject is viewed from different angles or moves from under one light source to another. Relatively little use can be made of dimmers to control the brightness of incandescent lamps.

3. Light sources for background illumination need not be balanced so precisely provided no objects whose colors are familiar to the viewers are included in the background.

4. Ideally, key-plus-fill to fill-light ratios in the vicinity of 2 to 1 and absolute key-light levels of at least 400 foot-candles should be maintained for currently available color films. Larger ratios may be used sparingly to obtain desired effects, and are, of course, encountered in outdoor shooting. They are likely to result in very contrasty pictures when the film is viewed on a color television system. Lower absolute light levels may produce too shallow a depth of field.

5. Fill-light for outdoor shooting must match the color temperature of the natural light (which, for full sunlight plus skylight, approximates 5900°K).

6. Uniformity of lighting in the playing area is essential (except where special pictorial effects are desired). Small variations in illumination can result in exaggerated deviations in the fidelity of reproduction as seen over a television system.

7. Flat lighting, although easy to use, results in a lack of modeling and destroys the sense of

space between objects, particularly when viewed over a monochrome television system.

8. Specular lighting (as compared to diffuse lighting) enhances image sharpness and highlight detail.

9. High key lighting (i.e., high average luminance) of a scene results in the most consistently satisfactory or pleasing color reproduction. Low key lighting (i.e., low average luminance) is less predictable in color and sometimes results in a muddy reproduction.

10. Subject contrast as determined by a spot-brightness meter should not exceed 30 to 1. This value is in keeping with the capabilities of the present-day color television system and takes into consideration the print-through gamma (approximately 1.5) of present-day color film systems.

11. Exact reproducibility of lighting, both as to lighting ratios, color temperatures and direction of light are essential to reduce to a minimum shot-to-shot and scene-to-scene variations. Accurate and reliable incident-light and spot-brightness meters are recommended, the former for setting lighting levels and the latter to control contrast. Detailed lighting plans of the entire shooting area are also recommended.

Cameras

The performance of a motion picture camera cannot be as readily checked as can that of a television camera. The television camera may be trained on a test chart and its performance determined immediately by measurement or observation. The motion picture camera, on the other hand, can only be checked by exposing test film and having it processed. This is unfortunate since, despite their relative simplicity, motion picture cameras often develop faults that adversely affect the end result.

The camera checks outlined below are undoubtedly standard operating procedure for the professional cameraman who has worked with color film. They are, however, reiterated for the benefit of those who may not realize how small a latitude for error is permitted by color film. The need for carefully checking the performance of a camera and its associated lenses under actual operating conditions cannot be overemphasized.

1. Complete focusing tests should be run on all cameras and with all lenses. Since, at best, the depth of field is limited, the distance calibration of all lenses in all cameras should be accurately known.

2. The accuracy of the range finder or visual focusing attachment, if used, should also be determined.

3. The accuracy of the viewfinder and the existence of any parallax errors should also be determined, particularly since many close-ups are likely to be involved.

4. The safe title and safe action areas as defined, respectively, by the SMPTE Recommended Prac-

tices RP-8 and RP-13 should be indicated clearly by the viewfinder.

5. The flatness of the field of all lenses should be checked as a function of aperture. No reliance should be placed upon a lens simply because it bears a prominent name.

6. The depth of field of the equipment in use should be accurately ascertained. Where a follow-focus arrangement is not available, it may be necessary to raise the lighting level and reduce the aperture until an adequate depth of field is obtained to cover the action.

7. Jump or weave should be eliminated in all cameras in use. The skill and precision with which a particular camera is built and subsequently maintained largely determines the perfection of its performance. No reliance should be placed upon a camera simply because it was made by a well-known manufacturer.

