Telepresence via Television:
Two Dimensions of Telepresence May Have Different Connections to Memory and Persuasion. [1]

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Abstract

To be truly useful for media theory, the concept of presence should be applicable to all forms of virtual environments including those of traditional media like television and traditional content such as advertising. This study reports the results of an experiment on the effects of the visual angle of the display (sensory saturation) and room illumination (sensory suppression) on the sensation of telepresence during normal television viewing. A self-report measure of presence yielded two factors. Using [Gerrig's (1993)] terminology for the sense of being transported to a mediated environments, we labeled the two factors "arrival," for the feeling of being there in the virtual environment, and "departure," for the feeling of not being there in the in physical environment. It appears that being in the virtual environment is not equivalent to not being in the physical environment. A path analysis found that these two factors have very different relationships to viewer memory for the experience and for attitude change (i.e., buying intention and confidence in product decision). We theorize that the departure factor may be measuring the feeling that the medium has disappeared and may constitute a deeper absorption into the virtual environment. The study did not find evidence that visual angle and room illumination affected the sensation of telepresence.

Introduction

The term telepresence has been used to describe the compelling sense of being present in a mediated virtual environment [(Held & Durlach, 1992; Steuer, 1995)]. The concept of telepresence is becoming an important component in our understanding of how people experience television, virtual reality, and other mediated environments [(Biocca, forthcoming; Lombard & Ditton, 1997, this issue; Steuer, 1995)]. But understanding the psychological experience of telepresence has been especially central to the design of advanced virtual environments such as immersive virtual reality and augmented reality systems [(Biocca & Delaney, 1995; Biocca, 1997, this issue)]. Researchers, especially those working on human performance in virtual reality, have noted that there is a need to conceptualize and measure telepresence more effectively [(e.g., Biocca & Delaney, 1995; Held & Durlach, 1992; Sheridan, 1992)].
As research on telepresence is expanded to different media and different contexts, a number of key research questions are emerging. The experiment reported below attempts to address some of these questions, especially the following:

**Is Telepresence Related to Any Other Cognitive Correlates or Outcomes, Specifically Memory and Persuasion?**

While the study of telepresence can be pursued as end in itself, most researchers believe that the experience of telepresence should be correlated with or may be a causal factor of human information processing performance ([Biocca, 1997]). [Lombard & Ditton (1997, this issue)] review studies that have explored the relationship between telepresence and other cognitive variables. One of the traditional interests in media studies is the relationship between exposure to media content and memory and persuasion ([Eagly & Chaiken, 1993]). This study explores the concept of telepresence and examines whether the experience of telepresence is correlated with differences in memory or persuasion.

**Is Presence a Unidimensional Construct?**

Telepresence implies a state of presence in a remote environment. If we turn to the Webster's dictionary, we find that *presence* is defined as "the fact or condition of being present" and defines the adjective *present* as "being at the specified or understood place" ([*Webster's New World College Dictionary*, 1996]). The integration of the two definitions seems to provide a more specific definition of presence: *the fact or condition of being at the specified or understood place*. When the subject is a human and the definition is psychological as opposed to ontological, presence is defined as *a person's perception of being at a specified or understood place*. Because presence is fundamental property of consciousness ([Loomis, 1992]), it is unlikely to be unidimensional. Telepresence, a facet of presence, is also likely to have more than one dimension.

**What Insight Might the Concept of Telepresence Provide for User Interactions with Traditional Media and Media Content?**

Most studies of telepresence have been conducted with advanced media interfaces such as virtual reality ([e.g., Slater *et al.*, 1994]). But some theorists argue that the pursuit of telepresence has been part of the evolution of all media ([Biocca, Kim & Levy, 1995]), and that a theory of telepresence should apply to all mediated environments ([Biocca, forthcoming; Lombard & Ditton, 1997; Steuer, 1995]).

A number of studies have explored telepresence, or concepts similar to telepresence in media other than virtual reality. Telepresence has been demonstrated in media that have very low levels of sensory engagement such as novels. For example, ([Gerrig, 1993]) reports on research on feelings of "transportedness" when using media with low sensory bandwidth like novels. There has been interest in how television, especially large screen television systems, has an effect on some of the cognitive correlates of telepresence ([e.g., Detenber, 1994; Lombard, 1995; Lombard, Bolmarcich-Ditton, Grabe, & Reich, 1994, Lombard, Grabe, Reich, Campanella, & Ditton, 1995, Lombard, Reich, Grabe, Campanella, & Ditton, 1995, Reeves, Detenber, & Steuer, 1993; Reeves, Lombard, and Melwani, 1992]). Some of the studies of projection screen television failed to measure the sensation of telepresence adequately, preferring to concentrate on some of the correlates of telepresence such as memory and attention. In this study we wanted to examine the generalizability of the concept of telepresence. We decided to explore the experience of telepresence with standard television systems and with a common genre of television, the humble advertisement.
Defining Presence and Telepresence

Although users of virtual reality systems who have experienced telepresence know "how it feels" [(e.g., Rheingold, 1991)], the concept of telepresence can be defined and measured in a number of ways.

The Idea of Telepresence as Transportation:
Departure, Arrival, and Return from a Mediated Place or Space

The users of today's mass media, such as books, newspapers, magazine, and television can feel present in the remote or artificial environment created by the mediated information. According to [(Gerrig, 1993)], a reader of a book can be phenomenally transported to the narrative environment created by the medium. Specifically, Gerrig's theory of "being transported" includes the following propositions:

1. Someone ("the traveler") is transported
2. by some means of transportation
3. as a result of performing certain actions.
4. The traveler goes some distance from his or her environment of origin
5. that makes some aspects of the environment of origin inaccessible.
6. The traveler returns to the environment of origin, somewhat changed by the journey. (pp. 10-11)

With little doubt, Gerrig's concept of "being transported" seems equivalent to that of "being there," a handy name for telepresence used by some human-computer interaction researchers [(e.g., Heeter, 1992, 1995; Reeves, Detenber, & Steuer, 1993)]. The rationale of "being transported" is that a reader is phenomenally transferred to a mediated environment, resulting from low accessibility to the unmediated information and high accessibility to the mediated information. The concept of telepresence describes the same psychological phenomenon.

