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TAPE AND FILM— A COMPARISON

Historically film was one of the earliest methods devised to record and store moving picture and sound information. The sound signal was, and often is, recorded on an optical sound track on the film. However, magnetic sound recording techniques have developed from the large steel wire recorders to modern tape machines and sound information for film is now always first recorded on magnetic tape.

The production advantages of recording sound were seen as equally important for the production of broadcast television programmes and so various methods of telerecording onto film were developed. Generally, telerecording systems involve projecting an image on to unexposed film with the correct intensity for the film exposure characteristics. However, since the time between frames in a television system is far shorter than that in the film system, special techniques were developed which fell into two categories—continuous and intermittent motion of the film stock. The intermittent system was divided into two principal methods, suppressed frame and fast pull-down. Many organizations put a great deal of development effort into methods of

recording television signals and, indeed, The Marconi Company explored both these latter systems extensively.

In 1956 a breakthrough in magnetic recording of video signals was achieved by the Ampex Corporation of America. The trick, now of course well known, was to use a 2in wide tape and scan it transversely with four magnetic recording heads situated on the periphery of a rotating wheel thus achieving a high head-to-tape velocity without moving the tape itself at high velocity.

It was not long before colour television signals could also be recorded on tape and, as time went on, so new devices were added to the tape machines to reduce or remove distortion. The replayed signal is now very close in quality to the original, and the machine can be considered as a black delay box with a linear transfer characteristic.

The development of 1in helical-scan machines has progressed and acceptable broadcast-quality replays are possible. These machines are smaller, lighter and require less power to operate them, thus opening up more possibilities for mobile use.

During this development of magnetic tape recording, film telerecording systems have not stagnated. The difficulties associated with monochrome telerecording are greatly increased when attempts are made to record colour television signals onto film. There are many methods being examined and employed, with fast pull-down, continuous motion, colour separation, electron beam and laser beam processes all in current use. The electron beam process takes the film into the vacuum of the cathode-ray tube and exposure is effected by directly scanning the film with an electron beam thus avoiding many optical aberrations. However, the electrons are not coloured and the process is essentially monochrome. The image transform system which is cloaked in secrecy and known to have produced excellent results may possibly employ the electron beam technique as a basis.

The most interesting new technique is the CBS laser beam recorder which operates on the principle of mechanically deflecting three laser beams each of a wavelength matching the centre wavelength of the three dyes in the film. Current machines use an intermittent film transport but it is possible that



A new generation broadcast/recorder reproducer that sets a new 'high' in performance and stability.

Ampex photo

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continuous motion techniques will be adopted in later models.

Since all this development is taking place it is clear that there must be a considerable incentive to record television material, and obviously, it is not just a matter of recording since magnetic tape does this very well. It is, presumably, to do with the greater distribution possibilities of film; there are many more film projectors in the world than television tape replay machines. This situation may change in the future, particularly with the advent of domestic video cassette recorders (v.c.r); these might become as plentiful as film projectors. The advantages are obvious. The ability to play into any television receiver without a darkened room; no special screen and loudspeaker system to be erected, no long cables to lay.

It is interesting to note that the EBU is already standardizing on a v.c.r system for programme exchange assessment purposes.

The advent of lightweight hand-held colour television cameras of broadcast quality, coupled with smaller magnetic-tape recorders, brings the possibility of making, by electronic means, that which has hitherto been possible only on film. These techniques would of course be relatively ineffective without facilities for subsequently editing the tape. This can be achieved basically in two ways either with sophisticated electronic editing or by replaying the tape into a studio system as insert material for a programme being recorded at that time. Both methods are used and have value (see page 12).

There are real improvements possible in reducing the size of hand-held electronic cameras and it is expected that a new, very small model will be produced shortly in the USA.

These significant improvements in electronic methods might be thought to ring the death knell of film for use in broadcasting so it is interesting to observe that neither are film techniques standing still nor are the methods of scanning film for broadcasting.

Colour negative film can now be reproduced by

telecine machines and the results obtained with 16mm stock are extremely impressive compared with the equivalent prints. There is a marked improvement in resolution 'graininess' and general dirt. The problem of grading (adjusting the printing process to match different shots) is however transferred to the telecine machine.

An image intensifier has recently been demonstrated attached to a film camera. It increases the effective sensitivity by a large factor and good pictures have been taken of a model illuminated only by the light from the hot end of her own cigarette – fading up and down with each puff!

Looking at the different methods for recording images for use in broadcasting it is interesting to note the reasons for choosing one system rather than another for different purposes.