Film

Where program material from color motion picture film is intended to be comparable in quality to that obtainable from a color television camera, 35mm film should be used. For broadcasting stations not equipped to handle 35mm film, reduction prints from 35mm originals should be provided. This recommendation is made to achieve optimum quality for the 16mm print. Although it is possible to make reasonably satisfactory prints from 16mm originals (e.g. Ektachrome 7255), they will usually evidence more grain and less resolution than reduction prints from 35mm color negatives.

More important, 35mm film is recommended because most productions require optical effects (lap dissolves, wipes, montages, etc.). This requires the use of color master positives and color dupe negatives. The degradation in quality when 16mm film is used for this purpose is generally unacceptable for serious color television applications.

1. Color Negative Film (e.g. EK5251) is capable of producing 35mm original negatives from which satisfactory prints for color television use can be obtained.

2. Color Print Film (e.g. EK5385) is capable of producing satisfactory 35mm release prints for color television use.

3. Color Print Film (e.g. EK7385) is capable of producing satisfactory 16mm release prints from 35mm color dupe negatives (e.g. EK5253) which, in turn, may be made from 35mm color intermediate master positives (e.g. also EK5253). Alternately, with a loss of quality, the 16mm release prints can be made from a 16mm color dupe negative (e.g. EK7253).

4. Color reduction prints usually tend to become more contrasty than prints made from the original negative. Thus, particular care should be taken to maintain the over-all contrast range within acceptable limits. This can only be done by careful control of both staging and lighting.

5. Reversal Print Film (e.g. Kodachrome 7387) has been used successfully where only a few 16mm prints are required from a low contrast original (e.g. Ektachrome 7255). This practice, however, presents matching problems when it becomes necessary to integrate stock shots and commercials or other announcements made on a different film stock.

6. Exposure tests of the particular batch of film to be used in a given production should be made under actual operating conditions. This should include the lighting, the cameras, the lenses and the processing laboratory that will handle the work.

7. In critical work each job should be treated as if it were the first since changes can occur in the film because of improper storage conditions, cameras can develop troubles, and lenses can become damaged.

8. A contrast range of 45 to 1 should be used as a target for the final print. Since the color printing process does not lend itself to control of contrast, this means that the luminance contrast on the set should not exceed 30 to 1 as discussed previously.

9. The density of the highlights on the finished prints should be as low as possible consistent with obtaining good facial tones and retaining detail in the significant highlights. Glint lights and specular reflection from jewelry, musical

instruments and other highly polished objects should not be considered as "significant" highlights in determining highlight density.

10. Jump and weave introduced by poor printing machines should be guarded against by critically sampling release prints delivered by the processing laboratory.

11. Prints should be carefully color corrected by the processing laboratory to obtain consistency of facial tones and of over-all color balance. In some instances, a degree of compensation for color inaccuracies may be obtained in the television system. It is not feasible, however, to make scene-to-scene color adjustments during film transmission.

12. Where exact color reproduction is essential, such as for packages and trademarks of well-known products, photographic tests should be made and observed on a color television system.

Sound

The sound track that accompanies a color motion picture is just as important as the picture portion of the print. Trite as this observation may seem, preoccupation with the picture photography has sometimes been detrimental to the sound recording operation. Since, in television broadcasting, a motion picture presentation often follows or precedes a live product, the audience can make direct comparison of live and recorded sound. Whether this comparison is made consciously or not, the results are not likely to be favorable to film unless the sound track is of the highest quality. Although this direct comparison is commonplace in television, it is a test which few theatre-type films have to face. The following practices, though known to most producers, are sometimes overlooked by others.

1. Minimum cross-modulation distortion, maximum signal-to-noise ratio and adequate frequency range should be the objective of the sound recording work.

2. Violent changes in peak sound levels should be avoided. Television listeners object to the wide range of peak sound levels that apparently find acceptance in the theatre.

3. Sound recording tests, accompanied with sensitometer strips, should be made with the equipment and the processing laboratory that will handle the final work. All subsequent work should be tagged with such test strips.

