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ABSTRACT

Based on the notion that technological and artistic developments in the area of television production affect viewers' comprehension and appreciation of televised programs, this essay examines the impact of telecommunication advances on the industry. The first section briefly considers the technological advances of the last decade in major TV production units such as cameras, lights, audio, switchers and recorders, 3-D video, cable TV, and direct satellite broadcasting. The second section discusses the application of these technologies to such key TV programming formats as newscasts, music videos, and interview or talk shows. Potential covert effects of such programs are discussed in terms of viewers' total awareness, comprehension, and appreciation of the programs' visual content when these technologies are overused. The third section provides information on future directions in TV production hardware development, underlining the potential consequences developments might have on information and entertainment programs. Finally, this section suggests that publication of scientific research on television production related variables and the direct involvement of academicians in the television industry might help researchers better to understand and control future trends in television production development. Three pages of references are included. (JD)

COMPUTERIZED TELEVISION: NEW DEVELOPMENTS IN TELEVISION PRODUCTION TECHNIQUES

by

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Abstract

Such rapid developments in telecommunication technology as computerized television recording, television editing, television graphics, laser video discs, etc., have revolutionized the structural processess of television images. New television production techniques have been generated which, in turn, make new approaches to the study of television production techniques and television aesthetics a necessity. But is new always better?

In this paper, various technological and artistic developments in the area of television production are examined via their potential effects on viewers' comprehension and appreciation of televised programs.

It is suggested that rapid technological developments in television production hardware will continue being made. However, effectiveness in communication does not always keep pace with the speed at which these techniques are adopted. Consequently, neither television production techniques, nor the study of television aesthetics will benefit if the viewer is not given the chance to perceive and fully appreciate the televised messages.

Introduction

Scholars who have observed the influence of communication technology on contemporary society have long ago identified ours as the information society. New communication media technologies have caused an information explosion in contemporary society which has reached global dimensions (Arnopoulos, 1982, Valaskakis, 1980, Rogers, 1986). As is the case with such explosions, however, the entire environment has been shaken up, altered, or even damaged and many observers are concerned and alarmed about it (McPhail, 1986).

In the field of visual communication, in general (the academic discipline which studies the processes and the effects of the visual communication media), and in television production techniques, in particular, observers have warned us that some ecological changes and environmental damage due to many new technological advances in television production techniques can be devastating (Zettl, 1982). Many viewers are fascinated by and attracted to the new visual imagery, but remain unaware of and often indifferent to the visual content and the synthesis of such peculiar visual messages (Chartrand, 1986). In other words, television viewers see the changes in television production techniques as they appear on the television screen, but are unaware of the potential effects such visual displaces might have on them. Furthermore, the new computerized television pictures may be able to catch viewers attention and curiosity instantly, but constant exposure to such images can immunize viewers' perceptual and cognitive ability (Treisman, 1986, p. 114 B) to such an extent that recall of these visuals is found to be minimal (Metallinos, 1985).

How are we, in the field of visual communication media, to warn viewers of the possible effects of these technological advances in television production imagery? Are there workable ways to inform viewers of these gimmicks and to

prepare them to choose visual comprehension over visual confusion? Scholars in the field of visual communication, perceptual psychology, television composition and media criticism have all provided some answers. They have all helped to establish the interdisciplinary communication field known as television aesthetics which examines such basic elements of television production as light, space, time, motion and sound in relation to each other, and to the total television program. If viewers are aware of the aesthetic value and the communicative potential of given television images, it is thought that they will become more selective in their choices of television programs. Research studies in television aesthetics, some scholars suggest, will enlighten the viewers and allow them to exercise effective and workable value judgements underlined in such television aesthetic research studies. Viewers and critics alike, aware of these guidelines, will be able to point out the visual gimmicks of computerized television, and thus to avoid them.

Concerned about the abuse of these new technologies introduced in television hardware, Zettl (1982, p. 9) questions the intentions of these technologies via the effects they might have on contemporary television viewers. He asks:

> A whole new level of pictorial abstraction has evolved in television presentations with new production requirements and, I am sure, with new perceptual effects on the viewer. But what exactly are they? Do such animated graphics maximize communication? What is the full potential of such visuals? What are their covert effects on our perception? Are they ecologically sound or do they, or could they, add to the pollution of our electronic environment?

In this paper, a series of new developments in television production technologies will be examined via their influence on the aesthetic quality of the

television program. A key question addressing the problem of media technology versus media aesthetics is: Do new developments in television production techniques increase viewers' awareness, comprehension and appreciation of the entire content of the end product, the television program?

