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# At the Heart of It All: The Concept of Presence

Matthew Lombard, Theresa Ditton

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## Abstract

A number of emerging technologies including virtual reality, simulation rides, video conferencing, home theater, and high definition television are designed to provide media users with an illusion that a mediated experience is not mediated, a perception defined here as presence. Traditional media such as the telephone, radio, television, film, and many others offer a lesser degree of presence as well. This article examines the key concept of presence. It begins by noting practical and theoretical reasons for studying this concept. Six conceptualizations of presence found in a diverse set of literatures are identified and a detailed explication of the concept that incorporates these conceptualizations is

presented. Existing research and speculation about the factors that encourage or discourage a sense of presence in media users as well as the physiological and psychological effects of presence are then outlined. Finally, suggestions concerning future systematic research about presence are presented.

## Introduction

Virtual reality. Simulation rides. Home theater. 3-D IMAX films. State-of-the-art video conferencing. Computers that "talk." Although these emerging technologies are different in a number of ways, each of them (and many others) is designed to give the user a type of mediated experience that has never been possible before: one that seems truly "natural," "immediate," "direct," and "real," a mediated experience that seems very much like it is not mediated; a mediated experience that creates for the user a strong sense of presence. Meanwhile, traditional media including the telephone, radio, film, and television continue to offer us a lesser sense of presence as well. This paper is about the concept of presence: what it is, what is known about how it is generated and the effects it has on media users, and how it might be studied.

Why examine the concept of presence? There are compelling practical and theoretical reasons. An enhanced sense of presence is central to the use, and therefore the usefulness and profitability, of the new technologies mentioned above and others such as the video telephone, high definition television (HDTV), home and arcade video games, the World Wide Web (WWW), and more. These technologies either are now changing or are expected soon to change many of the ways we work, play, and live. In the business world video conferencing has already begun to replace physical travel [([Muhlbach, Bocker, & Prussog,](#)

1995]). Related systems are used in telemedicine [(Crump & Pfiel, 1995; Hamit, 1995)] and telepsychiatry [(Abkarian, King, & Krappes, 1987; Dongier, Tempier, Lalinec-Michaud, & Meunier, 1986; Jerome, 1986)], in distance learning [(Chu & Schramm, 1967; Hackman & Walker, 1990)], and for legal testimony from remote locations [(Miller, 1991)]. Virtual reality may have begun with military training and flight simulators [(Karr, Reece, & Franceschini, 1997; Rheingold, 1991)], but it is now or soon will be used for everything from arcade games [(Cook, 1992; Martin, 1997; Robertson, 1994)] to architectural and interior design [Yan & Ouhyoung, 1994] to new kinds of exercise equipment (e.g., the VRbike [(Tectrix, 1995)]), to virtual sex [(teledildonics (Harvey, 1995))] to underwater exploration [(Stoker, Barch, Hine, & Barry, 1995)] to the training and assessment of surgical skills [(Ota, Loftin, Saito, Lea, & Keller, 1995)] and much more [(see "Information Group," 1997)]. Developing technologies in cinematography and film presentation have transformed the movies, providing us with life-like encounters with "Jurassic Park" dinosaurs, extraterrestrial "Aliens," and terrifying "Twisters" (the film "brings screen fiction unnervingly close to virtual reality" [(Ryan, 1996)]). Simulator rides (or "motion-based movies") add hydraulic movement to sequences that typically feature rapid-point-of-view movement, so "viewers" can take a Sub Oceanic Shuttle from San Francisco to Tokyo [(Take undersea tube," 1992)] or move through the environment of a music video [(Moon, 1993)] [(see Mahoney, 1996)]. Future generations of human-computer interfaces, with "intelligent agents" that have their own personalities and follow users' bidding, will surely further transform our use of the modern computer [(see Coughlin, 1996)]. But despite what may be the beginning of a new trend in which companies add social scientists and other "interaction specialists" to their design teams [(Aldersey-Williams, 1996)], most design decisions concerning all of these technologies are made by trial and

error, lore, and “seat of the pants” exploration [(see [Huston-Stein & Wright, 1979](#))]. A better understanding of what presence is, what encourages and discourages it in users, and its effects, should save valuable time and money and improve the end-product in the design of new and the redesign of current media technologies.

On the theoretical side, scholars in communication, psychology, and other fields want to better understand psychological and physiological processes as they occur in nonmediated settings; how humans organize and interpret information in their environment, store and retrieve memories, make decisions, etc. To accomplish this, researchers often use mediated stimuli as a substitute for the nonmediated stimuli of interest (for convenience as well as control) and assume that their findings will apply in both contexts. A few of many examples that could be cited are studies of person perception [([Ekman, 1982](#); [Feshbach & Cohen, 1988](#); [Kleck & Mendolia, 1990](#); [Provine, 1989](#))], how people estimated time to collision in auto accidents [([Hoffmann & Mortimer, 1994](#); McLeod & Ross, 1983)], the causes and effects of motion sickness [([Alexander & Barrett, 1975](#); [Parker, 1964, 1971](#))], and the treatment of phobias [([McNally, 1987](#))]. Our current understanding of these processes is based on studies in which it has been assumed that mediated (i.e., presence-inducing) stimuli are exactly the same as nonmediated stimuli; if that assumption is wrong, we need to know (work by [[Gale, Golledge, Pellegrino, and Doherty \(1990\)](#)] suggests it may be wrong, at least in some learning contexts). So a better understanding of presence will allow us to refine and improve our psychological theories.

Media scholars are interested in particular in how people are influenced by media presentations; an understanding of presence can enhance our theories here too. For example,

[[Shapiro and Lang \(1991\)](#)] used a model of memory developed by [[Johnson \(1983\)](#)] to explain how people incorporate information from television into their judgments about the “real” world. They suggest that mediated experiences that closely mimic nonmediated ones cause difficulties for the reality-monitoring process so that when memories are retrieved, mediated and nonmediated experiences are confused. [[Ditton \(1997\)](#)] found tentative empirical support for this idea. Media scholars have begun to consider the role of presence in theories concerning the negative impact of violent portrayals, the positive impact of prosocial portrayals, the perceived credibility of news and information, the persuasiveness of advertising, and more.

Beyond these reasons for examining presence, the fact that there is so much intense popular as well as academic interest in technology that creates a sense of presence beckons study. Why do we want these experiences that (at least in some sense) aren't “real”? What does presence offer us? Aside from its practical uses, what needs does it fulfill? How do these gratifications compare to those offered by the other media and nonmedia activities?