Summary

The successful shooting of film for color television requires full appreciation of the differences between the requirements for viewing directly on a motion picture screen and for viewing on a television system. Once these differences are understood, experienced personnel should have no difficulty with the mechanics of producing color film tailored to the needs of the color television system. The recommendations covering staging, lighting, camera, film and sound recording practices set forth in the foregoing paragraphs represent good starting points from which deviation may be made after extensive testing and field experience indicate the desirability of doing so.

Finally, one non-technical subject warrants comment: the temptation to over-do color in the "novelty" stage. Experienced producers warn against over-emphasis of color merely for color's sake—the use of a riot of color which detracts from the play, the performers or the commercial product. There are no technical aids that can be substituted for actual experience, good judgment, artistic skill and proper organization. A reasonable share of these ingredients is required in the production of film for color television use.

References

CBS Color Television Staging and Lighting Practices, R. S. O'Brien, Journal of SMPTE, Vol. 63, No. 2, p. 41 (August 1954).

Color Television Film Shooting Practices, W. B. Lodge and H. A. Chinn, Journal of SMPTE, Vol. 63, No. 6, p. 230 (December 1954).

Elements of Color in Professional Motion Pictures, Society of Motion Picture and Television Engineers, New York, 1957.

Safe Title Area for TV Transmission, Recommended Practice RP-8, Journal of SMPTE, Vol. 70, No. 7, p. 541 (July 1961).

Safe Action Area for TV Transmission, Recommended Practice RP-13, Journal of SMPTE, Vol. 72, No. 6, p. 953 (December 1963).

Considerations in Color Film Production for Color Television, John M. Waner, Journal of SMPTE, Vol. 73, No. 5, p. 411 (May 1964).

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Color Television Film Evaluation Practices

CBS Television Network Engineering Department

"Color
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The direct screening of color film to assay the technical quality of its reproduction over a color television system is not an easy task. Not only must the person doing the screening bear in mind the peculiarities of the color television system, but he must also consider the appearance of the program material when viewed on a monochrome television receiver. Since these judgments are largely subjective, the necessary skill can best be developed by practice. Such practice should include an initial screening and systematic rating of the film followed by a viewing of the film over a television system and on both monochrome and color monitors (or receivers) to check the ratings. Because of its subjective nature some will readily develop a screening skill while others will find it very difficult, if not impossible, to acquire an acceptable degree of proficiency.

Obviously, normal color vision is a prerequisite to becoming a good judge of color film quality as seen over a television system. Some 8% of the male population (roughly one out of twelve) have color vision which is distinctly different from that of the normal observer. Accordingly, it is important that all persons engaged

in, or responsible for, color film judgments be checked for normality of color vision.

Furthermore, it is important to evaluate color film under proper viewing conditions. For example, it is standard laboratory practice to color balance 16mm film for projection with an incandescent light source. But 35mm film is normally balanced for arc (or xenon) light projection. Accordingly, 16mm and 35mm color film should be reviewed with incandescent and arc (or xenon) projectors, respectively*.

If color film is viewed with other than the intended light source, color values are distorted. For instance, a 16mm film viewed with a xenon light source is likely to appear too blue or "cold." Similarly, a 35mm film viewed with an incandescent source usually appears too yellow or "warm." Thus, judgments of the color balance of films made under such circumstances can be erroneous. It is also important that the projection room screen not add any coloration of its own. This may happen if, because of age, the surface of the screen departs materially from a neutral color.

This booklet has been prepared as an introduction to the problem of evaluating color film for television. Among other things it discusses the various characteristics that are important to making a judgment of technical film quality from a color television viewpoint. The various items are presented in an approximate order of importance and include: (a) scene lighting, (b) contrast, (c) skin tones, (d) picture sharpness, (e) color fidelity, and (f) general conditions. Finally, but by no means least, sound quality should be rated.

