FILM IN A TELEVISION ENVIRONMENT

DOM STASI
VICE PRESIDENT
NETWORK OPERATIONS & DESIGN ENGINEERING

WARNER AMEX SATELLITE ENTERTAINMENT COMPANY
NEW YORK, NEW YORK

ABSTRACT

Variety notwithstanding, the staple of pay T.V. programming remains the feature film.

It is interesting to consider then that most feature film material was never produced for television viewing. Primarily intended for theatrical exhibition, film characteristics such as light transfer function or aspect ratio are not readily compatible with display on the small screen.

Therefore, if we are to maintain fidelity of light and shadow, scene content, and sound that the director intended, the transfer characteristics of the electronic system (camera / tape / transmission / distribution / T.V. receiver) must be considered. Very significant progress has been made in this regard in the recent past through waveform pre-distortion, camera target matertials etc.

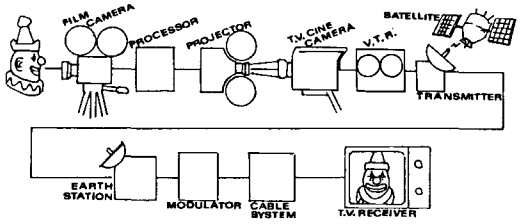
Engineering efforts in this regard by The Movie Channel, as well as other pay programmers, will be described and augmented by demonstrations of processed, as well as "straight", film to tape transfers.

INTRODUCTION

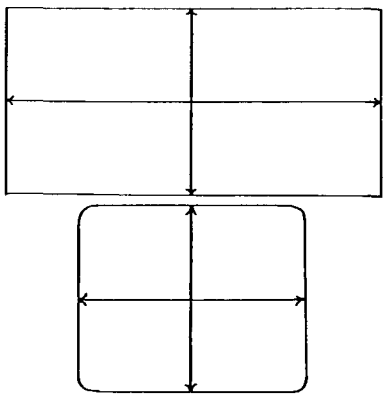
To appreciate the nature of film to television conversion, it becomes necessary to dismiss the pre-conception that the two mediums are strongly similar. Of course, both use cameras and screens and microphones and actors; but similarities end at the artistic level (there are those who would claim that no similarity whatsoever exists here either). In fact, dissimilarities render the two nearly incompatible; with film being by far the more potent genre in both its capability for artistic expression and quality of reproduction. While this statement may constitute heresy by a TV practitioner at a TV conference, anyone ready to dispute it need only compare quality theatrical reproduction with that of large screen projection television (or small screen direct television) to mention nothing of sound track. However, unless you happen to live next door to a drive-in theater, it is at best difficult to watch large screen feature film entertainment by direct projection from your living room.

Television is the only medium with such versatility and its overwhelming audience acceptance obviates all comparative discussion. Therefore, our audience has given us our mandate. If then any semblance of film quality is to be maintained, the inherent aspects of the television reproduction system must be altered to that effect.

Figure 1 illustrates the stages a filmed image undergoes on its way to the TV viewers eyes.



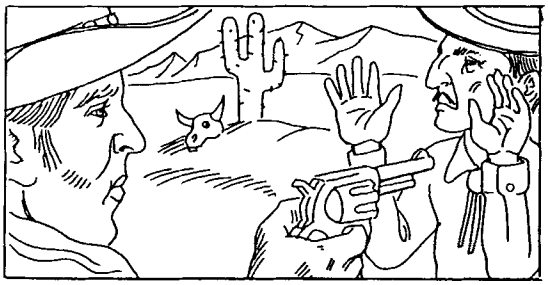
Each element exhibiting its own inherent non-linearities to the general detriment of reproduction quality. The most evident of these, is that of "aspect ratio", as shown in figure 2.

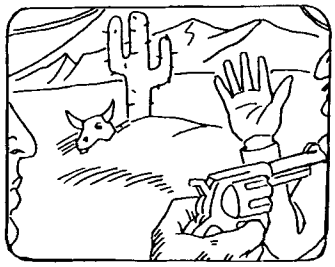


Aspect ratio, the relationship of height to width in a reproduced picture, varies drastically between a frame of film and that of TV.

Film producers, in an effort to more closely duplicate the field of vision, have developed wide aspect ratio formats such as cinemascope (8:3) while television, limited by bandwidth subordinate standards, is fixed at 4:33.

