DOCUMENT RESUME

ED 252 899 CS 504 807

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TITLE Visual Space: Empirical Research in Television Z-Axis Staging.
PUB DATE Nc- 84
NOTE ; Paper presented at the Annual Meeting of the Sp.. ch Communication Association (70th, Chicago, IL, November 1-4, 1984).
PUB TYPE Info mation Analyses (070) -- Speeches/Conference Papers (150) -- Viewpoints (120)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Depth Perception; Media Research; Production Techniques; *Psychophysiology; Research Methodology; *Research Needs; *Technological Advancement; *Television Research; Television Viewing; Visual Aids; Visual Perception; *Visual Stimuli
IDENTIFIERS *Media Imagery

ABSTRACT

Technological advancements in television images have resulted in an increase of media imagery. One cause of people's fascination with the new media technology is the constant utilization of depth axis staging. The visual elements that make up the image are often placed within the Z-axis, moving rapidly toward or away from the viewer, often vanishing from the screen or blasting toward the viewer unexpectedly. Sometimes, entire frames fly away, flip over or retreat toward the vanishing point. The emphasis on and persistance in the use of depth composition and extraordinary special effects, coupled with the unusually fast advance and retreat of visual space, have been found to have some negative effects on viewer comprehension and understanding of visual space. The combination of rapid inward-outward movement, distorted depth of field, and forceful direction of visual elements placed on the Z-axis disturbs viewer comprehension and diminishes the aesthetic appreciation of such images. Empirical research in the composition of the depth axis in television images would aid in the study of the psychophysiological effects of these images on viewers. Since psychophysiological measuring techniques concern themselves with the covert or hidden repsonses to communication stimuli such as detection of eye movements or changes in heart rate, they would be the most suitable for the study of such new and complex media images. (HOD)

VISUAL SPACE: EMPIRICAL RESEARCH IN TELEVISION Z-AXIS STAGING

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A Paper Presented to

The SCA 1984 Annual Conference

Chicago, Illinois

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1984

Abstract

Our perception of visual space has been influenced decisively by constant exposure to digital television pictures, video game imagery and computerized graphic designs. In this study, (1) the empirical findings on the composition of such images are reviewed, (2) their potential effects on heavy users are underlined, and (3) suitable research instruments for their study are suggested. It is concluded that since new technology produces new and unanticipated perceptual effects in visual space composition which users do not easily conprehend, technologically more advanced and more suitable research instruments need to be employed for their study.

Visual Space: Empirical Research in Television Z-Axis Staging

The new visual communication media imagery such as video games digital television, and computerized pictures are capturing the attention of viewers of all ages and causing a real revolution in imagery while stressing contemporary man's ability to fully perceive and accurately recall visual information to its fullest extent. Some of the consequences of this boom in computerized video imagery are obvious, and some of their characteristics are easily identifiable. But many more remain hidden.

A noticeable cause of this revolution is the instant acceptance of visual display and images. Prior to the invention of computerized graphic designs, video game imagery and digital television effects, the length of time required to digest and comprehend visuals after perceiving them was fairly noticeable. Today heavy users of these new visual communication media can instantly read, evaluate and recall them, as can be attested by watching young people in any video arcade.

Another cause of the rapid growth of the new media imagery is the nature of their visual elements. The elements used to fill in the visual space are no longer those of everyday life in the real world. These new elements are small squares, plastic boxes, contours of the actual images. They all provide a novelty which attracts. People unquestionably accept them and easily adopt them, never challenging their aesthetic value.

An additional cause of people's fascination with the new media technology is the constant utilization of depth axis staging. The visual elements that comprize the image are often placed within the Z-axis, moving rapidly towards or away from the viewer, often vanishing from the screen or blasting towards the viewer unexpectedly. Sometimes, entire frames fly away, flip over or retreat towards the vanishing point.

This instantaneous acceptance of digital TV pictures, video game images and computerized graphic designs might not show any serious effects at a glance, but as Kuipers (22, p.27) points out, such effects do exist. They are multidimentional, and the most common ones are physical and psychological.

These unreal cartoon type images could be one of the reasons young people are being driven further and further away from the reality of the physical world (15). It might be that such images are affecting their basic understanding of the dichotomy between the visual world and the visual field, and the unique properties assigned to each of them (16, p.164).

The emphasis and persistance in the use o :pth composition and extraordinary special effects, coupled with the unusually fast advance and retreat of visual space, have been found to have some negative effects on viewer comprehension and understanding of visual space (7), the most serious of which is viewing fatigue (24, p.2).