Both the 16mm and the 35mm film projectors used on television film chains normally use incandescent light sources. This does not, however, invalidate the foregoing. In properly set-up television film chains suitable compensation is made for the fact that 35mm film is projected with an incandescent rather than arc (or xenon) light source.

Scene Lighting

The most consistently satisfactory and pleasing reproduction on a color television system is obtained from scenes that employ high key lighting. The lighting of a scene is defined as "high key" when the average luminance is high (e.g., a scene with a minimum of deep shadows). Reproduction of scenes employing low key lighting (low average luminance), on the other hand, is less predictable and sometimes results in a somewhat muddy appearance of the colors and in rather obscure monochrome reproduction. Thus, in reviewing film for color television, particular attention should be paid to low key scenes since these are likely to be troublesome when transmitted over a color television system.

It is recognized, of course, that low key lighting is often essential to establishing the mood for a scene. Short sequences that employ low key lighting can generally be used without distracting seriously from the quality of the reproduction over a color television system. On the other hand, if an entire play is photographed with low key lighting, extra care must be taken to insure that the result, as seen on a television system, will contain enough visual information to be meaningful both as seen on color and on monochrome receivers.

Contrast

There are four kinds of picture contrast that must be given consideration in evaluating color motion picture films for television applications. These are (a) color contrast, (b) monochrome or brightness contrast, (c) subject-to-background contrast and (d) over-all contrast range.

When viewing a scene in color there is a natural tendency to confuse color contrast with brightness contrast. Although two juxtaposed

contrasting colors (e.g., red and blue) may appear visually to be widely different in brightness, this effect is largely a matter of color contrast and not an actual brightness difference. When translated into terms of gray, as on a monochrome television receiver, the two colors may appear as the same shade of gray. Many instances have been encountered where scenes with beautifully contrasting colors have appeared on monochrome receivers in only two or three shades of gray.

Considerable experience must be acquired to accurately judge the brightness or monochrome contrast of scenes that are being screened in color. A "viewing glass" (a neutral density filter with a few per cent transmission) can be of assistance in making this judgment. In addition, screeners should be given the opportunity to check and sharpen their judgments by viewing sample films on both color and monochrome television systems.

In general, color contrasts that appear pleasing as seen on the screen will reproduce well over a *color* television system. They may not, however, reproduce in exactly the same way on the television system as on the screen. This stems, in part, from the fact that color films can reproduce saturated colors only at low brightness levels. A color television system, on the other hand, produces saturated colors only at relatively high brightness levels unless viewing takes place in total darkness. These differences do not, in general, distract from the production of pleasing pictures on a color television system where the original film as seen on a screen is satisfactory from a color contrast standpoint.

Brightness contrast, on the other hand, requires careful scrutiny to insure satisfactory reception of color transmissions on monochrome receivers. Adequate brightness contrast is particularly important to insure that foreground

subjects stand out from backgrounds as viewed on a monochrome television system. If sufficient brightness separation is not present, all illusion of depth is destroyed. This is an area where contrasts may be very satisfactory, as seen on a color receiver, but may be entirely inadequate or even non-existent as seen on a monochrome receiver.

The over-all contrast range of color film (ratio of significant highlights to significant shadows) is also very important since the television system can only handle a finite range of something less than 50 to 1. Motion picture film produced specifically for the theatre is quite likely to have an over-all contrast range considerably in excess of this value. This is particularly true where 16mm prints have been made from 35mm originals. At the present state of the art, the duplicating steps necessary to produce the reduction prints inevitably increases the contrast range. In many instances it has been found that 16mm reduction prints from theatrical film was quite unsuitable for television use because of the excessive contrast.

Skin Tones

In real life the facial skin tones of people cover a very wide gamut as can be observed by looking at any representative group. On the screen, on the other hand, a very wide variation in complexion tones can appear unnatural and disconcerting. Reasonable uniformity of flesh tones from person-to-person is therefore desirable.