Despite the centrality and importance of presence, it has not yet been carefully explicated, operationalized, or studied. The work that has been done is fragmentary and unsystematic, in part because the people interested in presence come from many different academic fields (including communication, psychology, cognitive science, computer science, engineering, philosophy, and the arts). Further, research conducted for or by private industry and government has typically remained proprietary. This article provides a unifying explication of the presence concept and brings together much of what is known or has been suggested about presence in the hope that it can serve as a starting point for systematic research and theory on this topic.

In the remainder of this paper we (a) review several conceptualizations of presence in the literature and provide a unifying explication of the concept, (b) review some of what is known about the causes and effects of presence, and (c) recommend attributes of a program of research concerning this concept.

## Concept Explication

### Conceptualizations in the Literature

As suggested above, a diverse group of people are interested in presence, how to create it, how to use it effectively, and how it mediates or generates a variety of responses. A review of several relevant literatures finds six interrelated but distinct conceptualizations of presence. Each of these conceptualizations, and where possible corresponding operational definitions, is presented here; this is followed by a detailed explication that encompasses all six conceptualizations.

#### 1. Presence as social richness

To some scholars, primarily those who study communication in organizations, presence is the extent to which a medium is perceived as sociable, warm, sensitive, personal or intimate when it is used to interact with other people. Social presence theory [([Short, Williams, & Christie, 1976](#))] and media richness theory [([Rice, 1992](#))] were developed to better match communication media and organizational tasks to maximize efficiency and satisfaction. This is necessary because communication media are said to differ in the extent to which they "(a) can overcome various communication constraints of time, location permanence, distribution, and distance, (b) transmit the social, symbolic, and nonverbal cues of human communication; and (c)

convey equivocal information" [([Rice, 1992, p. 452](#))].

To measure social presence subjects perform various tasks with different media and evaluate each medium via a series of bipolar, seven-point semantic differential items including impersonal-personal, unsociable-sociable, insensitive-sensitive, and cold-warm [([Perse, Buton, Kovner, Lears, & Sen, 1992](#); [Short, Williams, & Christie, 1976](#))]. The social presence ranking thus depends on the interaction of the medium and the task at hand and is based on the subjective judgment of the user. Media richness or information richness is measured less subjectively by examining a medium's "capacity for immediate feedback, the number of senses involved, personalization and language variety" [([Rice, 1992, p. 4](#))].

Presence as social richness is related to two important concepts originally applied to nonmediated interpersonal communication: intimacy and immediacy. [[Argyle and Dean \(1965\)](#)] suggested that interactants vary physical proximity, eye-contact, intimacy of conversation topic, amount of smiling, and other behaviors to establish an equilibrium between conflicting approach and avoidance forces and thereby optimize an overall level of intimacy. Other scholars have expanded the list of intimacy behaviors to include posture and arm position, trunk and body orientation, gestures, facial expressions, body relaxation, touching, laughter, speech duration, voice quality, laughter, olfactory cues, and others [([Cappella, 1981](#); [Hall, 1966](#); [Mehrabian, 1969](#); [Patterson, 1973](#))]. A medium high in presence as social richness allows interactants to adjust more of these variables and therefore more precisely adjust the overall level of intimacy.

[[Weiner and Mehrabian \(1968\)](#)] outlined how choices of language can help create a sense of psychological closeness or immediacy. Others have suggested that intimacy

behaviors [(e.g., [Hackman & Walker, 1990](#))] and even the choice of a medium for interaction [(e.g., [Heilbronn & Libby, 1973](#))] also influence this sense of immediacy. Although language and therefore immediacy can be varied within any medium that can transmit language, it seems logical to expect immediacy and presence as social richness to be correlated [(see [Short, Williams, & Christie, 1976](#))].

## 2. Presence as realism

A second conceptualization of presence concerns the degree to which a medium can produce seemingly accurate representations of objects, events, and people – representations that look, sound, and/or feel like the “real” thing. This conceptualization is typically used by human factors engineers to assess consumers' responses to variations in the characteristics of a medium. For example, in a study of television, [[Hatada, Sakata, and Kusaka \(1980\)](#)] manipulated viewing angle, display area, viewing distance, and other variables and then asked subjects to report their subjective evaluation of the “sensation of reality” they experienced. [[Neuman \(1990\)](#)] varied the resolution and screen size of high definition television systems and measured viewers' evaluation of a “sensation of realism effect.” Heeter (1995) asked users of consumer virtual reality entertainment systems, “How real did the overall experience feel?” This conceptualization of presence is often used in a vague manner that fails to distinguish between two key types of “realism,” which are here termed “social realism” and “perceptual realism.” Social realism is the extent to which a media portrayal is plausible or “true to life” in that it reflects events that do or could occur in the nonmediated world (this is analogous to what [[Potter \(1988\)](#)] labels the semantic component of the “magic window” dimension of perceived reality). While presence as realism may include this type of social realism it also

includes a perceptual element that is separate: a scene from a science fiction program may be low in social realism but high in perceptual realism because although the events portrayed are unlikely, the objects and people in the program look and sound as one would expect if they did in fact exist. On the other hand, the people and events in an animated presentation may be high in social realism but because they are not "photorealistic," they are low in perceptual realism.

### 3. Presence as transportation

Another conceptual definition of presence involves the idea of transportation. Three distinct types of transportation can be identified: "You are there," in which the user is transported to another place; "It is here," in which another place and the objects within it are transported to the user; and "We are together," in which two (or more) communicators are transported together to a place that they share.

#### *"You are There"*

This is perhaps the oldest version of presence. The oral tradition of early humans involved the telling of tales that transported each generation of listeners to a different time and place where the events occurred [([Biocca & Levy, 1995](#))]. Written narrative can have the same effect [([Gerrig, 1993](#); [Radway, 1991](#))]. Recent AT&T advertisements told us that the telephone was "the next best thing to being there." Borrowing from the [1976 Jerzy Kozinski novel] and 1979 film, [[Reeves \(1991\)](#)] used the term "Being There" to describe how viewers experience the environment they encounter on television. Again with regard to television, [[Kim \(1996\)](#)] defines presence as a "feeling of being a part of the phenomenal environment created by television and not being a part of the physical environment surrounding the viewer and the television set" (p. 27). (The phrase often

viewer and the television set (p. 27). (The phrase often spoken by television hosts following a commercial break, "Welcome back," is consistent with the idea that viewers are "transported" during viewing.) The "you are there" concept is often used in discussions of virtual reality, which takes users to a virtual environment and leads to the "suspension of disbelief that they are in a world other than where their real bodies are located" [(Slater & Usoh, 1993, p. 222)]. [Sheridan (1992)] discusses teleoperation (human manipulation of elements of a remote environment) and, following [Minsky (1980)], defines telepresence as "feeling like you are actually 'there' at the remote site of operation," while virtual presence is "feeling like you are present in the environment generated by the computer" (p. 120). (See also [Rheingold, 1991], who calls telepresence a "form of out-of-the-body experience" (p. 256), and [(Biocca & Levy, 1995; Heeter, 1992; Held & Durlach 1992; and Steuer, 1995)] for similar definitions). The concept of transporting users to remote physical places can also be found in "virtual tours" of art exhibits, museums, and tourist destinations on the world wide web [(WWW Virtual Tours, 1997)].