[(Gerrig, 1993)] also argues that the sense of being transported to a mediated environment, or telepresence, is a moment-by-moment feeling. This indicates that, at a given time, the sense of presence is limited to one environment and the sense of presence in the mediated environment, or telepresence, cannot be mixed with the sense of presence in the unmediated environment. This indivisible sense of presence does not allow such concepts as auditory presence or visual presence, though such modality-based classification is possible in the cases of attention, perception, and awareness.

Where is the Person Present?
The Physical Space, the Mediated Space or the Imaginal Space

We hypothesize that the sensation of presence is unstable and oscillates around three senses of place. From moment-to-moment the user may feel present in the physical environment, the virtual environment, or the imaginal environment (i.e., the space of daydreams, dreams, and hallucinations).
Clearly the sense of presence was not created just for use with virtual environments. Rather, as [Loomis (1992)] points out, presence is a basic state of consciousness, the attribution of sensation to some distal stimulus, or more broadly to some environment. The senses and the brain are the recipient of a continuum of sensations, patterns of energy directly impinging on the senses. In perceptual psychology this is known as the proximal stimulus. Some of this continuum of sensation is separated into the set of sensations emanating from inside the body, the self, and those emanating from "outside" the body, the non-self. The non-self is the environment we perceive around us [(See Loomis, 1992)]. In modern technological environments what we perceive "around us" may be the physical environment or it may come from a display like a television screen that mimics through colored dots on a screen the pattern of lights from another environment, for example, the virtual environment represented on a television or computer screen. As individuals experience sensations coming from the physical environment or the virtual environment, their sense of presence, or being there, may oscillate moment-to-moment between these two senses of place, or they may withdraw their attention to these stimuli and retreat into the imagination. Therefore, at any moment users might feel "present" in one of three places:

**Presence in a Physical Environment (Distal Immediate)**

The default sense of "being there" is the basic state of consciousness in which the user attributes the source of the sensation to the physical environment. We have been present in this environment for so long and it is so natural that the idea that presence might be a psychological construct is usually only raised by philosophers and perceptual psychologists.

**Presence in a Virtual Environment (Distal Mediated)**

Virtual environments are those environments artificially constructed in any communication medium. When the incoming information from the unmediated physical space is technologically or attentionally diminished or suppressed, and the media interface allows the mind to focus on information coming from the virtual environment, a person may experience telepresence. Otherwise called "virtual presence" [(Barfield & Weghorst, 1993; Sheridan, 1992)], telepresence is a subjective sensation of being present in a remote or artificial environment but not in the surrounding physical environment [(Held & Durlach, 1992; Sheridan, 1992; Steuer, 1995)].

**Presence in an Imaginal Environment (Reduced Attention to Distal Stimuli)**

Dreaming and daydreaming reveal that there is another place we can be present, an environment dominated by internally generated mental imagery. In dreams, and to a lesser degree in hallucinations and daydreaming, it is apparent that the mind is capable of producing very compelling spatial environments. Even though all of the "sensations" are manufactured by the mind, part of these sensations are experienced as "me" and the rest are experiences as "not me": environments with places, people, and things. But these imaginal environments do not rely on stimuli impinging the senses and, therefore are not directly influenced by media.

**Exploring the Causes and Correlates of Telepresence**
TELEPRESENCE VIA TELEVISION: by Kim and Biocca

Figure 1: Telepresence involves competition of stimuli from the physical environment and the virtual environment for cognitive accessibility. The experience of telepresence is influenced by the mix of stimuli from the physical and virtual environments and by the user traits and states.

A Proposed Model of Telepresence

As suggested by some human-computer interaction researchers [(e.g., Biocca, forthcoming; Biocca & Delaney, 1995; Held & Durlach, 1992)], a key determinant of telepresence in the mediated environment is the user's sensory immersion into the mediated information. This is also consistent with the proposition that a user's degree of immersion into the mediated environment is determined by the balance of the unmediated information and the mediated information in terms of accessibility [(Gerrig, 1993)].

Figure 1 represents a general model for approaching studies on telepresence. [Lombard and Ditton (1997)] review a number of studies on telepresence suggesting variables that either cause telepresence or are cognitive correlates of telepresence. Many telepresence studies appear to be using some version of the model in Figure 1. In general it is hypothesized that there is a competition between stimuli from the physical environment and the virtual environment for cognitive accessibility. The experience of telepresence is influenced by the mix of stimuli from the physical and virtual environments and by user traits and states.

Sensory Engagement

[Biocca (1995)] suggests that presence may be influenced by the degree to which user's sensory bandwidth is engaged by the interface. For each sensory channel, stimuli from the physical environment compete with stimuli from the virtual environment for focal consciousness of the individual. One element that may determine where a user feels present is the relative amount of information coming from the physical environment versus the virtual environment. [Biocca (1997)] defines this as sensory saturation or "the percentage of the sensory channel occupied by stimuli (information) from the virtual as opposed to the physical environment." In the visual channel, sensory saturation is often manipulated by increasing the percentage of the field-of-view occupied by the visual display, be it a head-mounted display or video screen.
In this study, sensory saturation was manipulated in the visual channel using television sets of different screen sizes.

Experiencing telepresence may become easier when information from the unmediated physical environment is suppressed or diminished in its ability to reach the sensory processing stage of information processing. (The incoming information is considered to have reached the sensory stage of human information processing as it makes an impact on human sensory receptors such as eyes and ears. When the information is successfully delivered to the person's brain through the nervous system, it is considered to have reached the perception stage of human information processing.) For the visual channel, suppression of the physical environment can be accomplished in many ways. In this study, it was achieved by dramatically diminishing the ambient light in the room that contained many other elements (plants, VCR, bookshelf, picture frames, etc.) than the television set.