Even more important is the uniformity of facial tones of a given person from scene-to-scene. Assuming the make-up, lighting and photographic departments have done their jobs right, scene-to-scene uniformity is largely in the hands of the color timer in the film processing laboratory. Scene-to-scene differences in facial

tones must be believable, such as would be occasioned by moving from an artificially illuminated indoor set to a sunlit outdoor scene.

Picture Sharpness

At best, the capabilities of 16mm film leave something to be desired insofar as making full use of the capabilities of the television system are concerned. Thus, 16mm motion picture prints that do not exhibit their full capabilities in terms of picture sharpness are not generally acceptable for television purposes. The problem is more critical with 16mm film than with 35mm film for two reasons. First, the smaller format inherently results in less resolution. Second, 16mm prints are often reduced from 35mm originals with the degradation that occurs, to a greater or lesser degree, in any duplicating process. Where picture quality comparable to that obtainable from live television cameras is desired, the use of 35mm film is indicated.

In observing picture sharpness, attention should be paid to both the sharpness of the key subject and to the uniformity of the sharpness throughout the picture area (i.e., flatness of field). In this latter determination due allowance must be made for photographic effects that were deliberately sought by the use of special lenses or by the use of lens apertures that produced a shallow depth of field.

Finally, films in which close-ups are emphasized reproduce more satisfactorily than those with broad panoramic views. Thus, for television applications, it is desirable that there be a minimum of scenes containing small detail.

Color Fidelity

In reviewing color film for color fidelity, three aspects deserve attention, viz., (a) fidelity of

familiar objects, (b) uniformity of color from scene-to-scene and (c) over-all color balance.

In some instances very bright yellows and highly saturated reds may cause some problems in exact duplication. The problem is not of sufficient magnitude, however, to cause concern unless precise color reproduction is essential, such as for packages and trademarks of well-known products. In these instances observation over a color television system is indicated.

Uniformity of color of costumes, stage properties and backgrounds should be maintained from scene-to-scene, just as with facial skin tones. Not infrequently, shifts in color will be observed as the color timer in the processing laboratory endeavors to maintain uniform flesh tones. If carried too far, these general color shifts can be disconcerting and, under any circumstances, they are undesirable.

Sometimes in an effort to achieve acceptable flesh tones during the color timing process in the film laboratory, the over-all color balance will be distorted to the extent that it is no longer realistic. Prints of this type may have an undesirable over-all hue or color tinge in some scenes and not in others. These shifts in color can be annoying to the viewer.

General Conditions

On occasion (and more so in the case of 16mm than for 35mm film), film grain will manifest itself to the extent that it becomes objectionable. Film grain that is objectionable as seen on direct screening will, in general, be equally or even more objectionable as seen over the television system.

Similarly, improperly handled film can acquire abrasions, scratches, finger prints, water marks and other damage. If sufficiently extensive, a new or different print is indicated.

Sound Quality

In order to avoid becoming immersed in the story line, it is sometimes advisable to review films without reproducing the accompanying audio channel. On the other hand, preoccupation with the picture should not cause one to overlook the sound quality.

Poor sound quality, especially where the dialogue is important to the plot, makes the viewer more critical of the picture, whether he is conscious of the fact or not. This stems from the viewer's closer scrutiny of the speaker's lips to discern the words he is saying. Thus a film with marginal picture quality might be passable in a pinch if it has good sound quality. However, a marginal picture combined with marginal sound is usually ample grounds for rejection.

The usual three attributes of sound quality should be observed. These are tonal range, sound distortion, and background noise level.

Summary

The ideal way of reviewing color motion picture film for its technical quality from a color television standpoint is to view the film over a television system. Because of the relatively large amount of equipment and personnel necessary to do so (together with the attendant cost), this is not a practical approach to the problem where large quantities of film are involved. Alternately, with training and experience, many can develop the skill necessary to appraise color film by direct screening. This is a talent that must be acquired through reference to what is seen on the direct screen and on both color and monochrome monitors or receivers.