A number of closed-ended questionnaire items have been used to measure this type of presence. After watching television, subjects in a study by [Kim (1996)] were asked to report how often they had had the following perceptions: "I felt I was in the world the television created," "the television-generated world seemed to me to be more like 'somewhere that I visited' rather than 'something that I saw'," and "my body was in this room, but my mind was inside the world created by the television." Following [Gerrig (1993)], Kim tentatively identified two factors that emerged in subject responses as "departure" (from the nonmediated environment) and "arrival" (in the mediated environment). In another study of responses to television, [Ditton (1997)] asked subjects, "How much of a sense of participation in the scene did you feel?" and "How much of a sense of

scene did you feel? and how much of a sense of involvement in the scene did you feel?". [Slater and Usoh (1993)] asked virtual reality users, "To what extent did you experience a sense of being 'really there' inside the virtual environment?" (p. 227). In a study of consumer responses to a second person virtual reality entertainment system (one in which users stay in front of a camera and watch a television monitor that displays images of themselves acting inside a virtual environment), [Heeter (1995)] asked subjects, "Which felt like the real you - the being on the screen or the one the camera was pointed at?" All of these measures assess the degree to which media users are transported into a distinct mediated environment.

### *"It is Here"*

Instead of transporting the user to a different place, a sense of presence may bring the objects and people from another place to the media user's environment. According to [Millerson (1969)], "Watching a television programme, we feel not so much that we are being taken out into the world, as that the world is being brought to us" (pp. 201-202). Extending this idea, [Flavell, Flavell, Green, and Korfmacher (1990)] examined whether 3 and 4 year old children believed that "an object seen on videotape could be touched or could come out if the top of the set were removed, whether it would spill out of the open container it was in if the set were turned upside down, and whether a person seen on videotape could see, hear, and know about the experimenter's ongoing actions" (p. 402). The youngest children seemed to fail to make what the authors termed this image-referent distinction.

[Reeves (1991)] suggested that even though adults don't express the beliefs that young children do, they may also fail to distinguish fully between images and referents (adults' sophistication may be the result of experience

rather than development: for example, some theater-goers at the beginning of the film era are said to have panicked and run for the exits when a black and white film of an oncoming locomotive was shown [([Schoen, 1976](#))]. [[Lombard \(1995\)](#)] argued that when media users fail to distinguish between image and referent, they respond directly to what they see and hear in a mediated experience, as if what they see and hear was physically present in their viewing environment, rather than respond indirectly by decoding something they perceive only as a symbolic or representational message. A general measure of these direct responses used by [[Lombard, Reich, Grabe, Campanella, and Ditton \(1995\)](#)] was, "How much did you feel like it was happening to you?"

*"We are Together" (Shared Space)*

A third form of presence as transportation is found in literature concerning video conferencing as well as virtual reality. For example, in a study of video conferencing [[Muhlbach, Bocker, and Prussog \(1995\)](#)] defined "telepresence in video communications" as "the degree to which participants of a telemeeting get the impression of sharing space with interlocutors who are at a remote physical site" (p. 301). This was measured by asking participants to report the degree to which they agreed or disagreed with statements such as "[It felt] as if we were all in the same room" and "[It felt] like a real face-to-face meeting" (p. 301). Some of the pioneers of virtual reality have suggested that its greatest potential is as a virtual gathering place in which people from around the block or around the world will be able to gather in a shared virtual space that is different from any of the individuals' "real" environments [([Lanier & Biocca, 1992](#))]. Precursors of these Distributed Virtual Environments (DVEs) include the popular "chat rooms" of today's Internet [(see [Braham & Comerford, 1997](#); [Rockwell, 1997](#); and [Waters & Barris, 1997](#) for

[1997](#), [Rockwell, 1997](#), and [Waters & Barris, 1997](#) for detailed discussions)].

#### 4. Presence as immersion

A fourth conceptualization of presence emphasizes the idea of perceptual and psychological immersion. [[Biocca and Levy \(1995\)](#)] note that in the most compelling virtual reality experiences, the senses are immersed in the virtual world; the body is entrusted to a reality engine. The eyes are covered by a head-mounted display; the real world is invisible. The ears are covered by headphones; ambient sound is muffled. The hands are covered by gloves or props: 'touch only the virtual bodies.' Virtual reality may share common elements with reading a book in a quiet corner, but this book has stretched in all directions and wrapped itself around the senses of the reader – the reader is swallowed by the story. (p. 135)

Perceptual immersion, “the degree to which a virtual environment submerges the perceptual system of the user” [[\(Biocca & Delaney, 1995, p. 57\)](#)], can be objectively measured by counting the number of the users' senses that are provided with input and the degree to which inputs from the physical environment are “shut out” (see [[Kim, 1996](#)]). Not only immersive virtual reality systems but also simulation rides, IMAX theaters, and even standard movie theaters can be said to immerse the senses of media users.

Presence as immersion also includes a psychological component. When users feel immersive presence they are involved [[\(Palmer, 1995\)](#)], absorbed [[\(Quarrick, 1989\)](#)], engaged, engrossed. This psychological state typically is best measured via subject self-report (although observation of involved media users might also be a useful indicator). For example, a factor analysis of responses to items used by [[Heeter \(1995\)](#)] in a study of user reactions to consumer virtual reality systems resulted in an “involvement” factor

virtual reality systems resulted in an involvement factor containing the items "intense," "fun," "competitive," "addictive," and "exciting"; scores on this factor were the highest of all factors (8.7 out of 10).

## 5. Presence as social actor within medium

In a classic 1956 article, [Horton and Wohl] suggested that even though the relationship between a television personality and a television viewer is one-sided, with no possibility of real time interaction, skilled personalities use direct address camera views (in which the personality seems to be looking at the viewer), informal speech patterns, sincerity, and simplicity to generate a "simulacrum of conversational give and take [that] may be called parasocial interaction" (p. 215). In a parasocial interaction media users respond to social cues presented by persons they encounter within a medium even though it is illogical and even inappropriate to do so. Studies have shown that people respond to interpersonal distance cues in [(Lombard, 1995)], and even talk to [(Lemish, 1982)], the pictures of people on the television screen. The mediated nature of the "interaction" is ignored and the media personality is incorrectly perceived as a social actor.