Film directors take full advantage of the wider field and frequently place subjects at the edges of a frame. As figure 3 illustrates when that frame is converted to TV without some alteration the result can be catastrophic.

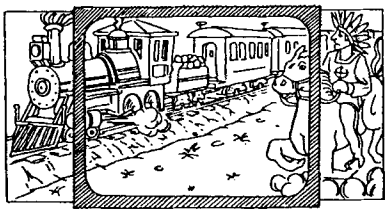




The intent of this paper will be to illustrate this as well as the less apparent but no less detrimental incongruities extant in the translation of theatrical release motion pictures to television. The input (film) and the output (TV receiver) are generally outside of our control. While most other elements in the system such as VTR's and transmission equipment are essentially linear. That leaves those devices at the interface, the projector and TV camera and associated optics, as the most likely to exhibit alterable transfer characteristics.

ASPECT RATIO

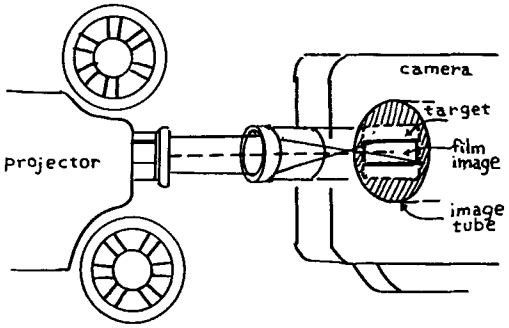
The problem we will discuss first and the one which creates the most controversy is that of aspect ratio. As mentioned earlier, in its original form a frame of film is of a different shape than a frame of television. Placing all of the information existing in a frame of film into a frame of television is rather like trying to place a rectangular peg in a square hole (Fig 4).



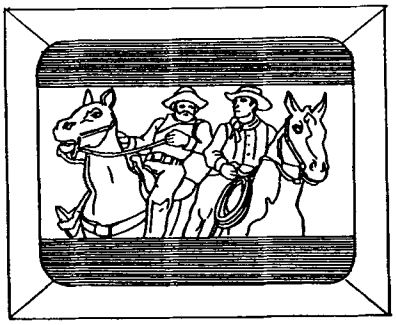
A number of methods have been developed with which to deal with this. Some more practical than others; all, however, require that the engineer performing the film to television transfer assume to take liberties with the program content. Usually, in the absence of the film's director and the TV technical director.

Herein lies the controversy; no known method of converting aspect ratio is wholly acceptable to all three (Director, Engineer, Technical Director). Current practice is limited to three techniques.

1. Masking: By effectively shortening the throw from the projector to the cine' camera, the film image is prevented from overflowing the image tube target area.



The result is, as shown in Fig. 6, a television picture which reproduces all elements of the original frame but, since it does not occupy the entire TV screen, is considerably reduced in size. This is doubly disagreeable in that we have taken a product intended for very large screen exhibition, reduced it to TV size, then reduced it further to accomodate masking.

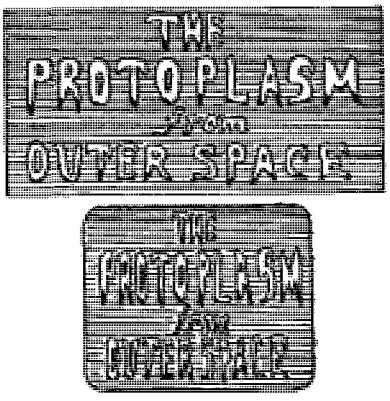


This technique while simple, diminishes the visual impact and causes small detail such as titles and credits to fall outside the resolution capabilities of the TV system.

2. Anamorphic: The term "Anamorphic" is applied to any optical system capable of compressing a normal image, in the case of TV horizontally and projecting it. FIG. 7.

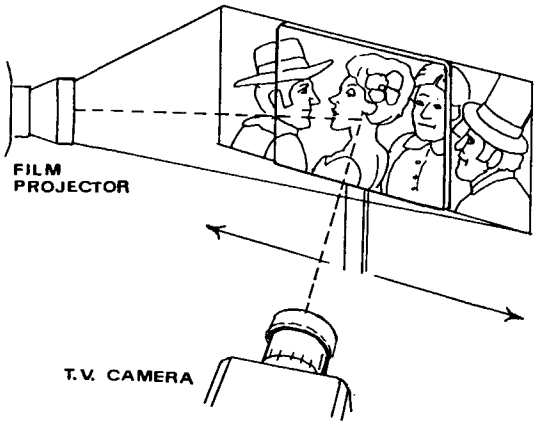
Again, this system accumulates all of the information in a given film frame for TV reproduction without loss of content. However, displaying a film in this manner would be well beyond the viewers ability to adapt. The result would be comical.