![Physical Environment Diagram](image)

**Figure 2:** Model of Effects of Television Viewing Angle and Unmediated Visual Stimuli on Telepresence and Cognitive Representation of an Advertising Message

The instantiation and specification of the general model tested in this study is represented in Figure 2. In the present study the effects of two visual immersion factors, 1) presence of unmediated visual stimuli and 2) viewing angle were examined. Unmediated visual stimuli are stimuli originating in the physical environment. Therefore, suppressing the unmediated visual stimuli (by extinguishing the room lights) should make the immersion level significantly higher than leaving the unmediated information active, and therefore the probability of experiencing telepresence should be increased as well. Visual angle is one variable influencing the amount of visual stimuli coming from the virtual environment. A larger...
viewing angle means a greater portion of the viewer's visual field occupied by the television screen. A larger viewing angle might be created by a larger television screen or by a change to a viewing position closer to the television screen. When the viewing angle of the television screen is larger, the viewer has less visual access to the outer background, or unmediated visual stimuli. As the accessibility to the unmediated visual stimuli decreases as viewing angle increases, a larger viewing angle is expected to improve the viewers' likelihood of experiencing telepresence.

**Effect of Telepresence on Memory**

We theorize, following [(Gerrig, 1993)], that information in a mediated environment has to be more accessible when a television viewer feels present in the mediated virtual environment than when he/she feels present in the unmediated physical environment. Therefore, as the time that the viewer feels present in the mediated environment increases, the amount of information about the mediated environment processed by the viewer is also expected to increase. This suggests that telepresence and memory should be positively correlated.

There is some evidence that telepresence should increase memory for product-relevant information. This is supported by a study by [Wu and Shaffer (1987)] who found that direct experience generated more cognitive elaboration of the central arguments. Telepresence, defined as the feeling of being a part of the phenomenal environment created by a medium, implies that the user of the medium considers the items in the mediated environment as unmediated and reacts directly to the items as if they are physically present objects. In other words, a user of a medium who feels present in the mediated environment will consider his/her experience in the mediated environment as first-hand, or direct [(Lombard, 1995; Lombard, Bolmarcich-Ditton, Grabe, & Reich, 1994, Lombard, Grabe, Reich, Campanella, & Ditton, 1995, Lombard, Reich, Grabe, Campanella, & Ditton, 1995)]. Then, telepresence, or simulated direct experience, should have the same effect that direct experience has -- more cognitive elaboration of the central arguments. Because cognitive elaboration is associated with memory, this suggests that telepresence should have a positive effect on memory of central arguments embedded in the mediated information.

**Effect of Telepresence on Persuasion**

It has long been believed that the vividness with which a message communicates interaction might increase its persuasive power, but the empirical evidence is not clear [(Taylor & Thompson, 1982)]. The rationale supporting the effects on persuasion of telepresence can be derived from studies of how direct experience influences persuasion [(e.g., Croft et. al., 1969; Fazio & Zanna, 1978a, 1978b; Wu & Shaffer, 1987)]. These studies found that direct, first-hand experience of participating in psychological experiments, solving puzzles, tasting peanut butter, or simply sitting before a live communicator gives a person an opportunity to infer an attitude from the experience. Thus he/she is able to hold that attitude with greater confidence. When a user experiences telepresence, it is assumed that he/she is more likely to consider his/her experience in the mediated environment as first-hand, or direct. Therefore, as with direct experience, the sense of telepresence is expected to have a positive effect on attitude confidence.

**Method**

The study used a between subjects experimental design. Two independent variables, "(presence of) unmediated visual stimuli" and "viewing angle," were manipulated. The variable "unmediated visual stimuli" has two levels, "active" and "suppressed." The variable, viewing angle had three levels, "low," "medium," and "high" (9.8 degrees, 21.5 degrees, and 33.7 degrees, respectively). The combination of these two variables created six different viewing conditions. The dependent variables were memory, confidence in brand preference, and buying intention.

**Subjects**
A total of 96 subjects participated in the experiment. Subjects were stratified by gender and randomly assigned to six experimental conditions. Each condition had eleven female subjects and five male subjects. All of the subjects were students enrolled in journalism or mass communication courses who took part in the experiment for extra credit in one of their courses.

Materials

Stimulus Materials

A version of the infomercial for Health Rider (fitness equipment) was taped from a cable service in 1996. The use of an infomercial, instead of a 30-second advertisement, was to provide the subjects sufficient time to develop a sense of telepresence and to assure the reliability of the memory measure. (The number of memory test items that can be extracted from a 30-second advertisement is limited.) The young subjects participating in the present study were expected to be interested in physical fitness and associated equipment.

The Display Television Sets

The three viewing angle levels selected were 9.8 degrees, 21.5 degrees, and 33.7 degrees. Screen sizes of television sets were manipulated, while the viewing distance remained constant at 4.4 feet (or, 52.8 inches). In order to create the desired viewing angles, three televisions with the screen sizes of 9 inches, 20 inches, or 32 inches were used. The method of viewing angle calculations was same as in the study by [Lombard (1995)]. The formula was used in defining the viewing conditions in the present study and recalculating the viewing angles of the past studies. This makes the results of the past studies and those of the proposed studies comparable with each other. The formula is presented in [Appendix 1]. The use of ordinary, direct-view CRT televisions, instead of projection televisions used in most past studies [(e.g., Detenber, 1994; Lombard, 1995; Lombard, Bolmarcich-Ditton, Grabe, & Reich, 1994; Reeves, Detenber, and Steuer, 1993; Reeves, Lombard, and Melwani, 1992)], was to minimize the effect of room illumination manipulation on the perceived vividness of the pictures. (The perceived vividness of the pictures on the projection television decreases as the room becomes brighter.) The picture resolutions of the three televisions were above the level of the transmitted signal. The two smaller television screens (9 inch and 20 inch) were lifted to the proper heights so that the centers of the three television screens were placed at the same height as the subjects' eyes. Black non-glossy paper was used to cover the wooden blocks used to raise the two smaller televisions. Other apparatus include a computer (for the computer-guided post-stimulus-presentation interview), a stereo hi-fi VCR, a wireless headphone, a comfortable chair, and some decorative items placed behind and beside the television set (e.g., plants, picture frames, etc.; for simulation of a typical television viewing setting).