For an analytical and comprehensive examination of this question, the following three subquestions emerge to guide the study: (1) Due to the overall technological developments in telecommunication media during the last decade, which particular units of the television system have been drastically changed? (2) In what specific areas and to what degree have changes in television production hardware covertly influenced television viewers? (3) What is called for in the future concerning the composition of TV images and their presentation?

Developments in Television Equipment

A sizable number of new telecommunication media have emerged during the last decade such as cable television, Direct Broadcast Satellites, video games, video texts, teletexts, two way television, computer graphics and holography (Fletcher, 1984) to mention only a few. As a consequence of these developments, a considerable number of technologies have been developed in television hardware which have had a profound effect on the end product. In this section, the most important such developments will be examined via their influence on the synthesis of television pictures.

Cameras

The television camera, which is the first unit in the television production system, has undergone drastic changes over the last decade. From the RCA TK 60 monochrome big TV studio camera to the portable, solid state, digitally controlled models, cameras have been greatly improved.. They provide maximum

picture clarity and require less lighting (i.e. the small ENG/EFP camera); they offer maximum depth of field (i.e. the big TV studio cameras such as the RCA TK-4 and other similar ones). Equipped with high quality electronically operated zoom lenses and supported by new, lighter and more flexible camera apparatuses (such as pneumatic studio pedestals, TV studio cranes, etc.), the big studio cameras have enhanced the quality of TV studio productions. Unstable and often unnatural camera movements of the past such as dollying, pedestalling, panning, trucking, etc., have been replaced by more stable, smoother and more flexible camera movements which convince the viewers that they are directly observing the action. Equally, the development of smaller, portable television cameras has changed both traditional TV production processes (i.e. news, sports, rock videos, documentaries, public affair events, etc.) and television production techniques (i.e. live, direct broadcasting which bypasses editing). Network competition in news gathering has triggered the development of new technology and generated ENG/EFP (Electronic News Gathering/Electronic Field Production) procedures. These procedures, in turn, have revolutionized television production techniques, challenging the human involvement, the software, of television production.

Several improvements in television production videotaping techniques were made due to the invention of the high-flying computer guided cameras known as "skycam," and the hand held cameras known as "steady cam." Skycam has helped to substantially modify sportscasting techniques (Talen, 1986, pp. 50-55), and the steadycam has brought the media of film and television closer together. As television cameras have become smaller and more flexible, they are handled as film cameras, merging film with video to create the field of electronic cinematography, one of the major revolutions in television production techniques and television

programming today. In Mathias' and Patterson's (1985, p. xii) view, "Electronic cinematography is a new form of production, born of the marriage of video hardware and film techniques; it offers not only the best of both worlds but entirely new creative possibilities."

Such creative possibilities have been in practice since the introduction of the first broadcast quality ENG/CCD (Charged Couple Device), the solid state technology attached to small video cameras. These cameras, according to Westport (1984, p. 28), create video pictures that capture almost everything a film camera captures.

Similar creative possibilities also emerged with the introduction of HDTV (High Definition Television) cameras by Sony in Japan and Philips in Europe. Using a double 625 PAL signal, these cameras produce pictures of as high a quality as those of film cameras. According to Schubin (1981, p. 77), "HDTV can provide details as crisp as those in 35 mm film and will enable filmmakers to begin to take advantage of all the beneficial aspects of video technology." Mathias and Patterson (1985, p. xi-xii) project that "The future demands a new analysis of the visual techniques that will be required by the improved picture quality of HDTV and its application to dramatic subjects."

Lights

The second unit of television production system, and one of the most basic, is lighting. Improvements in television lighting equipment which were brought about mainly in order to meet the electronic demands of the new television cameras, have occured in several major areas.

First, the lighting instruments themselves have improved. The heavy, bulky, old incandescent lighting instruments used in film studios such as Fresnels and scoops have been replaced with smaller, more flexible, easily manageable

lighting instruments. These lighting instruments use quartz (tungsten-halogen) lamps, or H.M.I. (Halogen-Metal-Iodide) lamps. This change allows for faster lighting set-ups and the use of less lighting instruments. Another important development occured in the area of portable lighting instruments with multiple usage. New television lighting instruments were developed which can be used either in complex TV studio productions, or in remote or location shooting. Instruments such as the Sweep Focus or External Reflector lights (Zettl, 1984, p. 138), the Ring Focus Fresnel Spotlights (Zettl, 1984, p. 145) and the Omni-Light (Lowel) for the ENG/EFP cameras (Zettl, 1984, p. 147) are specialized instruments and their multiple use capabilities have increased the creativity of lighting engineers.

