

# High Definition Television: New Perceptual, Cognitive and Aesthetic Challenges

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**Abstract:** The perceptual, cognitive and aesthetic principles governing the medium of television are decisively challenged by the advent of high definition television (HDTV) or improved definition television (IDTV). Established rules of visual perception, cognitive processes, and aesthetic appreciation of television images of the past must now change to compensate for the high quality, film-like picture produced by HDTV.

This article focuses on the major adjustments that need to be made in perceiving, comprehending, and appreciating the newly emerging technology of HDTV.

**Résumé:** Les principes perceptuels, cognitifs et esthétiques régissant le médium de la télévision sont désormais mis au défi par l'avènement de la télévision à haute définition (HDTV) et par celui de la télévision à définition améliorée (IDTV). Les règles et principes de perception visuelle, de processus cognitif et d'appréciation esthétique de l'image télévisuelle, établis par le passé, doivent maintenant être révisés, s'ajustant ainsi à la haute qualité, à la ressemblance cinématographique, des images produites par la télévision à haute définition (HDTV).

Cet article concentre son propos sur les ajustements majeurs et nécessaires à apporter à la perception, à la compréhension et à l'appréciation de cette nouvelle technologie émergente qu'est la télévision à haute définition (HDTV).

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The advent of electronic cinematography, defined by Mathias and Patterson (1985, p. XII) as “. . . a new form of production, born of the marriage of video hardware and film techniques,” was an inevitable development of communication media technology. So confident were these authors in the development of the field of electronic cinematography, that they predicted that:

The future of electronic cinematography lies in high definition television. When video images achieve a resolving power comparable to images recorded on 35mm film, electronic cinematography will begin to realize its full potential. (p. 220)

For the most part, the predictions of these authors proved to be right, and, according to Carbonara (1990), HDTV technology consists of:

...five times the visual information detail {1.125 scanning lines} of pure NTSC {National Television Systems Committee, 525 scanning lines}, about ten times the color information, more than two times the horizontal and vertical resolution, great improvement in picture brightness, a wider aspect ratio {5:3} and sound quality that is equal to compact disc. (p. 1)

Technical, political, and economic problems have delayed the mass application of HDTV technology everywhere but in Japan where it has been in use for more than a decade. This could be a welcome sign considering the preparation and the consumer adjustment needed to meet the challenges of HDTV technology. The "technical" problems imposed by HDTV touch on the *production* of HDTV, the projection of images and the means of *distribution* of HDTV programs. The "political" problems center on the issue of arranging a world-wide accepted standard for the transmission of HDTV programs. The economic problems have to do with the enormous amount of money required for the development of electronic cinematography, the production, and the distribution of HDTV programs as opposed to the limited funds required to produce regular 35 mm films (the estimated ratio is 5:1). The bulk of the literature on HDTV technology centers on various technical, political, and economic issues. Excellent seminars on these issues are found in the proceedings of several recent world conferences, most notably, 1) *High-Definition Technology: The Critical Choices* (Checco, Russell, & Behrens, 1988); 2) *Technology Update: High Definition Television Production of Electronic Films, Strategies and Experiences* (Zwaneveld, 1987, June 4); and 3) *Proceedings From the 2nd Annual Conference and Exhibition on High Definition Television and the Only one Devoted Exclusively to HDTV* (Meckler, 1990). However, very little has been done on the artistic, cognitive and perceptual issues related to HDTV technology.

In the view of some scholars and researchers, so much emphasis has been placed on these technical, political, and economic issues that the technology is already ten years behind in its proper development. Researchers at M.I.T.'s Media Laboratory have worked out an alternative solution to HDTV technology and claim that they ". . . can deliver those gorgeous HDTV-quality images within existing TV bandwidths by clever data compression and image improvement" (Brand, 1987, p. 75). In fact, the founder and director of M.I.T.'s Media Lab, Nicholas Negroponte, prophesizes that the future of HDTV technology will be even greater if we redirect efforts towards computer generated HDTV pictures which can go beyond 1.125 scanning lines (Rice, 1988, pp. 62-71). Negroponte's associate, Andrew Lippman (1990), suggests open architecture and computational video as the most likely high definition system for the 1990's and states that:

A change in television has already begun with so-called "intermediate digital" TVs (IDTV). . . . digitally translate an image onto a higher definition scanning system. So, it will not be long before the computer

*qua* TV will be the receiver, whether the broadcaster is delivering NTSC, 1125, 1250, 1375, or any other type of signal. (p. 3)

Regardless of the means of transmission (regular broadcast or computer image compression), when the outstanding technical, political, and economic problems are resolved, the new technology imposes some challenges for today's producers and researchers.