In order to be able to isolate and examine such specific effects, the following three questions must be perused:

1. In the area of film and television composition, which research studies deal specifically with picture depth?
2. What are the specific effects which influence viewers' perception of visual space as it relates to television Z-axis staging?

3. Given that the above effects could be readily identified and controled, what are the most suitable research measuring devices for their systematic verification and study?

Visual Space: Composition on the Depth Axis

The term visual space, in this study, refers to the opening of the two dimensional surface of a regular TV screen surrounded by the borders of the TV set. It is often refered to as "the concentrated living space, a new field of aesthetic expression" (40, p.100). It is the field in which constructors of visual images compose pictures by controling the various forces generated by visual elements operating within its borders (30, p.206). Due to its small size and its condensed visual field, television picture constructors have tried to gain in depth that which they lose in horizontal framing. The small vista of the TV screen necessitates the practice of favoring the placement of visual elements on the depth axis rather than the horizontal one. This is known as the television Z-axis staging technique (40, p.175).

Numerous scientific studies dealing with the placement of visual elements within the depth axis for maximum utilization of visual space are found in such fields as painting, photography and film. A classic review and discussion on the depth variable in motionless visual space is given by Arnheim in his book Art and Visual Perception (1). In film, the most prominent of such studies are Deregowski's examination of depth cues and pictorial perception of people from different countries (8, 9), and Evans and Seddon's investigation of the perception depth cues among Nigerian students (13).

Empirical research examining the potential perceptual and physiological effects of the Z-axis staging technique in television are non-existent. Research studies that would varify the Z-axis staging theory and underline its advantages and limitations are limited. Various constructs which identify the theory have been underlined by Millerson (33), Zettl (40), Malik (27), Dondis (10) and others.

A major construct of TV Z-axis staging is movement towards or away from the foreground of the visual space. Millerson discusses this construct in terms of viewer interest in movement of the camera and contends that:

> Movement towards the camera being more striking than movement away from it, we find that any forward gesture or movement is more powerful than a recessive action (e.g. a glance, a turned head, a pointed hand). A shot approaching a subject arouses greater interest than one withdrawing from it... (32, p.290)

Zettl asserts that motion along the Z-xis can be one of the most powerful indicators of depth in the two dimensional field of the TV screen (40, p.192). He recognizes the visual impact generated by the combined motions of the camera moving towards or away from the foreground, zooming in or zooming out, and movement of the object or subject (40, p.194). Anticipating users abusement of such a technique, Zettl warned us that if the zoom-in and zoom-out on the Z-axix is fast enough, it gives the impression that the objects or people either crash through the screen, right towards the viewer, or crash into something beyond the horizon away from the viewer (38, p.194).

Malik recognizes three types of movements within the video image which he calls "movement of the electron beam," "movement of the camera," and "inner movement" (27, p.11). He emphasizes that abusement and mishandling of any such movements while on the Z-axis will have negative effects on the viewer and warns us that "if several domains within the picture are moved simultaneously, the possibility of information delivery diminishes arithmetically" (27, p.11).

Another major construct of TV Z-axis staging is the depth of field, which increases or decreases with the use of the wide or narrow angle lense or the telephoto or normal zoom lense. Recognizing the flexibilty offered by the manipulation of the depth of field in television composition, Millerson states that "deep-focus techniques may help to achieve an illusion of spaciousness and depth, when scenic planes stretch from foreground into the distance" (33, p.225).

Zettl, in discussing the depth characteristics of lenses as they relate to the depth of field in television pictures, explains that such depth cues as "overlapping planes," "relative size," "height in plane," "linear perspective" and "aerial perspective" shrink space and make objects appear closer together than they really are when they are paired with the wide angle lense, and create a "forced perspective" when paired with the narrow angle lense (40, p.190)

A third construct of the television Z-axis staging theory is direction within the visual space created by objects and people placed in succeding lines, one after another, or by vectors leading the viewer's eyes towards the center of the screen, or by people and objects moving towards or away from the foreground. Zettl discusses this variable in television composition in terms of blocking on the Z-axis vector which is defined as the visual line (action line) created by the placement or blocking of objects and people on the vertical plane within the X and Y axis (40, p.214). Although Zettl has stressed the power exerted by such direction indicators when blocking on the Z-axis, empirical research which precisely measures and verifies its power and effectiveness is non-existent.

In fact, none of the constructs or variables mentioned above have been empirically verified. It is speculated that the delay in dealing with these variables could be detrimental to the study of television composition, and the development of the field of television aesthetics.