This technique does, however, lend itself well to the display of opening and closing credits and titles, appearing at the outside extremes of a film frame (FIG. 8) allowing them to fall within a TV frame's limits.



3. Pan and Scan: In this technique, a device, usually optical, in the film chain isolates a portion of the film image which corresponds to the TV aspect ratio. (FIG. 9) This device placed in the light path is moveable and under an operator's control.

A compromise by any interpretation, the pan and scan technique is both the most widely used by programmers and the least obtrusive to the viewer.



By being positioned horizontally, anywhere across the scene, the operator can select, for recording, that portion of the frame most necessary while losing the rest to overflow.

The receiver is rarely aware of the process or that more may be going on in a given scene than meets the eye, provided a deft and tactful hand is at the controller. Some disasters have occurred, however, where critical scene elements have been excluded; and while viewers are rarely aware of exclusions, directors are not.

Film directors are becoming increasingly dissatisfied with the pan and scan techniques and are understandably reluctant to leave such major creative decisions as scene content to a surrogate.

It remains, however, the only acceptable method in practical use today!

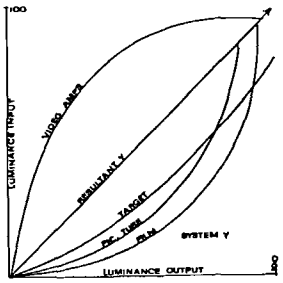
TRANSFER FUNCTION

Film generally exists in four generations:

1. Camera: The actual footage shot in production.
2. Lab: The intermediate stage used for producing protection copies etc.
3. Full Coat Magnetic: Magnetic sound track (oxideon film)
4. Print: For making copies or tape transfers

High quality tape transfers for television usually incorporates items 3 & 4 in a 35 mm format. The prevailing attitude for simplicity sake being; if a film (print) produces an acceptable image rendition in direct projection, it can be suitably transferred to television.

In order to reproduce the tonal gradations of the film image with fidelity, the transfer functions of the television system must be known. These non-linearities, in aggregate are known as system gamma. The controlling element in the system is the gamma or characteristic curve in the television receiving picture tube.



Most picture tubes exhibit a gamma other than unity. Therefore, low level input signals will cause output height levels to vary very little resulting in black compression. If similar transfer functions are present in camera target tubes and film emulsions, extreme black compression will result. This is often present in poorly transferred films as a loss of detail in dark or night scenes when viewed on television.

The condition if anticipated is correctable during the film to tape transfer process. Non-linear operation of the telecine' camera video amplifiers in a complimentary gain configuration will, at some sacrifice to video s/n ratio, neutralize compression yielding a linear transfer with gamma equaling one.

FRAME RATE

The final major dissimilarity evident in film to tape transfer is the difference in frame rate between the two mediums. Film is normally displayed at twenty-four (24) frames per second. Television (NTSC) operates at a thirty frames per second rate.

If no conversion is undergone, the reproduced television image will be rife with flicker and dark horizontal segments known as application bars, formed at the delta frame rate.

To eliminate these disturbances early film chain projectors were equipped with a clever shutter device; modern variations of which remain in use. The shutter operates on the principle that each frame of a television raster is composed of two fields occurring serially at a 60 Hertz rate.

$$(60/24)2=5$$

If during the film pulldown each two consecutive frames can be exposed to the camera target five times, scanning unity can be achieved.

This is accomplished by placing a shutter drum with five correctly positioned openings between projector and camera. By rotating the drum at 720 RPM as the film is pulled down, the shutter will open three times during the first frame, two times during the second, three times during the third and so on. The result being each twenty-four frames of film is exposed to the TV camera 60 times; corresponding directly with the TV field rate.

CONCLUSION

Few products available to consumers today are produced with the emphasis on quality apparent in feature films. That quality is, however, highly susceptible to degradation when a film is not converted with the same professional care with which it was produced.

While none of the techniques described in this paper could be considered new, all play an important part in maintaining the quality of reproduction with which we are entrusted.