Existing perceptual, cognitive, and aesthetic principles governing the medium of television are fundamentally challenged by the advent of cinematographically produced high quality, film-like images which are transmitted by television. Some well established rules and principles of visual perception (stemming from related studies in the fields of perceptual psychology and neurophysiology), certain bases which are needed in order for the viewer to easily decode and recognize television images (stemming from related studies in the field of cognitive psychology and semiotics), and some guidelines for composing television pictures which can be more readily appreciated (stemming from the related fields of the arts, communication and media aesthetics) need to be altered due to new electronic cinematography technology. This article is an overview outlining these changes and pointing out the adjustments that must be made in order to meet the challenges presented by future mass application of HDTV,

#### ***Changes in the Perception of HDTV Pictures***

Such perceptual variables as 1) life-like pictures; 2) aspect ratio; 3) screen size; and 4) frame rate, are among the most significant factors found in numerous empirical research studies coming from Japan where the technology has been in full swing for more than a decade (Takahashi, 1982), from Canada (Conway, 1988; Cook, 1990; Hearty & Phillips, 1988). and from the United States (Mathias & Patterson, 1985; Meckler, 1990; and Zwaneveld, 1987, June 4).

Unquestionably, HDTV or IDTV pictures are superior to those of the NTSC (National Television System Committee), PAL (Phase Alternation Line) or SECAM (Sequential Couleur à Memoire) systems. Such picture clarity, however, has caused concern to some researchers. They contend that in HDTV pictures, detailed and unnecessary visual elements -third level visual information - can assume a prominent role - first level visual information - disturbing rather than enhancing the visual communication process (Behrens, 1986; Metallinos, 1990; Winner, 1989) if the priorities of the visual information are not predetermined and the figure/ground hierarchical order is misrepresented. Empirical studies on figure/ground anomalies in commercial television have shown that picture perception of certain television commercials was decisively diminished when the background (third level visual information) took precedence over visual elements in the foreground (first level visual information) (Metallinos, 1988). Film and television directors have used the technique known as *depth axis*, *vertical axis*, or *Z-axis* staging to increase the

perception of depth of field in film and television pictures. It should be noted, however, that film and television cameras produce high or low resolution pictures indiscriminately. They cannot replace the human eye which perceives images in accordance with their position in the visual world. Consequently, placement of visual elements in the vertical axis alone does not guarantee normal figure/ground relationships.

Empirical studies conducted in Japan by NHK (Nippon Hoso Kyokai), the Educational Television Network, have determined that HDTV pictures are better perceived by a wider screen aspect ratio (preferably 5:3) than the conventional 4:3. This is confirmed by Mathias and Patterson (1985) who state that:

Studies indicate that the impact of wide-screen images results from the fact that the wide format doesn't allow the viewers to take in the whole image in one glance. It requires them to scan the image with their eyes and edit it into a visual experience. The fact that the viewers must participate in their visual experience tends to involve them more fully. (p. 224)

Experimental studies on the I-IDTV screen size confirm that the larger the screen, the more comfortably the picture is perceived. As stated by Zwaneveld (1987):

The advantages of HDTV cannot really be appreciated unless the display is much larger than at present. For an optimal "presence", at a ratio of 5:3 and an image diagonal size of 2 meters, observed at a distance of 2 x image height, and a 45° viewing angle, the monitor or video projected display should measure 1 meter x 1.8 meter for an 1100 line TV system. (p. 2)

Apparently this has been the experience over the years with the motion picture industry- the larger the film screen, the better the visual impact on the spectators (Mathias & Patterson, 1985, p. 224).