This illogical treatment of mediated entities as social actors is not limited to television. "Virtual actors" are created with digitized data from sensors attached to a real person and computer voice synthesis; the data give a computer character human gestures, facial movements, and voice (e.g., Mario, a sports mascot seen on stadium screens [(Takiff, 1993)] or "Dev," the computerized bartender/news anchor on MSNBC's "The Site"). The Microsoft personal computer software product titled "Bob" features 14 on-screen characters that guide the novice user through his or her computer's functions; Cliff Nass and Byron Reeves of Stanford University call it a "social interface" [(see Coughlin,

[1996](#)]). Intelligent computer agents of the future will have avatars (an incarnation in human form) with which users interact [([Boyd, 1996](#))], making the interaction more like interacting with another human. In the software product Dogz: Your Computer Pet [([Dogz, 1995](#))], users adopt one of several puppies which they then teach tricks, play games with, feed, groom, pet, and discipline as their “desktop companion” grows from puppy to adult dog (a version for cats is available as well). “The Tamagotchi” (“cute little bird”) is a “cyber pet” that appears on a three-quarter-inch computer screen attached to a key chain and needs constant “food, exercise, play, medicine, etc.”; it is hugely popular in Japan, the Far East, and now America [([Boccella, 1997](#))]. And in a software product popular in Japan called Princess Maker, the user controls a female animated character:

She's your little princess. You name her, wring your hands when she's sick, fret over her schooling. Like any caring dad you keep steady watch over her hobbies, clothes and manners. But if after all your lavish attention, she becomes a bar hostess strutting around in fishnet stockings or a club-swinging street tough – no problem. Just reboot your computer and start again. [([Coleman, 1996, p. D3](#))]

The virtual characters in similar games have their own fan clubs in Japan; a magazine, Virtual Idol, “deals not with game-playing strategy but with the hobbies, life experiences and physical measurements of [these] people who do not exist” [([Pollack, 1996](#))].

In all of these examples users' perceptions and the resulting psychological processes lead them to illogically overlook the

psychological processes lead them to ignoring or overlooking the mediated or even artificial nature of an entity within a medium and attempt to interact with it; this phenomenon represents a fifth type of presence.

## 6. Presence as medium as social actor

The final conceptualization of presence involves social responses of media users not to entities (people or computer characters) within a medium, but to cues provided by the medium itself. Debate about the potential of modern computers to mimic humans officially began in 1950 with [Alan Turing's] "Turing Test" and continues today. While computers, robots, and androids in science-fiction often evoke social responses from other characters (and many audience members) because they seem so "human" (e.g., Data in Star Trek, C3PO and R2D2 in Star Wars, Hal in 2001: A Space Odyssey, the Terminator in the Terminator films, the Replicants in Blade Runner, etc.), the phenomenon seems to exist even with today's less sophisticated computers. Nass and his colleagues at the Center for the Study of Language and Information at Stanford University have demonstrated in a series of studies [([Nass, Lombard, Henriksen, & Steuer, 1995](#); [Nass & Moon, 1996a, 1996b](#); [Nass, Moon, Fogg, Reeves, & Dryer, 1995](#); [Nass & Steuer, 1994](#); [Nass, Steuer, Henriksen, & Dryer, 1994](#); [Nass, Steuer, Tauber, & Reeder, 1993](#))] that because computers use natural language, interact in real time, and fill traditionally social roles (e.g., bank teller and teacher), even experienced computer users tend to respond to them as social entities. In most of these studies a social psychology finding concerning human-human interaction is replicated in the context of human-computer interaction. For example, in human-human interaction we follow the rule "praise from others is more valid than praise from self" [([Jones, 1990](#); [Joshi & Rai, 1987](#); [Meyer, Mittag, & Engler, 1986](#); [Wilson & Chambers, 1989](#))]. In a study by [[Nass, Steuer, Henriksen,](#)

[and Dryer \(1994\)](#)] subjects evaluated a computer's performance in a tutoring task more favorably when the tutor computer was praised by a different computer than when it praised its own performance. These results were found despite the fact that the subjects consistently said that such responses to computers are illogical and inappropriate. Computer users also follow social rules concerning politeness and gender stereotypes. [\[Nass and Moon \(1996a\)\]](#) demonstrated that these social responses are to the entity of the computer and not the person who programmed the computer.

[\[Nass, Reeves, and Leshner \(1996\)\]](#) found an even more surprising social response to a communication technology: just as individuals consider the work of specialists in a field to be of higher quality than the work of generalists, subjects in an experiment reported that the quality of the news or entertainment programs presented on different ("specialist") television sets was higher than when the same programs were presented on just one ("generalist") set. Another example of social responses to television comes from [\[Lemish \(1982\)\]](#), who observed people watching television in public places:

- Certain viewer mannerisms suggested that television [not the people on television] was perceived as a communicative partner and not merely as a physical object. For example, viewers would rarely leave the viewing area in the middle of a segment. While it could be argued simply that viewers were involved in the program or that they were showing respect for other viewers, this observer could not avoid the impression that viewers acted as if leaving in the middle was rude and inconsiderate. (pp. 755–756)

In these social responses to computers and televisions users again ignore, in a counter-logical way, the mediated nature of a communication experience. Basic social cues exhibited by the medium lead users to treat the medium as a social entity.

### Presence Explicated

Although the conceptualizations discussed above vary considerably, they share a central idea. Each represents one or more aspects of what we define here formally as presence: the perceptual illusion of nonmediation. The term "perceptual" indicates that this phenomenon involves continuous (real time) responses of the human sensory, cognitive, and affective processing systems to objects and entities in a person's environment. An "illusion of nonmediation" occurs when a person fails to perceive or acknowledge the existence of a medium in his/her communication environment and responds as he/she would if the medium were not there. Although in one sense all of our experiences are mediated by our intrapersonal sensory and perceptual systems, "nonmediated" here is defined as experienced without human-made technology (note that under this definition even hearing aids and eyeglasses are media that "come between" our environment and our perceptual system).

The illusion of nonmediation can occur in two distinct ways: (a) the medium can appear to be invisible or transparent and function as would a large open window, with the medium user and the medium content (objects and entities) sharing the same physical environment; and (b) the medium can appear to be transformed into something other than a medium, a social entity.