Material intended primarily for the cinema is shot on film (usually 35mm) because cinemas are equipped with optical projectors. These films eventually find their way to the broadcasters and are replayed through telecines. Unfortunately, the cheapest method of distribution is by 16mm prints from a 'dupe' negative produced from the original 35mm material. The broadcast results after transportation, sometimes in corrugated cardboard wrapper without a pool or tin, are usually execrable. Subtitling or language dubbing involve extra processes which do nothing to improve the quality of the picture.

Material which is intended essentially for broadcasting is made in different ways according to the type of programme. Documentaries which involve a high proportion of location work particularly in remote parts of the world are usually filmed on 16mm negative stock, developed, printed for editing purposes, edited, checked, the original negative cut to match the edit, trial printed, graded and printed off with as many copies as required.

Programmes which are made as a series and are expected to be sold throughout the world are often, but not invariably, made on film in a similar way.

Drama and light entertainment programmes are usually made in electronic studios. Location material has hitherto been shot on 16mm film and inserted into the programme during the electronic recording session. On rare occasions an outside broadcast unit with full production facilities is taken on location work.

Small two-camera and tape recorder units mentioned earlier are currently being constructed to enable more location work to be carried out electronically. This new trend arises because of the greater ease of matching the location shots to studio material, the greater productivity obtained in practice, the greater control obtained in achieving exactly the required shots (since the preview pictures can be seen on the monitor), the certainty that the material is correctly recorded while the artistes are still available (rather than waiting until the film is processed) and the greater ability to compensate for varying lighting conditions. (The BBC maintain that in British climatic conditions a real advantage is apparent in the increased length



The Philips Video Cassette Recorder Type N1500. Simple to operate with the advantage that it can play into any television receiver, requires no special screen or loudspeaker systems and no complicated cabling.

Photo Pye Business Communications

of the shooting day.)

Most broadcasting organizations in the UK tend to use colour reversal film for inserts although consideration is being given to the use of colour negative stock replayed and corrected on telecine machines as described earlier.

It is in this area of insert material that economies are being made by the introduction of electronic methods. Although the cost per hour for the use of a simple two-camera electronic unit considerably exceeds that of a film unit, the shooting ratio achieved by a film unit might average 8:1 and of an electronic unit 1.2:1 (allowing for small wastage in editing). More of the cost of the use of an electronic unit is a fixed amount not dependent on the time of use than a film unit and the number of skilled personnel required to operate it is higher. However, when an insert exceeds something between two and seven minutes of finished product, the shooting ratio difference shows a distinct economic advantage in favour of the electronic system.

Table 1 shows the costing estimated by Thames Television in 1970 for seven minutes worth of insert material for a situation comedy series. One sequence was shot in a railway station, another at the seaside.

Table 2 shows similar estimates for two minutes worth of insert material for a drama series. The sequence was shot in a park.

Table 3 shows a comparison between film and electronic costs for a fifteen minute item in the BBC

drama series *30-Minute Theatre*. The sequence was shot in a picture gallery.

The reasons for the difference in shooting ratios are essentially historical in that the methods used for film production have not changed greatly over the years. They have not changed partly because of the fundamental fact that it is impossible to be absolutely certain, at that time, that the required programme has been correctly recorded on the film stock. Precautions therefore have to be taken by shooting several 'takes' to avoid the even greater costs of having to shoot again later, involving recalling expensive artistes and waiting, perhaps, for suitable weather and conditions.

Systems have been devised to overcome this problem by fitting electronic cameras to film cameras and film cameras to electronic cameras so that the director can see shots as they are taken, as in electronic systems. These methods also enabled multicamera techniques to be used, each camera being 'rolled' by remote control. However, there still remained the basic disquiet that the film might not have been properly exposed.

These systems have not been exploited to any great extent and it seems that any success in this direction would be achieved only if this uncertainty could be eliminated.