Visual Space: Psychophysiological Effects of the New Imagery

The imagery explosion, created by the new technology in visual communication media, has had its effects on multiple levels (psychological, physiological, neurological, sociological, etc.), and has generated a plethora of literary sources on their impact upon users of these media. Herein, the psychophysiological effects that these media exert on heavy users will be underlined insofar as they relate to the constructs of "movement," "depth of field," and "direction" in the theory of television Z-axis staging.

Rapid Inward-Outward Movement

Perceptual psychologists have pointed out that rapid inward and outward movement of visual elements in the visual field decrease the viewer's ability to receive, process and recall detailed information (32). The span of time required to make a judgement about the structure of the perceived visual image is analogous to the speed at which such images move in and out of the visual space.

The problems pertinent to the perception of motion and the limitations imposed by our eidetic apparatus have been examined by such psychologists as Spigel (36), who underlines the overall problems of visually perceived movments, Kolers (21), who discusses the differences between real and apparent visual movements, Mackworth and Kaplan (25), who examine visual acuity when the eyes are perceiving moving targets, Treisman (38), who has studied the elements producing visual attention in the confined visual space, Averbach (2), who has measured the span of apprehension as a function of exposure duration, and others. What these and similar studies confirm is that, neurophysiologically speaking, man's ability to receive (see), process (recognize) and recall (remember) visual information in motion is limited. Furthermore viewers' ability to instantaneously perceive and comprehend images moving rapidly towards or away from the forground of the visual space depends greatly on several external and internal parameters which must be correlated and controled. Externally, the shapes, sizes and structures of objects in the environment must be perceived, and internally, the total synthesis of such images must be comprehended.

An unusually accelerated motion of images placed within the Z-axis line is perceived as unnatural and unbalancing, contrasting the viewer's apprehension against his/her appreciation of the synthesis of the images. Let us consider, for example, what happens during an airplane chase as presented by video game imagery when placed along the Z-axis line. A barrage of planes (levels on which the various reference points of the field are placed) and various objects surrounding these planes move rapidly towards of away from the viewer, leaving no noticeable trace as to their structures, shapes, sizes, colors, or synthesis. These structures, moving so rapidly, do not produce any perceptual excitement and/or aesthetic feeling other then the anticipated immediate collision and explosion. Persistent viewers of these images and actions do not have the chance (due to the split-second span of time required between perception and cognition) to comprehend the messages, let alone to appreciate them. This causes "perceptual and emotional numbing" (11, p.52) in heavy users of video games and viewers of constant special effects in television images.

Distorted Depth of Field

Painters, photographers and filmmakers have always recognized the need to create the illusion of depth in the visual space. They have employed such techniques as "overlapping planes," "relative size," "hight in plane," "linear perspective," "aerial perspective" (40), "tonal manipulation of the light and shade of pictures" (10), etc. Filmmakers and photographers were also able to make use of different lenses to create depth such as (a) the wide angle lenses to produce a long, narrow depth of field, (b) the field, (b) the narrow angle lense to produce a short, wide depth of field, and (c) the normal lense. The invention of the moving camer gradually changed these fixed focal length lenses into zoom and telephoto lenses which have the capacity to enormously exaggerate or diminish the depth of field. Without doubt, the limitations posed by the fixed focal length lenses of the past have been greatly eliminated by this new technology. However, the abuse of such technology has caused considerable concern among constructors of visual images.

Some theorists have warned us that distorted depth of field caused by the combined application of depth cues and extreme variance in focal length produces forced and unnatural perspective (40, p.190) It shrinks space, or, as Dontis puts it, collapses "space like an accordion" (10, p.61). The technology has ignored and overlooked subtle principles of visual perception and neurophysiological limitations. The depth of field in a picture is the reference point, the establishing shot, the home base, which viewers use to observe, to perceive and to comprehend representations of the real world. When such fields rapidly and unexpectedly shrink or expand, shifting the convergence in depth perspective and destablizing the observer's point of view, a considerable break-down in the viewer's ability to distinguish optical reality from perceptual reality is caused (21).

Forceful Direction of Z-axis Vectors

Visual researchers have underlined the visual strength, power and dynamism exerted by directional lines found in the Z-axis vectors

(40,10,37,2). The dangers, along with the particular psychophysiological effects of directional lines caused by blocking in the Z-axis vectors were underlined and studied by Gregory (17), who pointed out the distortion of visual space caused by inapproppriate constancy scaling, Beck (4), who examined the changes in shape and orientation when elements are in vertical axis, and Mackworth (25), who found that eccessive and complex visual stimulus on the Z-axis line produces a visible noise known as "tunnel vision".