An additional development has occured in the area of lighting controls and intensity controls through dimmers (Zettl, 1984, p. 154). The previous manual dimmer control consoles in which each light intensity had to be controlled by hand, have been replaced by new, often computer assisted dimmer controls. This development allows the TV production crew (1) to control the intensity of the light at will, (2) to change the lighting from one set to another more quickly, (3) to change the color of a scene, (4) to create special effects such as night light, sunsets, etc. (Zettl, 1984, p. 154), and (5) to set up the lighting for several scenes at a time, economizing production time. In planning TV lighting equipment, contemporary television production centers emphasize ". . . the need to produce multiple productions with an improved look, with a rationalized production flow, with limited production time, and which permit alterations at any time." (Kreckel, 1985, p. 46).

Audio

The third unit of the television production system in which major improve-

ments have occured is audio. The entire technology of television's audio equipment, such as microphones, audio recording units, audio consols, stereophonic sound, etc., has been updated and refined, improving the quality of television sound substantially. Television production no longer uses conventional microphones used in film productions. It has created its own dynamic condenser ribbon-type microphones which operate both as mobile and as stationary microphones. They range from boom, hand, lavaliere, and wireless to desk, stand, hanging and hidden microphones. The quality of sound and the pick-up range produced by these microphones is superb, and their production flexibility and usage has greatly increased. In the area of sound recording units, such as turntable, tape recorders, audiotape cartridges, reel-to-reel tape recorders, etc., great improvements have occured providing excellent service and flexibility for the recording of television programs.

Audio control equipment of television systems has undergone the greatest change. The traditional manual audio consoles (such as RCA's BC - 7), commonly used in TV studio operations in the past have been replaced by new, multi-channel stereo, computer assisted audio consoles. Working with slide faders (such as the Audio Design BC-5), these new consoles are capable of storing and controlling many audio imputs, and are able to synthesize and produce a variety of sounds and sound effects which were previously impossible to achieve (Zettl, 1976, p. 178).

Finally, the most revolutionary change in the audio unit of the television system has occured with the introduction of stereophonic sound for television (Kaller, 1986). This innovation has elevated audio quality to a higher level than video quality. Those who have attached an FM band to their television sets can attest to such a serious imbalance. The presently low definition television picture is aesthetically incompatible with the high quality of stereophonic sound

(Zettl, 1982, p. 9). When however, stereophonic television and HDTV are allowed in North American broadcasting, this discrepancy will be resolved.

Special Effects

The television production unit known as the switcher or special effects apparatus has also undergone revolutionary changes and improvements. The switchers of the past had the capabilities to fade in and out, dissolve, cut, superimpose, shromakey, matte, matte key, clip, debeam, wipe, feedback, spot, etc. (Zettl, 1976, pp. 295-318). Today, the development of new computer enhanced DVE (Digital Video Effects) switchers allows such additional effects as flip-flops, quad split controls, cascading, double re-entries, screen simulations, multi-images, mirror or echo effects, compression and expansion, horizontal and vertical flips, autokeytracking, perspectives, posteriorization, mosaics, size and position changes, zoom effects, slide effects, rotation effects, fix effects, cube rotation effects, etc. (Zettl, 1984, pp. 367-385). The consequences of these developments to the study of television aesthetics are numerous. Circumstances and scenes which are totally impossible in real life can be recorded and produced visually through the magic of the television switcher. Beyond a shadow of a doubt, the visual effects produced by the DVE attached to computer assisted switchers are fascinating and attractive. They draw the viewers' attention and trigger their imagination. They provide easy solutions to complex production processes, making the impossible appear possible. In short, they are used as attention stimulators and entertaining devices. But should this happen so freely? Does this visual pandemonium enhance the content of the programs which make use of them? Are they always ethical in their intentions or justified in their purpose? Visual communications media observers fear that over emphasis of visuals gimmicks diminishes the credibility of the medium as an art form (Zettl, 1982, p. 9), and that constant

exposure to such visual barrages can have covert effects on viewer's comprehension and appreciation of the content of such televised programs (Metallinos, 1986, p. 12).