Another perceptual factor which challenges HDTV viewers is the rate at which the frames or pictures change to create the illusion of motion. In general, the higher and the more frequent the ratio at which frames change, the better the resolution of the picture. The adoption of HDTV requires a higher frame rate in order to avoid flickering and "promote better rendition of movement" (Mathias, 1985, p. 225), and to reduce the possibility of noise. Ordinary NTSC (a 525 line, 30 frame per second system) and PAL or SECAM (both 625 line, 25 frame per second systems) television viewers are not accustomed to this higher frame rate. The proponents of IDTV use the "frame rate" limitations of HDTV to promote the notion that the digitally created High Resolution TV picture system is completely free from flickering, reproduction of motion, noise and bandwidth requirements (Lippman, 1990).

*Changes in the Cognitive Process (Comprehension) of HDTV Pictures*

Recognition is another prerequisite for the study and understanding of the workings of the visual communication media, in general, and HDTV pictures in particular. Cognition here is synonymous with comprehension, recognition, interpretation, and understanding of the high quality of the pictures and sounds of HDTV technology. Scientific research on the cognitive effects of HDTV in North America and Europe are very limited-almost non-existent. From general research on technology imported from Japan, the emphasis is placed on such factors as 1) the overwhelming picture resolution; 2) the increased size of the TV screen; and 3) the entertainment value of the new technology.

In commenting on the cognitive impact of the picture resolution, Behrens (1986, p. 42) explains that minute details like, for example, the list of ingredients printed on a can of soup, overwhelm the viewer whose eyes capture things never before seen on television or details which were never intended to be of any visual importance. To avoid visual confusion and misunderstandings, the HDTV producer/director must pay special attention to this factor. Placement of the visual elements within the depth or vertical axes of the visual field becomes an even more necessary practice in HDTV productions.

Mark Fleischmann (1990) commenting on the issues raised by HDTV and IDTV regarding their use of bigger screens, suggests that the issue of acceptable size is related to the issue of viewer acceptance and understanding of the visual image projected by such TV set technology. It will take some time before NTSC, SECAM, or PAL TV viewers readily adjust themselves to watching larger TV screens. An image presented on a small screen does not offer the same level of comprehension or degree of understanding and is not appreciated the same as on a large screen. Epoch films intended for projection on large film screens are viewed differently when presented on the small TV screen. Size is a determining factor in comprehending the semantic dimension of televised images.

Several observers of the cognitive effects of HDTV have speculated that television programming which is not made solely to enhance the technology, will invariably not be recognized and appreciated by its viewers. Winner (1989) suggests that "If our society absolutely must spend billions on television during the next several decades, improving the quality of programming would seem a better place to start" (p. 276). In discussing the differences between film and HDTV or IDTV as far as future programming is concerned, Moore (1990) predicts that:

Sitcoms, talking heads shows, most news programs and the typical intimate drama will benefit little from improved picture quality. The most significant benefit<sup>8</sup> will be for sporting events, epic pictures, operas and ballets, and shows with exotic locales as backdrops. These type shows make up only a fraction of programs currently being broadcast, which again limits the attractiveness of HDTV. (p. 3)

Levy (1989) goes even a step further. He believes that HDTV will not only develop its own programming to feed the viewer's hunger for better home entertainment, but that technology will have a profound effect on the movie industry as well. He predicts that "We'll see an incredible increase in special effects, and films will more easily be able to portray fantasy" (p. 100). Improvement in the programming of the movie industry and creation of special programming for HDTV are both cognitive factors which will challenge the future viewer of electronic media.

### *Changes in the Aesthetics of HDTV Pictures*

The greatest challenges faced by the new technology will be in such widely practiced aesthetic principles (theories, concepts, rules, and constructs) as hot (film) vs. cold (TV) media; horizontal (film) vs. vertical (TV) staging techniques; small (TV) vs. large (film) visual fields, to mention only a few.