When television images represent the real world on the vertical axis of the visual field, they enhance the perception of depth because of the forced directional lines which are created by the blocking of visual elements. One such effect is known to perceptual psychologists as "convergence error" (29, p.81), a principle which states that the directional lines in the depth axis cause image distortion and viewer discomfort. To correct such effects, McKim suggest that:

> A rule of thumb for the freehand visualizer is that vanishing points for small objects should be located far apart relative to the size of the image, and vanishing points for large objects (such as buildings) should be located relatively close together (29, p.82).

Another effect caused by strong directional lines and forceful vectors is referred to as a "reinforced or focusing perspective" (1, p.284). Strong directional indicators on the Z-axis vector forces our visual attention on certain objects at the expense of other objects in the field which remain totally unnoticeable. Recognizing how powerful such a force is as a means of representation and expression, Arnheim warns that "focusing produces a powerful dynamic effect. Since the distortions of the receding shapes are compensated only in part, all objects appear compressed in the third dimension" (1, p.284)

When we consider the psychophysiological effects caused by rapid inward and outward movement, distorted depth of field, and forceful directional lines, and add them all together, one on top of the other, we can understand the degree to which these effects influence heavy viewers and persistent users. The new special effects in visual imagery may be creating what Aynsley describes as "a cinematic alchemy that is stunning and memorable" (3, p.6), but they are often in direct contrast with the basic laws of visual perception and picture composition, overstretching man's ability to comprehend and appreciate them (24).

Visual Space: Research Instruments

The necessity to apply more progressive, diverse and precise measuring devices to communication media research topics, has been the concern of several communication media research scholars such as Behnke (5), Siebert (35), Fletcher (14), Malik (28), etc. The most appropriate measuring devices for the study of visual images have been found to be the psychophysiological measuring instruments developed in the fields of neurophysiology and psychology (both visual and experimental).

In this section, the major and most commonly used psychophysiological research instruments will be briefly discussed in connection with their application to the depth axis variables in visual images.

Psychophysiological measuring techniques concern themselves with the covert or hidden responses to communication stimuli such as detection of eye movements and dilation of the pupils, increase in brain activity, changes in heart rate, variations in skin resistance and, changes in pulse. pressure and frequency, etc. These covert responses are accompanied by measurable sensoric reactions or release of energy which are considered indications in level of activation, or state of arousal of the individual. The ultimate purpose of communication media research that utilizes psychophysiological instruments is "to correlate physiological activation levels with various types of behavioral measures" (5, p.431).

The various sensoric reactions and energy changes due to information stimulation can be detected, analyzed, quantified and interpreted by accurate psychophysiological research instruments, all of which operate under a commonly shared measuring system. The psychophysiological devices that measure visual and auditory perception stimuli belong in the category of sensoric reactors. The most commonly used such instruments are:

1. <u>Depth, Size, Motion Apparatus</u>

   These are instruments which measure various depth effects or phenomena, sizes of visual stimuli (23) and numerous illusions of moving or stationary objects (34).

2. <u>Auditory Processors; Audiometers</u>

   These auditory perception measuring devices provide an accurate graphic display of informational input in upper and lower threshholds of frequency and intensity (23).

3. Tachistoscopes

These visual and eidetic devices measure high-speed visual projections of words, forms and pictures which can also be seen in parts (19) (left visual field or left eye and right visual field or right eye).

4. Eye Movement, Eye Dilation, Recording and Monitoring Devices

These are of two types: devices and methods that monitor the various "saccadic" and other eye movements, and those devices and methods that measure the dilation of the eye's pupil. The specific devices used, and the particular methods of measuring the eye movements, are dicussed by L.R. Young and D. Sheena (39). The most common eye movement measuring instruments are the Differential Reflection Reading Measuring Device and the Eye-Track. The more up-to-date devices used for monitoring pupil dilation are the Monocular and Binocular TV Pupilometer Systems (20, 18).

Psychophysiological instruments measuring energy changes of the body (due to informational stiumlation) are divided into five major areas, each of which have generated several devices.

1. Physiological Instruments that Detect and Record Electrical Activity of the Brain

The most frequently used instruments are the EEG (Electro-Encephalograph) and the BWA (Brain Wave Analyzer). While the EEG detects and measures the various "patterns" and "amount" of brain wave activity of a subject during varied states of stimulation, the BWA detects and identifies the neural efficiency of the subject in terms of learning capacity and learning disability (12).