Recorders and Editors

There has been steady development in television production recorders and editors during the last decade. Since 1976 when Ampex introduced the VPR-1, the first helical scan videotape recorder and its portable mode the VPR-10, video recording has been greatly improved. Recording machinery, modified and improved, has formed the bases for video editing technology. Starting with single source editing and advancing to the multiple source editing system (with computerized editing and precise electronic equipment), television editing has reached a high degree of sophistication. It is known that 85% of today's televised programs are the outcome of post-production or heavy editing. As a consequence, the production process (capturing original images in the studio or in the field) has been minimized and the sophistication of television editing machinery has been greatly elevated. An account of the post-production equipment which furnishes most of television production centers is given by Paulson (1984, p. 42) as follows:

> The average post-production suite is outfitted with three or four editing videotape machines; a film to tape transfer unit; a switcher with two or more preprogrammable mix/effect buses controlling 10 to 20 input sources, including single or multi-channel character generator; and a small computer-based videotape machine and switcher controller capable of executing long lists of preprogrammed mixing and edit decisions. The latest update of this basic configuration is a suite that adds computer control of multichannel audio sweetening.

This shift from studio (or field) based creation (in which human beings were

heavily involved), to an assemblance of synthetic images made by machines, could have consequences as yet unforseen.

Video Screens

Although the standard 3:4 aspect ratio television screen is still the most commonly used around the world, the development of the large screen in 1973 with its 3:5 aspect ratio has helped to modify the TV production approach. The first big television screen, named Videobeam, was ". . . a three color-tube projection system with a special six-by-four-foot screen that produced a bright picture more than ten times larger than that of the biggest conventional TV set....." (Lang, 1976, p. 24). Then, as HDTV was developed, and the standard television screen's picture was improved, Big Video Screens were developed in Japan. Describing one such big video screen on his visit to Japan's Tsukuba Expo '85, Castello (1985, p. 28) states:

> When the huge screen is turned on, loudspeakers announce that it's "zoom-in time." A camera picks out people or groups gathered on the grass near the 82-foot-high and 131-foot-wide Jumbotron, which is the world's largest TV and video display screen. With an aspect ratio of five to three, Jumbotron can receive HDTV pictures, as well as standard NTSC. The screen is 10,000 times the size of a 20-inch TV screen and 30 times brighter.

The big video screens, although still in limited use, will influence television production techniques. The traditional videotaping techniques developed for small screens cannot be employed successfully with large screens.

3-D, CATV, DBS

Although technological developments have occured in every piece of hardware in the television system, and it is impossible to single them all out, 3-D video,

cable television (CATV) and the Direct Satellite Broadcast system (DBS) deserve some attention.

The technology of 3-D television is not new. It has grown alongside the cinemascope concept and has always had problems. However, the creators of the system believe that 3-D will flourish again and offer exciting visual possibilities for the near future. As Green (1983, p. 29) states:

> Before its recent revitalization, 3-D was viewed as a gimmick that had the faddish future of shaky speculation. Now, however, with its feet on firm ground, and with the marketing support it deserves, 3-D productions, particularly in the field of 3-D video broadcasts, can look forward to an exciting development of its perhaps yet undreamed of possibilities.

Computerized television switchers and digital video effects attachments are producing three dimensional types of pictures on the small television screen which have superb quality.

The technology of cable television is not limited to transition of video programs. As a distribution system, disseminating information through ground wire, cable television has contributed to the development of television production. It has taken time to produce new and more challenging television programs and offers the opportunity for more artistic expression in its production process than networks do.

The technology of Satellite Broadcast Communication is new and fast developing. As a geospheric distribution system it offers great possibilities in the development of new television programming which, in turn, will require a different approach to television production techniques since there must be precision and universality in programs which will be seen globally.

In summary, the technological developments in the hardware of the television production system are directly affecting television production techniques and, consequently, the form of televised programs. Improvements in technology are producing better quality (technically) television pictures and sounds. But the question still remains: What particular covert effects will such technological developments have on those who work with them and viewers who consume the products of television?

Is New Always Better?

Although television is the most widely used medium today and one of the most effective communication medium the world has ever known, the influence of its programming on viewers is not always immediate or apparent. Researchers on the influence of television programming on society (Gerbner, Cross and Melody, 1973, Wright, 1959) contend that the cultural influence of television on special groups takes years to show up. During that time, the socialization process takes place and several cultural indicators emerge which help us to identify the degree to which television has influenced specific viewers. In this section the effects that new television production technology have had on contemporary viewers will be pointed out. The discussion will be limited to such television programs as newscasts, sportscasts, public affairs programs, music videos, interviews and talk shows.