Prior to the development of HDTV, students of television production, television criticism and television aesthetics full-heartedly embraced McLuhan's hypothesis of hot and cold media (1964, p. 37):

**There is a basic principle that distinguishes a hot medium like radio from a cool one like the telephone, or a hot medium like the movie from a cool one like TV. A hot medium is one that extends one single sense in "high definition." High definition is the state of being well filled with data. A photograph is, visual, "high definition." A cartoon is 'low definition,' simply because very little visual information is provided.**  
(p. 37)

Partly due to the low quality (low definition) of TV pictures and partly due to the small size of its visual field (the TV screen), television adopted the practice of using extreme closeups in dramatic television to more intensely involve the viewer. With the advent of massively applied HDTV, McLuhan's TV aesthetic hypothesis becomes outdated. As mentioned earlier, HDTV programming requires a larger TV screen. A larger TV screen with a high resolution picture requires less viewer effort for psychological closure. In short, HDTV is no longer a "cool" medium—it is a "hot" one. This implies that the aesthetic theory of "hot and cold" media in film and HDTV is inappropriate. It also implies that the production techniques for TV programs intended for HDTV presentation must follow, to a large extent, those techniques established by the film industry.

Research works stemming from various studies on film and TV production techniques have formed two distinct bodies of literature in film grammar in which Eisenstein (1942, 1949), Lindgren (1970), Bobker (1969), Mast and Cohen (1974) and Kauffmann (1979) are the most representative; and in television grammar which was created by Armer (1990), Davis (1974), Lewis (1969), Millerson (1972), Wurtzel (1983), and Zettl (1990) among others. These grammars formed the various compositional principles and production techniques in lighting, staging, editing, and audio which were unique to each of

these media. The emerging electronic cinematographer and HDTV producer/director must be knowledgeable and confident with both grammars in order to meet the challenges posed by the new techniques.

Until now, it was theorized that in order to enhance the illusion of depth of the small visual field of the low definition television picture, visual elements should be composed within the Z-axis, moving inwards or outwards, either towards or away from the center of the screen (Zettl, 1990, p. 193). It was further theorized that the small opening of the regular TV screen does not allow the composition of crowded scenes and shots of landscapes. Such scenes were deemed more appropriate for the larger high definition film screen. These theories are now fundamentally challenged and must be adjusted with new aesthetic rules applicable to HDTV programming.

Aesthetically speaking, the composition of visual elements within the small view offered by the ordinary home television set is much different than the composition of visual elements within a larger screen area. In addition to changes in framing and shot selection, there will be environmental changes of scenery, sets, props and the like. According to some speculators, not only will the new HDTV set be larger, but the entertainment center in the home will have to change. According to Levy (1989):

Unlike regular television, a tiny box in a room, HDTV cannot be ignored. Who can read a magazine in a movie theatre? Ultimately.. . the whole experience of watching television is going to be different. It will be a cinema experience. (p. 100)

## SUMMARY AND CONCLUSIONS

This article focuses on the major adjustments that need to be made in perceiving, comprehending, and appreciating the emerging technology of HDTV. Producers and consumers alike must be sensitive to and aware of this electronic cinematography technology. As television home viewing differs from attending a theatre or film presentation, so do the developers and producers of these two media differ in their expertise and attitudes. In this common practice, these two media are fundamentally different perceptually, cognitively, and aesthetically. The merging of film with HDTV is like asking artists to become scientists. It is possible, theoretically, but it is difficult in practice. As Blandford (1987) suggests:

Films were born from imaging and photography, It's easy to use, that is paramount. It's right side of the brain oriented. Video is a "left side of the brain" medium, its practitioners are electronics engineers and technicians. (p. 36)

Although this is an extremely provocative statement, it focuses on the

changes that need to be made and directs our attention to the challenges presented by the forthcoming massive application of HDTV technology,

It is, therefore, important that *we keep informed*, through systematic study and vigorous experimentation, on all aspects of this new technology, not only technically or scientifically, but practically and artistically as well. In developing and marketing HDTV technology, its artistic, cognitive and perceptual dimensions (aesthetic factors) should not be overlooked.

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