Presence in this view can not occur unless a person is using

presence in this view can not occur unless a person is using a medium. It does not occur in degrees but either does or does not occur at any instant during media use; the subjective feeling that a medium or media-use experience produces a greater or lesser sense of presence is attributable to there being a greater or lesser number of instants during the experience in which the illusion of nonmediation occurs.

It should be noted that this illusion does not represent a perceptual or psychological malfunction or psychosis, in which the mediated experience is consciously confused with what is nonmediated or "real." Clearly when asked, users of any current or likely future medium can accurately report that they are using a medium (the "holodeck" in the "Star Trek" television series and films is a exception; see in particular the episode of "Star Trek: The Next Generation" titled "Ship in a Bottle").

This definition of presence can be applied to any medium and encompasses each of the six conceptualizations discussed above. A medium that becomes invisible and produces a perceptual illusion of nonmediation analogous to an open window can provide rich verbal and nonverbal information for social interaction (presence as social richness); objects and entities in such a medium should appear perceptually (if not socially) vivid and real (presence as realism); the illusion that there is no medium at work means there is no border between "this side" and "the other side" of the medium, so users can perceive that they have moved to the other side, that objects/entities from the other side have entered their immediate environment, or that they and other users are sharing a real or artificial environment (presence as transportation); the illusion of nonmediation will be more complete if the medium is perceptually and psychologically immersive (presence as immersion); and if we encounter people or entities within

such a medium, even if there is no possibility of true social interaction with them, we are encouraged to respond to social cues they provide just as we would in nonmediated communication (presence as social actor within medium). Finally, when the medium itself presents us with social cues normally reserved for human-human interaction we are likely to perceive it not as a medium but as an independent social entity, a transformed medium (presence as medium as social actor).

Because it is a perceptual illusion, presence is a property of a person. However it results from an interaction among formal and content characteristics of a medium and characteristics of the media user, and therefore it can and does vary across individuals and across time for the same individual. We turn next to the limited evidence, as well as the speculation, concerning which of these characteristics encourage and discourage a sense of presence in media users, and the effects of presence.

## Causes and Effects of Presence

There has been relatively little research, and even less systematic research, conducted to investigate the factors that contribute to a sense of presence and the variety of consequences that it produces. "There is no scientific body of data and/or theory delineating the factors that underlie the phenomenon" [([Held & Durlach, 1992, p. 110](#))]. Previous discussions of presence have typically (a) been based on informed conjecture rather than research, and/or (b) focused only on specific media, and/or c) focused only on one or more specific conceptualization(s) of presence outlined above.

In this section we synthesize what is known about and what has been suggested about the causes and consequences of presence. The discussion can not be exhaustive, in either

breadth or depth; where possible we refer the reader to detailed discussions of variables. Our goal is to identify key variables and groups of variables to provide a framework for a systematic program of research on the concept of presence. We begin with variables that encourage or discourage presence as an invisible medium and then discuss variables related to presence as a transformed medium. In each case these variables are divided into characteristics of media form, characteristics of media content, and characteristics of the media users. Finally, we consider a number of the physiological and psychological effects of presence.

### Causes of Presence as Invisible Medium

As suggested above, presence is determined by formal and content features of a medium and by characteristics of the medium user.

### Form variables

The formal characteristics of media most often cited as important determinants of presence are those that involve sensory richness or vividness. [Steuer (1995)] argues that a sense of presence is based in large part on a medium's vividness, which includes sensory breadth ("the number of sensory dimensions simultaneously presented") and sensory depth ("the resolution within each of these perceptual channels")(p. 42). Other writers have echoed these ideas: [Zeltzer (1992)] links presence to "a rough, lumped measure of the number and fidelity of available sensory input and output channels" provided by a medium (p. 128). [Heeter (1992)] points to the "range and intensity of stimuli human senses detect and interpret in perceiving the natural world" (p. 263). We discuss first the range of senses served by a medium and then characteristics related to the individual sense modalities.

### *Number and consistency of sensory outputs*

Although it has rarely been examined by researchers, it is generally believed that the greater the number of human senses for which a medium provides stimulation (i.e., media sensory outputs), the greater the capability of the medium to produce a sense of presence [([Anderson & Casey, 1997](#); [Barfield & Weghorst, 1993](#); [Kim, 1996](#); [Short, Williams, & Christie, 1976](#); [Steuer, 1995](#))]. For example, media that provide both audio and visual stimuli are said to produce a greater sense of presence than audio-only (or video-only) media. In one study [([Short, Williams & Christie, 1976](#))], subjects reported greater social presence after an audio-visual task-based interaction than an audio-only one. Film and television should therefore more easily produce presence than radio. The addition of inputs for the senses of smell (as in Morton Heilig's Sensorama "experience theater" of the 1960s [(see [Rheingold, 1991](#))] and a handful of films), body movement and equilibrium (as in simulation rides), and touch (in advanced virtual reality systems) each seem likely to contribute to a strong sense of presence. The importance of all sensory outputs are not equal, however. According to Christie (1974, as cited in [Short, Williams, & Christie, 1976](#)) research has found that visual media have more social presence than verbal (audio) media, which in turn have more social presence than written media. In general, our visual and aural senses dominate our perception and have been most often identified with presence.

Not only is the number of sensory output channels an important factor in generating a sense of presence, the consistency of information in the different modalities is key: "the information received through all channels should describe the same objective world" [(Held & Durlach, p. 110)]. Failure to meet this criterion emphasizes the artificial

1993). Failure to meet this criterion emphasizes the artificial and thus the mediated nature of a media use experience (see [Stein and Meredith (1993)] for a detailed discussion of modality and information processing).

The number of channels of input accepted and processed by an interactive medium is also related to presence and is discussed below.

### *Visual display characteristics*

Many characteristics of visual displays encourage a sense of presence, including image quality; image size and viewing distance, which together determine the proportion of a user's visual field occupied by an image; motion and color; variables related to the perception of dimensionality; and the use of a variety of camera techniques.

*image quality.* The perceived quality of an image depends on many characteristics, including resolution, color accuracy, convergence, sharpness, brightness, contrast, and the absence of "ghosts" or other noise. Very high resolution images (e.g., those containing 1125 or 3000 horizontal scan lines) have been shown to evoke more self-reported presence (no definition was given to subjects) than standard resolution images (200–525 lines) [(Neuman, 1990)].

[Reeves, Detenber, and Steuer (1993)] manipulated image quality by using multiple-generation copies of video stimuli and found that high quality images were regarded as more "realistic." [Bocker and Muhlbach (1993)] found that higher resolution images in a video conferencing system elicited reports of greater "communicative" presence (analogous to social richness). Images which are more photorealistic, for example a live-action scene or a photograph rather than an animated scene or a drawing, are likely to provoke a greater sense of presence as well [(Heeter, 1992; Zeltzer, 1992)] (one of the critiques of current virtual reality technology is that it has not yet achieved a [photo]realistic appearance)

that it has not yet achieved a [photo]realistic appearance).