A Self-report Measure of Telepresence in Television Viewing Settings

In the context of television viewing, telepresence is defined as a television viewer's feeling of being present in the mediated environment created by the auditory-visual information emitted from the television, and at the same time, not being present in the environment physically surrounding the viewer. The ideal questions determine the probability of a television viewer's experiencing telepresence and, if telepresence occurs successfully, what communication effects it generates. In order for these questions to be answered in an empirical study, the concept of telepresence must be quantified in a reliable and valid manner. In fact, [Barfield and Weghorst (1993)] suggest various measures of telepresence including (1) subjective assessment; (2) physiometric indicators; (3) virtual world task performance; (4) natural world task performance; (5) frame of reference conflict resolution; (6) context reorientation time / degree of disorientation. Because the other techniques are considered inappropriate and because telepresence is defined as a subjective judgment of a psychological experience, self-report measures have been commonly used in the few empirical studies of telepresence conducted so far [(e.g., Barfield & Weghorst, 1993; Reeves, Detenber, & Steuer, 1993; Slater, Usoh, & Steed, 1994)].
Based on the definition of telepresence and several self-reporting measures of telepresence used in past studies [(Barfield & Weghorst, 1993; Slater, Usoh, & Steed, 1994)], a scale of self-reported telepresence was created for the television viewing situation using the following Likert scale items:

1. When the broadcast ended, I felt like I came back to the "real world" after a journey. (Strongly Disagree -- Strongly Agree)

2. The television came to me and created a new world for me, and the world suddenly disappeared when the broadcast ended. (Strongly Disagree -- Strongly Agree)

3. During the broadcast, I felt I was in the world the television created. (Never -- Always)

4. During the broadcast, I NEVER forgot that I was in the middle of an experiment. (Never -- Always; Reversed Scale)

5. During the broadcast, my body was in the room, but my mind was inside the world created by television. (Never -- Always)

6. During the broadcast, the television-generated world was more real or present for me compared to the "real world." (Never -- Always)

7. The television-generated world seemed to me only "something I saw" rather than "somewhere I visited." (Never -- Always; Reversed Scale)

8. During the broadcast, my mind was in the room, not in the world created by television. (Never -- Always; Reversed Scale)

**Factual Memory**

The variable memory is measured in two different ways to represent the memory of semantic information and the memory of episodic information. Semantic memory is defined as memory of concepts, ideas, or facts, while episodic memory is defined as memory of events [(Tulving, 1972, 1983, 1986)]. In the present study, these two facets of memory performance are quantified by a multiple-choice factual memory test and a recognition test, respectively.

The factual memory test included 25 questions regarding the information embedded in the stimulus. For each question, three answer choices were provided, and only one of them was true. Because telepresence is a concept that is beyond the dimension of sensory modality, the effects of telepresence on memory are not limited by the sensory modalities through which the information is delivered. That is, in the present study, telepresence is expected to improve both visual and auditory memory, though almost all test items in the present study are about the product claims transmitted through either the visual modality or both auditory and visual modalities.

**Recognition Memory**

A visual recognition test was also employed to measure the subjects' visual episodic memory of the information presented in the stimulus advertisement. A total of 25 picture frames edited from the stimulus advertisement were randomly mixed with another 25 distractors edited from several advertisements of competing products. The 50 picture frames were presented to the subjects during the computer-guided interview, in which the subjects' responses and their response speed were automatically recorded by the computer. The subjects were instructed to press a key marked "old," if they thought
they had seen the probe during the stimulus presentation, or "new," if they thought they had not seen the probe during the stimulus presentation.

As the subjects' visual recognition performance was expected to be fairly high (because the recognition test was administered approximately 10 minutes after the stimulus presentation), the subjects' average visual recognition speed for the "hits" ("old answers to "old" items) was used to represent the strength of recognition memory. Indeed, many past studies (e.g., Cameron, 1991; Cameron, Hanily, & Hazinski, 1991; Geiger & Reeves, 1991) have employed this measure as a representation of memory strength.

According to [Snodgrass, Levy-Berger, and Haydon (1985)], there can be two types of outliers in such reaction time data: those that are shorter than the irreducible minimum and those that are unreasonably long. The former type of outliers was called "anticipation" by the researchers, because it is considered as a result of the subject's higher readiness to give the particular answer. The irreducible minimum in reaction time is known to be between 90 milliseconds and 100 milliseconds [(Snodgrass, 1969; Woodworth, 1938)]. The second type of outliers, according to the researchers, are usually found when the subjects' attention wanders or when they momentarily forget the response manner (e.g., which key to press for their responses).

The present study used 100 milliseconds as the irreducible minimum of reaction time and 1500 milliseconds as the upper limit, based on the distribution of the response speed data. As suggested by [Snodgrass, Levy-Berger, and Haydon (1985)], the values smaller than 100 were replaced with 100 and those greater than 1500 milliseconds with 1500.

A short practice session preceded the recognition memory tests to train the subjects to be able to respond as fast as possible. A total of 12 figures (six circles randomly mixed with six other figures including squares, triangles, or crosses) were presented one by one on the computer screen and subjects were instructed to press one key if the figure was a circle or another if it was not. The two keys were those that would be used later in the recognition memory tests. The average response speed for the last four circles was used to adjust the Average Recognition Speed for the 25 main visual recognition test items. As indicated by [Basil (1994)], this was to control for the subjects' individual differences in age [(Bankhead & MacKay, 1982), intelligence (Carlson, Jensen, & Widaman, 1983; Larson & Alderton, 1990) and reflexes (Snodgrass, Levy-Berger, & Haydon, 1985)], which were found to have effects on response speed.