2. Physiological Instruments that Detect and Record Skin Resistance or Response

The GSR (Galvanic Skin Resistance) and the GSP (Galvanic Skin Potential) are the most often used devices in this area. Both are indices of activation level changes in the subject's exosomatic (external) resistance of the skin (GSR), or endosomatic (internal) resistance of the skin (GSP). Among the communication media related variables detected and recorded by GSR and GSP psychophysiological instruments are: alertness, efficiency, difficulty, information gain, group interaction, emotional impact of words or sounds, etc. (5, p.437).

3. Physiological Instruments that Detect and Record Heart Beat Rate

These are instruments that provide registers of activation level in the human circulartory system. The most commonly used heart beat rate devices are the EKG (Electrocardiograph) which records the electrical activity of the heart muscle, the Sphymograph, which records the arterial pulse contraction (systolic and diastolic) (5, p.442) and the Stythograph, which detects and measures heart rate, and consists of an ultra-sensitive microphone, and electrical amplifier, and a counter (5, 23). Studies which detect heart beat rates and which record reactions to specific communication media stimuli, always correlate the findings of these devices with other such psychophysiological instruments.

4. Physiological Instruments that Detect and Record Changes in Muscle Tension

Although there are numerous advanced models in existence today, the most frequently used apparatus that detects and measures electrical energy generated by a subject's muscle contraction, is the EMG (Electromyograph). Whether surface or intramuscular electrodes are used in communication research tests, the high and low amplitude muscle contraction is recorded in relation to the stressful or calm periods of the subject. In media-related studies, the findings of muscle tension indicators should be correlated with other such psychophysiological indicators for maximum validity and reliability (5, 23).

5. Physiological Instruments that Detect and Record Changes in Volume in Various Parts of the Body

These instruments are also indices of the levels of activation in the circulatory system, and specifically, the automatic nervous system. The devices that detect and record changes in volume in various parts of the body, are collectively called Plethysmographs (PG), from the Greek word "plethos" meaning a great number or enlargement. The commonly used plethysmographs are the Electrical Impedance Plethysmograph (EIPG), the Rheoplethysmograph (RPG), the Girth Plethysmongraph (GPG), and the Photo Plethysmograph (PPG) (6). Several communication media oriented variables which have been detected and studied by such plethysmographic instruments and which can be found in the literature of visual communication media are volume intensity, sound appreciation, and quality of performance in verbal tasks. But the variables of motion, depth of field, and direction in TV Z-axis staging have not been studied with these devices at all (31).

A number of serious restrictions are imposed on researchers using biometric instruments to measure media-related variables. The signal-to-noise ratio imposed by the instruments themselves is one such restriction. The need to correlate the findings (or graphic output) of one device with the recordings of one or more other devices on the same variable is another restriction. A third restriction is the tendency of the recorder to overgeneralize on the basis of intricate readings of complex body mechanisms. Fourth, there is the need to perfectly match the initial levels of each subject's biological and physiological activities with those performed during the experimentation period. Finally, there is the need to understand the sensoric, thermal, chemical, and electrical changes of the human body as they relate to both the instrument that records these changes and the conditions under which such recordings occur. However, as Behkne suggests, we should not overlook the application of biometric instruments in communication media research simply because they impose "serious problems and difficulties" (5, p.447).

The apparent and hidden psychophysiological effects of the new imagery will only be measured decisively when we begin utilizing these advanced and most appropriate research instruments and scientific measuring techniques.

Summary and Conclusions

It has been observed that technological advancements in television images have resulted in an increase of media imagery. It has also been speculated that viewer exposure to these images has increased. It was hypothesized that such developments were bound to have numerous psychopysiological effects on heavy viewers and users of such media.

In this paper it was argued that: 1. Empirical research in the composition of the depth axis in television images would be the most appropriate route to follow for the examination of the psychophysiological effects of these images on heavy viewers. 2. Examination of such effects should be centered on the three constructs of the theory of Z-axis staging: motion, depth of field, and direction. 3. The scientific study of the psychophysiological effects caused by heavy usage of new media imagery should be based on advanced and appropriate psychophysiological devices.

It is concluded that:

1. Empirical research on TV Z-axis staging which would aid in the study of the psychophysiological effects of new media imagery is conspicuously lacking.
2. The combination of rapid inward-outward movement, distorted depth of field, and forceful direction of visual elements placed on the Z-axis disturbs viewer comprehension and diminishes the aesthetic appreciation of such images.
3. The psychophysiological instruments developed in the fields of psychology and neurophysiology are the most advanced and suitable tools for the study of such new and complex media images.

Empirical research on the suggested factors underlined in this study are warranted if we wish to achieve a better understanding of the visual communication media.

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