Changes in the content of news programs have not occured over the last ten years. But the medium's treatment of the presentation of the news has changed. By and large, the network news has been polished; field or on the scene reports have increased; visuals have also increased; most of the visuals appear like the pages of popular news journals. The news has taken on a journalistic appearance.

The various parts of the television screen are filled in with other images and visuals in addition to the anchorperson. Some of these visuals are frozen (digitally), others have lettering, while yet others use live action squeezed in on each of the four corners of the television picture. In order to achieve all of these visual displays, several new television system technologies are involved, the most important of which will be pointed out this section.

Most network newscasts commonly use the small ENG/EFP cameras which are linked directly with the station and provide visual and verbal information. But the rush to be first with the news on the air usually produces field footage poorly shot, scenes which are unevenly lit and the sound is often overshadowed by the noises of the environment. Such poor presentation is common practice in network television newscast productions.

Another common technology which is widely used foremost in newscasts and sportscasts, but also in rock videos and daily talk shows is special effects and particularly DVE. To enhance the content of the programming and for the purpose of attracting the viewer's attention, the technology of television special effects is used to rescue the show. The extensive use of DVE's flipping and flopping of faces (i.e. the evening network television program Entertainment Tonight), compression or expansion of landscapes, the fast changes in size and position of visuals, and a barrage of other such visual tricks are often confusing and redundant. The aesthetic value of the visuals is dubious and serious observers of the medium have questioned the use of such special effects. (Zettl (1986, p. 1a - 1b), for example, raises the questions:

> Does such visual treatment enchance the news and make it more important? Or is it a gimmick, prompted by the manufacturers of DVE (digial video effects) equipment who invented such

> devices oblivious of use, and who now like to sell their goods and find some satisfaction and justification in seeing their technical creations applied, however frivolously?

The extensive use of computer generated graphics has created a new phenomenon in the television production of daily news and interview shows called graphication of television news. Zettl (1986, p. 2) defines this as "all aesthetic devices that are used to make a television image two-dimensional or graphic-like, often similar to a magazine page." This aesthetic device imitates the older, more traditional medium of print. These visual gimmicks do not enhance the viewers comprehension of the content of the news items. Zettl (1986, p. 1a) challenges these kinds of practices stating that:

> Computer-generated graphics pop on the screen to give us headlines, field reporters and their stories are squeezoomed in and out over the news anchor's shoulder and fancy lettering repeats what we have heard the newscaster tell us. Through the magic of digital video, live scenes are frozen into still images and peeled off page by page as though we were flipping through a magazine.

Schubin (1985, p. 68), a regular columnist for Videography magazine, calls such effects "cheap thrills."

The technology of video lenses has offered great service to television production due to their flexibility and optical range. But the lenses have not always been used aesthetically. An example of over-stretching the power of the telephoto super zoom lenses is shown in many rock videos in which the lenses are used freely. The compositional value of such video recordings leaves a lot to be desired. Many rock videos often overlook and defy basic principles of aesthe-

tic composition. Distorted faces, tilted horizons, fast motions all created by unorthodox zoom lens usage are not always justified. Even the younger viewers for whom most rock videos are made are becoming less and less fascinated with extensive visual gimmicks.

The comprehension and recall of visuals placed on the Z-axis is minimal when visuals move in and out over a certain speed limit (Chartrand, 1986). Studies on the stability and constancy in visual perception indicate that the average observer of visual stimuli requires certain visual conditions and needs a certain amount of time to successfully perceive and accurately recognize the motion of visual materials (Epstein, 1977). The instability and inconsistancy presented to the viewer by distortion of visuals through the use of zoom lenses or fast moving objects along the Z-axis is commonly observed in televised rock videos today. However, are network television producers sensitive to the covert effects of these gimmicks? Studies dealing with the complexity of television messages and the degree of attention paid to them by the average viewer reveal that the more visually complex the television message, the more mental effort is required by the viewer to comprehend it (Thorson et al, 1985, p. 427). Most visually complex television programs do not allow for the extra mental effort required.

We have the technology to create artistic television programming. But we must be aware that the emphasis should be on communicating with the medium.