**Brand preference**

Before the stimulus presentation, subjects saw a demonstration of a real product, of a different brand than was shown in the stimulus infomercial. The product features of the demonstrated brand were presented in a one-page brochure created by modifying the original manufacturer's publication. After watching the stimulus (a 15-minute infomercial) and answering some urgent questions (i.e., questions measuring self-reported telepresence), the subjects were asked to make a choice between the two brands and reveal their confidence in the choice.

The ultimate goal of advertising is to persuade the potential consumers to make a favorable decision when they have to buy a product in the category. Considering this, a more practical criterion measure in the examination of the persuasion effect of telepresence should be something more closely related to the buying decision. In order to measure the buying intention of the subjects, the following question was asked:

Suppose that your friend called you last night to get your advice in his/her search for a good fitness product. He/she said his/her budget was $500. Would you recommend him/her to buy (sic) a Health Rider?

Absolutely Not 1----2----3----4----5----6----7----8----9 Absolutely
This is rather an indirect measure of buying intention as opposed to simply asking how likely the subjects are to buy the advertised product. Measuring buying intention in such a vicarious manner was considered necessary, because it might be hard to create a sufficient amount of variance in the answers particularly because the subjects were not likely to be in the market for the product at the time of their exposure to the infomercial.

Confidence in Brand Preference

Confidence in brand preference is different from (the direction of) brand preference (between the brand of which the subjects saw the actual demonstration and the brand for which they saw an advertisement) in that the former measures the intensity of a subject's attitude regardless of the direction of the attitude. Measuring the intensity, as well as the direction, of attitude is considered important in the present study because it is hypothesized that telepresence simulates a real seeing and the real seeing generates a more intense reaction to the stimulus, which can be either more positive or more negative depending on the direction of the attitude. Confidence in brand preference was measured by a 9-point Likert scale (Not Confident At All -- Very Confident).

Measures of User Traits: Need for Cognition and General Engrossment in Television

A number of measures of individual differences were collected. Two are reported here.

Need for cognition. Eight most relevant items were selected from the original 18-item "need for cognition" scale developed by [Cacioppo et al. (1984)] and used to measure the subjects' individual difference in terms of the likelihood of elaborating the presented information [See Appendix 2]. A 9-point Likert-scale (Strongly Disagree -- Strongly Agree) used for each item. A reliability test was conducted to find that all items were reliable and non-redundant (Alpha = 0.70). The factor score for the eight items was used in the analysis.

General Engrossment in Television. This was measured with a single 9-point Likert-scale item (Strongly Disagree -- Strongly Agree): "I am the kind of person who easily gets engrossed in television shows."

Procedure

The presence of unmediated visual stimuli from the physical environment was manipulated by controlling the room lights of a simulated living room, where the stimulus was presented to the subjects through a television set. Very simply the "active" condition involved turning on the ceiling lights of the room, while the "suppressed" condition involved extinguishing all room lights. No outside lights affected the manipulation because the room had no windows and a black curtain covered the door, blocking the gaps between the door and the wall.

The subjects participated in the experiment individually. The subject entered into the simulated living room and was asked to watch a live demonstration of a real product (Nordic Rider), which was a different brand from one they would later see in the infomercial (i.e., Health Rider). A brochure advocating the effectiveness of the product was provided to the subjects. Then, each subject was guided to the other side of the room (separated by a black curtain from the ceiling to the floor) and asked to sit in a comfortable chair placed 4.4 ft. in front of the television set.

After watching the stimulus, the subjects were escorted to the other side of the room past a black curtain, where a computer was prepared for a computer-guided interview. The questionnaire presented by the computer was composed of the following sections in order: (1) telepresence scale; (2) a sign for a 3-minute break; (3) 12 circle/non-circle classification tasks; (4) 25 multiple-choice factual memory test items; (4) 50 visual recognition items; (5) questions asking the subjects' brand preference between the advertised brand and the demonstrated brand, the level of confidence in the
choice, and intention to buy the advertised product; and (6) questions measuring the subjects' need for cognition and general engrossment in television.

The post-stimulus-presentation interview was administered mostly by SuperLab, a computer based interviewing software. The software can present a series of images (or words saved in a graphic format) in a scheduled order and collects the subject's responses and the time taken for the subjects to make those responses. The package commands the computer to hold all images (or test items) in the random access memory (RAM) and present them instantly in the pre-scheduled order. In so doing, the measure of time between the test item presentation (onset) and the subject's response by a keystroke can be accurately measured to within one millisecond.

Results

Once the variables were created by statistical techniques or using arithmetical calculations, the proposed path model was tested by a series of multiple regression analyses. For testing the determinants and/or the effects of confidence in brand preference and buying intention, the data of the subjects who preferred the demonstrated brand (7 out of 96 subjects) were excluded in the analyses, as the direction of their data was not comparable with that of the other subjects' data. In order to reduce the sampling error and thus improve the validity of the study, two facets of personality traits, need for cognition and general engrossment in television, were measured and used as covariates in the analyses. Specifically, general engrossment in television was used as a covariate when the dependent variable is telepresence; need for cognition was used as a covariate when the dependent variable is memory.

Factor Analysis of the Telepresence Scale

The items included in the scale of telepresence were created based on the definition of telepresence and/or adapted from several different studies and the reliability and validity of the scale as a whole should be tested before the scale is used in any statistical analyses. An exploratory factor analysis revealed that the eight items of the telepresence scale (after the scales of negative items were reversed) could be grouped into two factors. Table 1 summarizes the two factors extracted. The present study tested for the two component factors of telepresence, labeled "departure" and "arrival," in the proposed relationships that include telepresence as an independent or dependent variable.