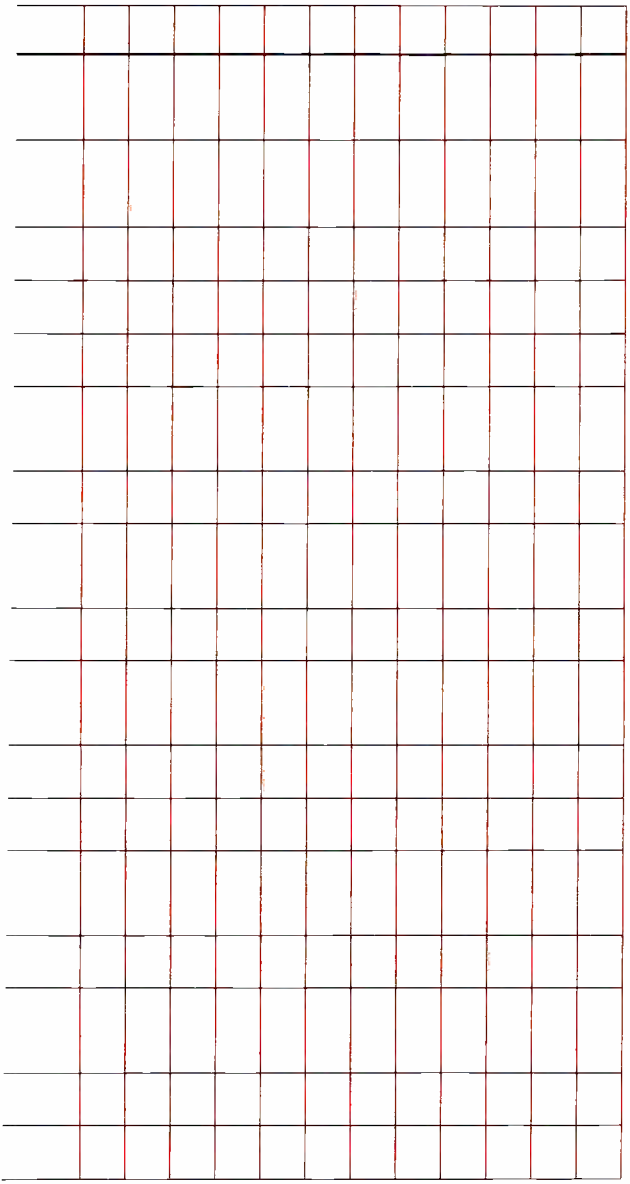
The attributes that require review include: general nature of the scene lighting, color and brightness contrasts, subject-to-background

contrast, over-all contrast range, uniformity of facial skin tones, picture sharpness and flatness of field, color fidelity of familiar objects, uniformity of color from scene-to-scene, over-all color balance, general physical condition of the film, and sound quality.

A rating sheet, such as illustrated herewith, provides a disciplined approach to evaluating color film for television applications. In addition, it provides a record of each appraisal for subsequent reference. The headings and subheadings suggested are keyed to the topics discussed in this booklet.

Color Film Evaluation

Title:	Date:	Scene or reel
1. Scene content High key (1) vs. low key (4)*		
2. Contrast a. Color		
b. Monochrome		
c. Subject-to-background		
d. Contrast range		
3. Skin tones a. Person-to-person		
b. Scene-to-scene		
4. Picture sharpness a. Key subject		
b. Flatness of field		
5. Color fidelity a. Fidelity of familiar objects		
b. Uniformity (scene-to-scene)		
c. Over-all color balance		
6. General conditions a. Grain		
b. Abrasions and other damage		
7. Sound quality a. Tonal range		
b. Sound distortion		
c. Background noise		



*__Rating scale:__ 1–excellent, 2–good, 3–fair, 4–poor

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