Future Predictions and Suggestions

Although scholars of the television medium are reluctant to make firm statements on the effects (positive or negative) of computerized television production techniques on contemporary viewers, the Research and Development Departments of the television industry have no difficulty at all making such future

predictions (Hodes, 1986, pp. 36-60). Academicians are wondering how we are going to deal with an ever increasing, rapidly changing television technology when we have a hard time understanding the effects of the present developments? The television industry, however, is not so sensitive to such questions. Since the industry always leads the way in television technology, it is easy for them to predict future developments and trends. A chief executive for Sony Broadcast Productions, for example, states flatly that:

> In 1984, we moved one year further into the era of not what can technology produce - but what should technology produce? To a great extent, that question will have to be answered by the users. Their needs should determine the direction of future technological developments. As an industry, we now have the power to shape technology to meet user needs (Hodes, 1985, p. 40).

This is ironic if we consider how powerless the viewer is and how powerful technology is. This is a paradox of our times with which we are confronted and must provide some solutions.

In a key article titled "A Glimpse Into Future Television," Nadan (1985) provides some insightful prophecies stemming from his laboratory research. Nadan (1985, p. 135) summerized the future of television technology improvements as follows:

> The next generation of television receivers, in order to gain our acceptance, will most likely have (1) a large display area with a wider aspect (width to height) ratio, (2) flexibility and interactivity, (3) approximately twice the perceived horizontal resolution and vertical resolution of NTSC (National Television System Committee) television, (4) true highfidelity stereophonic sound (not

discussed here), (5) no artifacts (visible effects on the display; for example, shimmer and color flashing) that were not present in the original scene.

It is apparent that commercial television will dictate major advances in two areas: information and entertainment, and the relationship between HDTV and two way interactive and cable television CATV will develop video shopping. Computer generated data and Direct Broadcast System through Satellite will increase news information and public affaires programs and will make direct and instantaneous global communication information possible. The development of digital memories within the television receiver will open up the possibility of watching more than one program simultaneously, and HDTV will generate longer and wider pictures on bigger screens for home use.

These major future changes, along with a plethora of smaller ones, will occur whether we want them or not. Our challenge and major task will be (1) to inform the viewers of the possible covert effects of these technologies and (2) to try to redirect the scope of these inventions by working hand in hand with the industry developers.

First, we must involve scholars of the television medium in serious research on all aspects of television production, but foremost, in the area of composition or television aesthetics. Studies in this area are very scarce (Metallinos, 1985). For a long time, and for many reasons, scholars of communication have neglected to study the components of the television system or the processes involved in the synthesis of television messages. Sporadic attempts to undertake such research are being made, but the field remains wide open. We need to scientifically study the key factors involved in the television production process. As Zettl (1982, p. 9) suggests:

> For some reason, aesthetic factors in television production and methods of presentation, or even the aesthetic potentials and requirements of the television medium, have not been considered an area of serious research. Whatever the reasons for this inactivity may have been, we simply can no longer afford keeping our back turned to study of television aesthetics.

Wide publication of such research findings will reach the viewers.

Second, in order to prevent the development of frivolous and destructive television production hardware, we must encourage our television production scholars to actively participate in Research and Development Departments of the television broadcasting industry. Today, very few scholars and serious researchers of television production and television aesthetics are involved in the industry. The dialogue that occasionally occurs between broadcasting industry personalities and broadcast education scholars is good, but not enough. Manageable, more systematic and more formal ways must be found to engage these two polarized worlds in common research in television production hardware. We are all responsible for the future of television. We all depend on it. The research and development of the television industry should not run so far ahead of the research and publication of television scholars or without their mutual understanding and cooperation. We should all be responsible for the welfare of human beings exposed to television's indisputable power.

Summary and Conclusions

This paper dealt with the issue of television technology versus television aesthetics. The intentions behind the developments of such extraordinary and advanced computerized television technology were challenged.

The first part of this paper briefly examined the technological advances of the last decade in the major television production units such as cameras, lights, audio, switchers and recorders, 3-D video, cable TV and Direct Satellite Broadcasting.

The second part of the paper discussed the application of these technologies to such key television programming genders as newscasts, music videos and interview or talk shows. An effort was made to point out the potential covert effect such programs might have in terms of viewers' total awareness, comprehension and appreciation of their visual content when these technologies are over used.

The third part of the paper provides some information based on existing liter ature on the future direction of the development of television production hardware. It underlines the potential consequences such developments might have on information and entertainment programs. Finally, it suggests that publication of scientific research on television production related variables and the direct involvement of academicians and the television industry might help us to better understand and control the future trends in television production developments.

It should be evident from the issues raised and discussed here that technological developments in the television industry are often insensitive to the covert effects the application of these technologies might have on the average viewer. The television industry, trapped by the competition for higher ratings, often employs new hardware in programming before it is properly tested. Consequently, any covert effects such programs may have on viewers are left to chance.

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