Table 1. Items of the Self-reported Telepresence Scale and Result of Exploratory Factor Analysis

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<th>Items Included</th>
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</thead>
<tbody>
<tr>
<td>FACTOR 1: A factor score for these items was calculated and labeled &quot;arrival&quot; (Being Present in the Mediated Environment).</td>
</tr>
<tr>
<td>1. When the broadcast ended, I felt like I came back to the &quot;real world&quot; after a journey.</td>
</tr>
<tr>
<td>2. The television came to me and created a new world for me, and the world suddenly disappeared when the broadcast ended.</td>
</tr>
<tr>
<td>3. During the broadcast, I felt I was in the world the television created.</td>
</tr>
<tr>
<td>4. During the broadcast, my body was in the room, but my mind was inside the world created by television.</td>
</tr>
</tbody>
</table>
5. During the broadcast, the television-generated world was more real or present for me compared to the "real world."

**FACTOR 2:** A factor score of these items, reversed, was calculated and labeled "departure" (Not Being Present in the Unmediated Environment).

1. During the broadcast, I NEVER forgot that I was in the middle of an experiment.
2. The television-generated world seemed to me only "something I saw" rather than "somewhere I visited."
3. During the broadcast, my mind was in the room, not in the world created by television.

The factor loadings are shown below (Rotation = VARIMAX):

<table>
<thead>
<tr>
<th>Factor 1 - Item 1</th>
<th>Factor 1 - Item 2</th>
<th>Factor 1 - Item 3</th>
<th>Factor 1 - Item 4</th>
<th>Factor 1 - Item 5</th>
<th>Factor 2 - Item 1</th>
<th>Factor 2 - Item 2</th>
<th>Factor 2 - Item 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.78</td>
<td>-0.04</td>
<td>0.76</td>
<td>0.36</td>
<td>0.83</td>
<td>0.70</td>
<td>0.73</td>
<td>0.80</td>
</tr>
<tr>
<td>0.76</td>
<td></td>
<td>0.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.83</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>0.73</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0.56</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0.05</td>
<td>0.70</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.18</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>0.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

The discriminant validity test showed that the smallest internal correlation (correlation between each item and the factor score) is still greater than the largest external correlation (correlation between an item in a factor and the factor score of the other factor), indicating high discriminant validity between the two groups of items.

**Testing of the Proposed Model - A Path Analysis**

**Effect of unmediated visual stimuli and viewing angle:** The two variables proposed earlier to affect telepresence, unmediated visual stimuli and viewing angle, were found to be insignificant for either departure or arrival. These findings indicate that the interface manipulations employed in the present study failed to generate any significant effects on the subjects' likelihood of experiencing telepresence (Main Effect of the Unmediated Visual Stimuli on Departure: F = .28, Sig. of F = .60, Mean (Suppressed) = -.10, Mean (Active) = .05 / Main Effect of the Unmediated Visual Stimuli on Arrival: F = .00, Sig. of F = .95, Mean (Suppressed) = -.03, Mean (Active) = .02 / Main Effect of the Viewing Angle on Departure: F = .21, Sig. of F = .82, Mean (Low) = -.01, Mean (Medium) = .04, Mean (High) = -.11 / Main Effect of the Viewing Angle on Arrival: F = .51, Sig. of F = .60, Mean (Low) = .11, Mean (Medium) = -.19, Mean (High) = .07 / No
two-way interaction effects were significant.

**Relationship of telepresence with cognitive correlates:** A series of multiple regression analyses were conducted to test the remaining part of the proposed model (i.e., effects of departure and arrival on memory and persuasion). The results are illustrated in the path model in Figure 3.

**Figure 3: Result of Path Analysis**

![Path model diagram](image)

As represented in Figure 3, departure and arrival appear to have distinct effects on memory and the two persuasion factors (i.e., confidence in brand preference and buying intention). As for memory effects, departure, but not arrival, seems to affect memory, either factual memory or average recognition speed. The direct effects of arrival on factual memory and average recognition speed were even negative, though not significant.
As for persuasion effects, arrival was found to have a positive effect on confidence in brand preference, which has a positive effect on buying intention, while departure has a direct positive effect on buying intention. In order to compare the persuasion effects of departure and arrival, the direct and indirect effects of departure and arrival on confidence in brand preference and buying intention were calculated (in terms of β-coefficient) and summed. Table 2 is a summary of the results.

<table>
<thead>
<tr>
<th></th>
<th>Confidence in Brand Preference</th>
<th>Buying Intention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct Effect</td>
<td>Indirect Effect(s)</td>
</tr>
<tr>
<td>Departure</td>
<td>-0.17</td>
<td>0.35</td>
</tr>
<tr>
<td>Arrival</td>
<td>0.32</td>
<td>0.03</td>
</tr>
<tr>
<td>Confidence in Brand Preference</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

As shown in Table 2, the negative direct effect of departure on confidence in brand preference was overpowered by the positive indirect effect, resulting in the positive total effect. The positive direct and indirect effects of arrival on confidence in brand preference resulted in the positive total effect. As the magnitudes of the total effects show, the effect of arrival on confidence in brand preference is twice as strong as the effect of departure on the same variable.

The positive direct and indirect effects of departure on buying intention resulted in the positive total effect. The negative direct effect of arrival on buying intention was overpowered by the positive indirect effect, resulting in the positive total effect. In terms of the magnitudes of the total effects, the effect of departure on buying intention is three times as strong as the effect of arrival on the same variable.