*image size*. The formal feature that has received the greatest attention from researchers concerned with presence is probably the size of a visual image. Larger images have been shown to evoke a variety of more intense presence-related responses. For example, [[Reeves, Detenber, and Steuer \(1993\)](#)] showed subjects clips from action films. Subjects who watched on a 70 inch screen (measured diagonally) reported significantly greater agreement with the statement "I felt like I was a part of the action" than subjects who watched on a 35 inch screen. [[Yuyama](#)](1982, cited in Neuman, 1990) found that subjects reported a greater "sensation of reality" when they watched a 54 inch image rather than a 28 inch image.

In a study of motion sickness [[Parker \(1971\)](#)] showed subjects an eight minute video segment taken from the point of view of a driver of a car as it traveled a winding mountain road. Several subjects became nauseated and could not complete the session. In a follow-up study, [[Alexander and Barrett \(1975\)](#)] explained their subjects' less severe response to the same stimulus by noting that they presented it to the subjects on a smaller screen than Parker had used in his study. [[Lombard, Reich, Grabe, Campanella, and Ditton \(1995\)](#)] showed subjects 10 different short scenes featuring this same type of rapid point-of-view movement on a consumer-model television set with either a 46 inch or a 12 inch screen. Subjects who watched the larger images were more aroused (a skin conductance measure) and reported a greater "sense of movement," "enjoyment of this sense of movement," "sense of participation," and "involvement." [[Ditton \(1997\)](#)] had subjects view 15 scenes from films on either a 52-inch screen color television with surround sound audio or a 5-inch, black and white television with monophonic audio. Subjects who viewed in the large-screen condition reported a greater sense of "participation" and

“involvement” in the scene. The difference reached significance when variance associated with the ability to screen irrelevant stimuli ([\[Mehrabian's \(1976\)\]](#) “screener” concept) was removed.

[\[Lombard \(1995\)\]](#) used a screen size manipulation to show that viewers respond to social cues they encounter in nonmediated communication, such as apparent interpersonal distance, in mediated experiences including television viewing. As predicted by Burgoon's Nonverbal Expectancy Violations Model ([\[Burgoon, 1978; Burgoon & Hale, 1988; Burgoon & Jones, 1976; Burgoon & Walther, 1990\]](#)), when subjects watched attractive and professional news anchors deliver stories on a large (42 inch) screen they reported more positive emotional responses to anchors and to the viewing environment, and then selected a viewing position that represented a smaller withdrawal from the encounter, than when the people appeared on smaller (26 inch or 10 inch) screens.

Because consumers are buying larger TV sets ([\[Pressler, 1996\]](#)) and because “bigger pictures are the essence of the coming HDTV format ([\[Thorpe, 1989\]](#)), image size is likely to be an increasingly important determinant of presence. (The combination of the larger size and improved quality of HDTV provides a picture that is “almost like looking out a window, almost feels three-dimensional,” according to Joel Brinkley, author of “Defining Vision” ([\[Utley, 1997\]](#))).

*image size and viewing distance: Proportion of visual field.*

Along with larger images it seems logical to expect that when people are physically closer (but perhaps not excessively close) to an image, they feel a greater sense of being a part of the image and therefore a greater sense of presence. But these two variables also act together to determine the value of a third variable, the proportion of the user's visual field that the image occupies also known

the user's visual field that the image occupies, also known as viewing angle [([Hatada, Sakata, & Kusaka, 1980](#); [Nathan, Anderson, Field, & Collins, 1985](#))] and field of view [([Biocca & Delaney, 1995](#); [Held & Durlach, 1992](#))]. A large image and a large viewing distance (e.g., in an IMAX theater) can result in the same proportion of visual field as a small image and a small viewing distance (e.g., in a virtual reality headmounted display). Studies by [[Hatada, Sakata, and Kusaka \(1980\)](#)] and [[Yuyama \(1982\)](#)] suggest that a "sensation of reality" is stronger in the former configuration, but more research is needed on the question.

*motion and color.* Despite a lack of research it seems reasonable to conclude that moving images that provide the illusion of continuous action can more easily evoke presence than still images [see ([Anderson, 1993](#); [Burr & Ross, 1986](#))]. Color images should evoke more presence than those in black and white.

*dimensionality.* There are several ways to make flat (two dimensional) images appear to contain the third dimension of depth. Principles of perspective have been used for centuries in drawing and painting. Near the end of the 17th century Andrea Pozzo painted "The Glorification of St. Ignatius" on the ceiling of the Church of Sant' Ignazio in Rome. Today spectators still look up to see "a three-dimensional panorama of arches supported by columns, windows, and sky, with human figures arranged in various positions throughout, some of them seemingly suspended in midair.... [I]t looks real, so real that it is virtually impossible to tell where the architecture of the church ends and the painting begins" [([Rock, 1984](#); see also Alberti, 1458/1966)]. The artist encourages illusions such as this by creating for the perceiver something very close to the pattern of light that would be etched on a viewer's retina if the person encountered the nonmediated scene. This involves "tricks" such as making distant objects smaller,

making near objects block parts of objects “behind” them (interposition), and reducing detail and texture in distant objects. These and other techniques are increasingly applied by designers of virtual environments [([Heeter, 1992](#))], computer interfaces (e.g., Windows 95, VRML Internet sites), and television graphics [([Olds, 1990](#))] to create the illusion that mediated objects have depth. Film or video images with great depth of field [([Hatada, Sakata, & Kusaka, 1980](#))] call this “pronounced perspective”) are frequently combined with “matte” paintings of distant backgrounds to enhance a sense of three dimensional space. The moving film or video camera provides viewers with additional depth cues, as distant objects “move” more slowly than near objects as the camera pans a scene. (See [[Gibson, 1979](#); [Hagen, 1980](#); and [Rock, 1984](#)] for more detailed discussions of depth cues in pictures).

Stereoscopic images – in which a slightly different view is presented to each eye, as in nonmediated perception – also enhance the sense of presence. [[Muhlbach, Bocker, and Prussog \(1995\)](#)] found that participants in a videoconference that employed stereoscopic imaging were more likely to report that “I felt like I was face-to-face” and “I felt as if we were in the same room” (see [[Patterson, 1992](#)] for a review of human stereopsis as it relates to the design of stereoscopic displays). When several of these techniques to simulate dimensionality are combined the effect can be quite impressive, as in Sony's 3-D IMAX presentations.