Directors who have used both electronic and film methods for programme making are now tending to favour the use of electronic cameras and tape where applicable. This appears to be because they feel more directly in control of the production. Ob-

TABLE 1
Situation Comedy Series : 7 minutes' running time - 2 sequences

Cost Item	<i>Elec-</i>	<i>Film</i>
	<i>tronic</i>	
	£	£
Artistes, misc and transport	130	130
Mileage allowance	63	13
Hire of coach	19	—
Make-up van	19	19
Hotels	17	—
Meals	32	19
Location facilities	55	55
Camera tubes	50	—
Tape (v.t.r)	47	—
Film and processing	—	268
Labour	—	—
Equipment hire	—	54
Total 'Direct'	432	558
Staff:		
Shooting	287	139
Editing etc	10	78
Production	107	107
Total 'Indirect'	404	324
GRAND TOTAL	836	882

TABLE 2
Drama Series : 2 minutes' running time - 1 sequence

Cost Item	<i>Elec-</i>	<i>Film</i>
	<i>tronic</i>	
	£	£
Artistes, misc	24	24
Transport and travel	29	6
Meals	54	3
Gratuities	4	—
Props	2	2
Facility fee	26	26
Lighting	83	12
Camera tubes	25	—
Equipment hire	—	15
Stock and Processing	—	64
Video-tape material	26	—
Labour	—	—
Total 'Direct'	273	152
Staff:		
Shooting	174	68
Editing etc	3	52
Production	62	62
Total 'Indirect'	239	182
GRAND TOTAL	512	334

TABLE 3
'30-Minute Theatre': 15 minutes' running time

	<i>Electronic</i>		<i>Film</i>	
	<i>Studio</i>	<i>O.B.</i>	<i>Stage</i>	<i>Location</i>
	£	£	£	£
Artistes/copyright	1,200	1,380	1,500	2,100
Facility fees		150		300
Transport/expenses		250		450
Film or v.t.r costs	121	116	780	950
Studio costs	1,727			
O.B unit costs		2,236		
Film unit costs			2,389	2,919
Production team	1,842	1,842	2,967	3,277
Design/make-up				
Scenery/costume	3,673	1,841	4,243	2,851
TOTAL	8,563	7,815	11,879	12,847
Production times	20 days	20 days	40 days	45 days
Shooting days	1	2	5	10
Shooting ratio	1.2:1	1.2:1	6:1	8:1

viously, the film lighting cameraman has to be responsible for ensuring that his film is correctly exposed including focus, composition, movement and framing. That he has got it right will not be 100% certain until he sees the rushes. He, therefore, has to take decisions based on his experience about whether to retake certain shots and to some extent it may be necessary for him to play safe. The artistic merit of the lighting is more self-evident and he can, to a large extent, judge this from what he sees at the time. On the other hand the television cameraman, although he theoretically carries many similar responsibilities, has an immediate feedback about the results of his labour and he can, of course, put necessary corrections in at the time of shooting. The point is that his finished product is 'on offer' to the director immediately and, just as the cameraman can apply correction, so can the director, hence his feeling of having greater control.

The advantage of a film unit for location work in remote places away from civilization or from electronic civilization is obvious. The camera is relatively light and the machinery very reliable, power requirements are minimal and spare batteries can easily be carried. Until an electronic camera with built-in tape cassettes and batteries which is as light and reliable as a film camera is produced, film cameras will continue to have a very important place for broadcasters.

One of the areas of change towards electronic methods is the making of commercial material. Hitherto commercials in the UK have been made on 35mm film. Each programme contractor receives a number of copies of the commercials to be shown and every day a number of reels of these commercials are made up in the correct sequence for



Random access to 24 cassettes and complete record/play-back flexibility. Six minutes playtime per cassette at 15 i.p.s or 12 minutes at 7½ i.p.s, completely automatic operation. Ampex photo

transmission. It is likely that some of them have to appear repeatedly during the course of the day, hence the need for several copies. At the end of the day the reels have to be broken down again so that the next day's reels can be made up.

With the advent of electronic cassette quadruplex recording machines the process of assembly and disassembly of commercials can be eliminated. The required cartridges can be loaded for each commercial break and re-used as necessary.

In addition, the cost of making these commercials electronically is likely to be considerably less than on film, but at this stage of development animation effects would continue to be made on film. It seems, therefore, that considerable advantages could accrue if an electronic animation system were to be evolved. It would not be difficult to fit an electronic camera in place of a film camera on an animation or rostrum bench. If the output of the camera were taken to a programmable system using a disc recorder of the type used for slow-motion replays, animation work could be greatly speeded up with the great advantage of immediate playback for assessment and adjustment. Furthermore, colour separation overlay techniques could be used to advantage.

CONCLUSION

It appears that there is a continuing process of development, both in methods of using films and of using electronics. Fundamentally the immediate accessibility of tape has great advantages but size, weight, power requirements, skills to operate/maintain it and capital costs limit the extent to which the technique can be used for all types of work. It is likely, however, that the most significant advances will be in electronics.

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