Discussion

Effects of Visual Angle and the Suppression of Unmediated Visual Stimuli on Telepresence

It was hypothesized that the suppression of unmediated visual stimuli (i.e., sensory suppression) and the visual angle of the television set (i.e., sensory saturation) would have an effect on telepresence. However, there was no significant effect. These findings imply one of two things: 1) that the suggestion of human-computer interaction researchers that sensory immersion is determined by sensory saturation and the suppression of unmediated stimuli is not applicable to television, or 2) that the manipulation was not strong enough to obtain a measurable effect. We believe that there is some validity to both of these. Visual angle of the virtual image has had an effect on correlates of telepresence in earlier studies using television and film (see review in [Lombard & Ditton, 1997]). Also, the audiences of IMAX theaters provide plenty of anecdotal evidence supporting the belief that visual angle influences telepresence, especially when the image stimulates feelings of vection (self-motion). It is also likely that the typical range of visual angles provided by today's televisions may not saturate the visual channel enough to exercise a powerful effect on telepresence. It is important to note that this conclusion is made in the context of today's television technology. With HDTV and the recently introduced head-mounted television this may not be the case. On the other hand, it should be noted that the largest viewing angle used in this study approximates that found with head-mounted televisions and some HDTV's viewed as normal viewing distances.

There is support for the effect of visual angle (field-of-view) on telepresence when VR head-mounted displays are used (Welch et al., 1996; Hendrix & Barfield, 1996). When there is tight sensorimotor coordination and the user is free to move the head around the virtual space, the value and effect of viewing angle may be enhanced. In the passive viewing
environment of television, the relationship of viewing angle and the likelihood of experiencing telepresence may be non-linear. The effect on telepresence may be slight or non-existent for differences in viewing angle when the viewing angles are small as they are with regular television, but significant when visual angles become quite large, as they are in the an IMAX theater.

The presence or absence of competing unmediated visual stimuli also did not affect telepresence. It is possible that suppressing visual stimuli from the unmediated environment has no effect on telepresence. On the other hand, two other factors may be playing a role here. It is possible that television viewers are adept at ignoring visual distractions from a static physical environment when viewing television. The data suggest this is unlikely in this case. In an exploration of the data, we did find that the presence of unmediated visual stimuli interfered with memory for factual information. This suggests that the physical environment did compete for the attention of viewers and, therefore, lessened memory. But the suppression of competing visual stimuli from the physical environment was not enough to boost the measurable sense of telepresence.

The difference in illumination between the two sets of conditions may have created an experimental artifact. We observed that the bright television set itself, especially the larger set, radiated a great deal of light and illuminated the room to a sufficient degree to lessen the difference between the experimental and control condition.

Are There Two Dimensions to Physical Presence?

A surprise finding was that the self-report of telepresence resulted in two separate dimensions and these dimensions were related with cognitive correlates in a distinct way. This is a potentially interesting finding that would need to be replicated. We labeled these two dimensions: departure and arrival based on Gerrig’s ([1993]) notion of being transported, a concept that is very similar to the common notion of telepresence as "being there," but emphasizing the user's experience as a kind of phenomenal travel from the physical environment to the virtual environment and back. Arrival appears to be the classic sensation of at least partially "being there" in the virtual environment. On the other hand, departure appears to mean "not being" in the physical environment. The existence of the two dimensions suggests that "being there" in the virtual environment is not cognitively equivalent to "not being" in the physical environment.

How can we interpret this finding? The finding suggests, contrary to [Gerrig (1993)], that presence may not be a 100% here-or-there sensation. Two things may be going on. The user may be maintaining two separate but partial models of both the physical environment and virtual environment, so that he/she might feel present in the virtual environment, but not completely removed from the physical environment. It may also be that the user’s phenomenal sense of presence oscillates between the virtual, physical, and imaginal environments. Self-report measures taken at the end of the experience would likely find traces of the sensation of presence in both environments or some ambiguity about stating that one's phenomenal self only felt present in one or the other environment.

Relationship of Telepresence as Departure or Arrival on Memory

Arriving in the virtual environment appears to have little effect on memory, but fully departing from the physical environment appears to increase memory. As shown in the path model (see Figure 3), "departure," defined as the feeling of not being in the unmediated environment, was found to have a significant, positive effect on factual memory and visual recognition speed. An additional analysis revealed a significant, negative effect of unmediated visual stimuli on memory (especially factual memory). This indicates that the real-environment information may be just a form of noise, defined as irrelevant or unwanted information, to a television viewer. Mentally leaving the physical environment and being free of the effect of noise helps him/her obtain more factual information (both auditory and visual) from the television. When the viewer not only arrives at the virtual environment, but fully "departs" from the physical environment, the effect of the noise from the physical environment is dampened. Memory is improved.
The effects of arrival on the two memory measures were negative, though not significant. This is opposite to the finding of the direct experience study of [Wu and Shaffer (1987)]. What might explain the inconsistency? When viewers arrive at the virtual environment, they arrive as voyeurs looking at a scene. It is a form of "being there," but it is not "being" physically active. Being a spectator is different from being an actor. The direct experience in the study of Wu and Shaffer involved full sensorimotor engagement; there was actual tasting of two peanut butter brands. Telepresence in the context of non-interactive television viewing can make a viewer only a spectator who is present inside the mediated environment (unless he/she takes a full control over the mediated environment). In the study of [Wu and Shaffer (1987)], this is comparable, in terms of the directness of experience, only to being a spectator watching someone else taste the peanut butter rather than being the one who tastes it. So "being there" as a spectator is not the same as "being there" as an actor.

In summary the findings suggest that simply feeling present in the virtual environment may not be enough for strong memory of the experience. It is only when users no longer feel present or connected to the physical environment that there is a noticeable effect on memory.

**Relationship of Telepresence as Departure or Arrival on Persuasion**

Only "arrival" was found to have a positive effect on confidence in brand preference, but it did not have a direct effect on the brand chosen. This implies that arrival, defined as a feeling of being there in the mediated environment, seems to simulate a first-hand experience and generate attitude confidence (i.e., confidence in brand preference). By virtually "being there" and "experiencing the information directly," the viewers seem to become more confident in their attitudes toward the mediated information.

"Departure," not being in the physical environment, was found to have a positive effect on buying decisions, but not on confidence in brand preference. The insignificant effect of memory on buying decisions indicates that the effect of departure on buying intentions has not been caused by the amount of information transmitted (i.e., memory). Rather, the indirect effect through "arrival" seems to provide a reasonable support in explaining the effect of "departure" on buying decisions.