*camera techniques.* The camera can be used in a variety of ways to create a sense of presence. Shot length, the distance from which objects or entities in an image are framed, appears to be important. Close-up views used in still images led subjects in a study by [[Hatada, Sakata, and Kusaka \(1980\)](#)] to report a greater sensation of realism. [[Short, Williams, and Christie \(1976\)](#)] report that

Unhappiness found the same result when subjects used a video conferencing system.

Subjective camera shots create a view through an actual or implied entity's eyes and so transform the viewer from an event-spectator into an event-participant [(Zettl, 1990)]. Ideally, this close association with the camera's point of view encourages the viewer to "participate in an event psychologically (feeling a part of the event) and occasionally also even kinesthetically (reacting physically to the screen event such as shouting approval, clapping, or moving one's arms when watching a boxing match)" [(Zettl, 1990, p. 221)].

Subjective camera shots are common in film and television and especially prevalent in computer video games (e.g., Doom, Hexen, Wolfenstein, and Duke Nukem). All of the "camera shots" in virtual reality are subjective views, and in many cases the illusion is enhanced because users can see "their" hands and feet as they navigate the environment. [(Bricken 1991)] notes that watching a dynamic representation of one's hands within a virtual world is "convincing evidence that you're There"; see also [Held & Durlach, 1992]).

The most common subjective technique is direct address, in which the person in the image (e.g., a news anchor or talk show host) speaks directly to the camera and therefore, apparently, the viewer. [Horton and Wohl (1956)] suggested that the ability of television personalities to talk directly to viewers this way is an essential part of parasocial interaction. Producers sometimes have a character "break the fourth wall" (the viewing screen that separates the viewer from the people in the image) by suddenly turning to directly address the viewer (this technique was used effectively in the television series "Moonlighting").

A subjective camera technique that dominates video games and simulation video and is increasingly favored in action

and simulation rides, and is increasingly found in action-adventure films (e.g., *Speed*, *The River Wild*) and television commercials (e.g., for automobiles), is rapid point-of-view movement. Here a moving camera mimics for the viewer the non-mediated experience of a person or object moving quickly through an environment. Producers "mount a camera to a racing car, strap it to a ski racer's helmet, or run with it through a city street," all in an effort to allow the viewer to "experience what driving a race car, skiing down a steep slope, or jogging through a city street feels like" [(Zettl, 1990, p. 221)]; recent innovations such as miniature radio-controlled helicopters and cars (e.g., "Flying Cam," "[Innovision Optics]") have made the technique increasingly practical and affordable. Common responses to rapid point-of-view movement in IMAX films and virtual reality include queasiness, dizziness, and even nausea [(Azar, 1996)]. (In fact, psychologists often study motion sickness by using filmed stimuli that feature continuous rapid point-of-view movement [(Alexander & Barrett, 1975; Parker, 1964, 1971)].

One study has demonstrated the effect of rapid point-of-view movement on presence. [Lombard, Reich, Grabe, Campanella, and Ditton (1995)] showed subjects 10 short scenes from commercially available video tapes that featured rapid point-of-view movement. Viewers of both a small (12 inch) and large (46 inch) television reported an enjoyable sense of physical movement, excitement, involvement, and a sense of participation.

Other subjective camera shots include over-the-shoulder shots and shots that employ a "shaky" handheld camera. Again, at least the intended effect is to make the viewer experience a sense of presence by becoming part of the scene, seeing through the eyes of an implied or actual character.

### *Aural presentation characteristics*

Although frequently undervalued [([Kramer, 1995](#))], mediated sounds clearly are important in generating presence. The two most frequently identified characteristics of aural presentations in discussions of presence are quality and dimensionality.

As with visual images, sound quality involves several variables, including frequency range, dynamic range (variations in loudness), and signal to noise ratio (which quantifies the degree of various forms of distortion in the sound reproduction process) [(see [Alten, 1990](#); [Everest, 1987](#))]. Although it seems logical to conclude that high quality audio is more likely to generate presence than low quality sounds, the scant available evidence is mixed. [[Reeves, Detenber, and Steuer \(1993\)](#)] showed subjects scenes from action films and varied the fidelity of the soundtracks by controlling both frequency range (with a graphic equalizer) and signal to noise ratio (via tape "hiss" added to the recordings). The presentations with high fidelity sound were judged more "realistic," but it was the low fidelity sounds that made subjects feel more "a part of the action."

We hear in "three dimensions," so the spatial characteristics of sound should be important for a sense of presence.

[[Biocca and Delaney \(1995\)](#)] note that

- the aural realism of virtual spaces requires replicating the spatial characteristics of sounds like the changing intensity of a race car engine as it approaches a listener and screeches past (Doppler effect); or the tapping of footsteps as they echo in a dark, empty corridor; or the chatter of a conversation off in the corner of a

room (cocktail party effect). (p. 81)

Spatialization, or 3-D sound, is an attempt to add these spatial characteristics to mediated sounds [([Kramer, 1995](#); see also [Anderson & Casey, 1997](#); [Blauert, 1983](#); [Wenzel, 1992](#))]. Dimensional sound is created in stereo (2 channel), quadraphonic (4 channel), and especially in surround sound systems (in which the amplitude, phase, and frequency of sounds arriving at each ear are adjusted to create the illusion of dimensional space).

There is little empirical research available concerning the effect of aural dimensionality on the sense of presence. [[Reeves, Detenber, and Steuer \(1993\)](#)] found no differences concerning presence for monaural presentations and presentations for which the dimensionality of sound was enhanced via Dolby surround sound decoding. On the other hand, Christie (1973a, as cited in [[Short, Williams, & Christie, 1976](#)]) found that social presence was greater on self-report measures for a “multi-speaker audio system” than a single speaker system. In other studies (e.g., [[Ditton, 1997](#)]), dimensionality is confounded with other variables, making it impossible to draw specific conclusions. Despite the lack of hard evidence, it seems likely that dimensional audio, at least in many circumstances, evokes increased presence.

The volume (loudness) of mediated audio stimuli also may have an impact on presence, with particularly low and perhaps particularly high levels less effective than moderate (“realistic”) levels (see [[Everest, 1987](#)]). [[Anderson and Casey \(1997\)](#)] suggest that the proper use of ambient sounds and music can “evoke an atmosphere or sense of place, thereby heightening the overall feeling of immersion in the virtual environment” (p. 47).

### *Stimuli for other senses*

Visual and aural stimuli may be the most common sensory outputs available in mediated experiences, but there are at least four others, each of which is likely to enhance presence: olfactory output, body movement (vection), tactile stimuli, and force feedback.