The total effects of "departure" and "arrival" on confidence in brand preference and buying intention were found to be all positive. This has an important practical implication. Telepresence, including both the "departure" and "arrival" dimensions, appear to be part of the mental state in which persuasion via mediated environments can be significantly improved.

**Conclusion**

The most interesting finding is evidence that there may be two dimensions to telepresence, one we have labeled arrival and the other departure. The sense of arrival appears to be close to the sense of "being there" in the virtual environment. But the sense of "being there" that we call arrival may not be equivalent to or as powerful as the sense of departure, the sense of "not being here" in the physical environment. It is possible that the experience of departure occurs when the sense of mediation disappears. By this we mean that the arrival dimension of telepresence measures the sensation of being in a virtual environment, but a virtual environment that remains inside a television set and inside a room. Users remain aware of the mediation, i.e. the television set, the means of their transportation to the virtual environment.

But the departure dimension of telepresence may be measuring the disappearance of mediation, a level of experience where the television set and the physical environment disappears from the viewer's phenomenal awareness. When experiencing the departure dimension of telepresence, viewers may be no longer be aware of the means of transportation to the virtual environment, the mediation of the television set itself. When this occurs they had better remember where they have been because they are no longer aware of the technology. Therefore, subjects experiencing the departure dimension of telepresence were able to deny that "the television-generated world seemed to me only 'something I saw'
Human-computer interaction researchers suggest that the likelihood of experiencing telepresence is affected partly by the balance between the mediated information from the virtual environment and the unmediated information from the physical environment. When the proportion of sensory information significantly favors the virtual environment we can say that the user is "immersed" in the virtual environment. [Biocca (1995)] refers to this as the level of embodiment in the interface, because the body is increasingly surrounded and coupled to virtual environments ([Barfield and Weghorst, 1993; Biocca, 1995; Held and Durlach, 1992; Sheridan, 1992; Steuer, 1995]). (The other determinants of telepresence suggested are sensory fidelity and the sensorimotor interaction between the user and the mediated information. See [Biocca, forthcoming and Steuer, 1995] for an extensive discussion.)

However, we could not find support for this theory, although there is support for this in studies using virtual reality. Differences in the manipulated level of sensory saturation did not appear when using differences in traditional television. It is possible that the hypothesized relationship between immersion in the virtual environment via sensory saturation with stimuli from the virtual environment and suppression of stimuli from the physical environment does not generalize to television. Today's television technology may not provide the level of sensory immersion required to facilitate the viewers' sense of telepresence. Embodiment ([Biocca, 1995]) in the traditional television interface is quite limited, as there is only light sensory engagement of two sensory channels and there is no motor engagement. The weaker immersion of the medium and the slight differences in sensory saturation may not have been powerful enough to generate a measureable effect on telepresence.

However, one finding has a practical implication for persuasion studies. Both "departure" and "arrival" may have facilitating effects on persuasion, as the negative direct effect of "departure" on confidence in brand preference and the negative direct effect of "arrival" on buying intention are overpowered by the positive indirect effects. This suggests that the virtual experience created by telepresence can simulate a real sense of "seeing" the product, which leads to a stronger sense of "believing" in the information embedded in the mediated communication. The sense of presence may be the mediating variable that has not been adequately measured in previous studies on the relationship between "vividness" and persuasion ([Taylor & Thompson, 1982]). Our finding suggests that when the users feel present in the virtual environment, they are also likely to feel persuaded.

Footnotes

[1] An earlier version of this article was presented at the annual meeting of the International Communication Association, Montréal, May, 1997.

References


**Appendix 1**

**Viewing Angle Calculation**
Appendix 2

Scale of Need for Cognition

Adopted from the original 18 items developed by Cacioppo et al. (1984). A 9-point Likert-scale (Strongly Disagree -- Strongly Agree) was used for each item. Alpha reliability was 0.70. The factor scores for the eight items were used in the analysis.

1. I like to have the responsibility of handling a situation that requires a lot of thinking.

2. I feel relief rather than satisfaction after completing a task that required a lot of mental effort. (Reversed Scale)

3. I find satisfaction in deliberating hard and for long hours.

4. I really enjoy a task that involves coming up with new solutions to problems.

5. Learning new ways to think doesn't excite me very much. (Reversed Scale)

6. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
7. It's enough for me that something gets the job done; I don't care how or why it works. (Reversed Scale)

8. I usually end up deliberating about issues even when they do not affect me personally.

About the Authors

Taeyong Kim received an M.A. degree in advertising from Michigan State University and a Ph.D. degree in mass communication research (concentration in advertising research) from the University of North Carolina at Chapel Hill. While at North Carolina, he authored over a dozen of journal articles and national convention papers. Currently, he is an assistant professor of advertising at Appalachian State University. He teaches the full line of advertising courses including principles of advertising, advertising copywriting, media planning, and advertising campaigns. "Telepresence and persuasion" has been his main research theme for the past several years. If seeing is believing, Taeyong argues, "virtual seeing" should also be believing. Taeyong dreams of the future when mass media become better able to reproduce the reality and a Pizza Hut advertisement can reproduce a sizzling pizza for the viewers.
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Frank Biocca is the Ameritech Professor of Telecommunication and Director of the Media Interface and Network Design (M.I.N.D.) Lab. Dr. Biocca's research explores human-computer interaction in virtual environments. His most recent book, Communication in the Age of Virtual Reality, co-edited with Mark Levy, was selected as a Choice Outstanding Academic Book for 1995. It was the first volume to explore the communication applications and implications of virtual reality. His forthcoming book, Presence of Mind in Virtual Environments, will examine how the sensation of "presence" in virtual environments might assist human intellectual and physical performance. Dr. Biocca has lectured or been a researcher at Stanford University, the University of California-Berkeley, Duke University, the University of Wisconsin-Madison, the University of North Carolina at Chapel Hill, and other universities.
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