Adding the smells of food, flowers, or the air at a beach or in a rain forest to the corresponding images and sounds seems likely to enhance a sense of presence for media users. In the 1960s arcade ride Sensorama, the simulation of a motorcycle ride included sending puffs of the aromas of exhaust, pizza, and flowers into users' nasal passages at appropriate times [([Hellig, 1992](#); [Rheingold, 1991](#))]. In the John Waters film [Polyester (1981)], theater-goers were given special "scratch-and-sniff" cards "enabling [them] to fill [their] nostrils with whatever scent or stench that the film's heroine, Francine Fishpaw, was inhaling" [([Rickey, 1996](#))]. Olfactory stimuli, however, have been used only rarely in mediated presentations because they are difficult to control and deliver [([Biocca & Delaney, 1995](#))]; their effectiveness in generating a sense of presence has not been tested empirically.

Presence should be enhanced when our body is moved in physical space during a mediated experience. A handful of films, including [[Earthquake \(1974\)](#), [Gunnm \(1993\)](#), [Midway \(1976\)](#), and [Rollercoaster \(1976\)](#)], have been presented in Sensurround, in which theater seats vibrate to enhance the illusion that the viewer is experiencing, for example, an earthquake or an air and sea battle. Simulation theaters [([Showscan, 1991](#))], simulation rides (e.g., Disney's "Star Tours"), and sophisticated flight simulators all use hydraulic motion platforms to create illusions of acceleration, deceleration, and other gravitational and inertial forces. Evidence for the contribution of body movement to a sense

Evidence for the contribution of body movement to a sense of presence is only anecdotal; it is likely that some types of movement contribute more than others.

Two additional types of sensory media output likely to contribute to presence occur only in interactive media experiences (interactivity is discussed in the following section).

- A virtual environment that truly “feels real” should be able to simulate the sensation of surface textures like sandpaper or velvet, the resistance of surfaces like rocks or pillows, and the sensation of physical resistance like moving an oar or stick through water, mud, oil, or rocks. [([Biocca & Levy, 1995, p. 84](#))

Although complex and currently expensive, it is possible to stimulate receptors in a media user's hands, muscles, and joints to reproduce the sensations we perceive when we touch and manipulate objects in nonmediated experience. Effective tactile or haptic sensory output produces the sensations of touching a surface; force feedback systems respond to user input with the sensations of physical resistance. It is generally assumed that each of these makes a substantial contribution to a sense of presence [([Biocca & Delaney, 1995](#); [Heeter, 1992](#); see also [Sutherland, 1965](#))]. While these types of media “displays” might seem exotic, force feedback can be created with simple “mediating objects” such as a joystick, steering wheel, or hand grip. The latest generation of computer joysticks for home computer games includes force feedback output and is receiving high marks from video gaming experts:

- The combination of visual cues with physical ones makes the experience more truly immersive than any advance in graphics or processor technology Next Generation [a magazine for leading edge computer gaming] has seen... It should open the way for entirely new types of games, where feel replaces graphics as the premium experience delivery mechanism. [“Get a grip,” 1996, p. 42]

Artists can use a special pen and a pressure-sensitive digitizing tablet to obtain “virtual tactility” so that using greater force produces wider and darker lines: “Pressure sensitivity is an enhancement that adds a new level of sensitivity and realism to computer art” [([Steltzer, 1992, p. 14](#))]. Again, research is needed to determine the role of haptic and force feedback output in the encouragement of presence.

### *Interactivity*

Most writers have either implicitly assumed or explicitly suggested that a major or even the primary cause of presence is the ability to interact with a mediated environment. The concept of interactivity is complex and multi-dimensional, but in this context an interactive medium is one in which the user can influence the form and/or content of the mediated presentation or experience as in [[Steuer's \(1995\)](#)] definition. The degree to which a medium can be said to be interactive depends on a number of subsidiary variables. Five primary ones will be discussed here.

The first variable is the number of inputs from the user that the medium accepts and to which it responds. [[Biocca and Delaney \(1995\)](#)] discuss a variety of user inputs, including

voice/audio input (e.g., speech recognition systems that allow a computer to accept and respond to voice commands), haptic input (e.g., television knobs and buttons and computer mice, joysticks, wands, etc. that record user commands via object manipulation), body movement and orientation (kinetic) input (e.g., data gloves, body suits, and exoskeletons that translate body movements into electronic signals a computer can use to “fit” the user in a virtual environment), facial expressions and eye movements, and psychophysiological input (e.g., heart rate, blood pressure, muscle tension, skin resistance, and brain waves could be input to a computer for mood management or enhanced mediated interpersonal communication); see [[Biocca and Delaney \(1995\)](#)] for a complete discussion of these. The extent to which each of these media input channels contributes to interactivity and to presence has not been demonstrated.

The number (and type) of characteristics of the mediated presentation or experience that can be modified by the user also help determine the degree to which a medium can be called interactive. [[Steuer \(1995\)](#)] identifies the dimensions of temporal ordering (order of events within a presentation), spatial organization (placement of objects), intensity (of volume, brightness, color, etc.), and frequency characteristics (timbre, color). Others might include size, duration, and pace. [[Heeter \(1992\)](#)] suggests that a highly responsive virtual environment, one in which many user actions provoke even unnatural responses (e.g., entering a room produces verbal or musical greetings or rain!) could evoke a greater sense of presence than less responsive environments.

A third variable is the range or amount of change possible in each characteristic of the mediated presentation or experience. Interactivity, and perhaps therefore presence, is

enhanced by expanding the degree to which users can control each attribute of the mediated experience. For example, in a highly interactive virtual environment the user can look out in any direction; move over large distances in each one; proceed at any pace and in any sequence desired; pick up, feel, and move many different objects each with different textures; and change the type and volume level of ambient sounds. In a different context, the larger the vocabulary of a computer speech recognition system (i.e., the more words it recognizes and to which it responds appropriately) the more interactive is the computer use experience.

A fourth variable important for interactivity and presence is the degree of correspondence between the type of user input and the type of medium response. [Steuer (1995)] suggests that the "mapping" between these two can vary from being arbitrary (e.g., pressing a sequence of keys on a keyboard to adjust a visual display) to natural (e.g., turning one's head in a virtual reality system to see the corresponding part of the environment). It is a "widely accepted working hypothesis" that "using our familiar sensorimotor skills to manipulate virtual objects directly by means of whole-hand input devices ... contributes to our sense of presence much more than writing programs, twisting knobs, or pushing a mouse to accomplish the same task" [(Zeltzer, 1992, p. 129; see also Bricken, 1996; Held & Durlach, 1992; Sheridan, 1992)].

The final variable is the speed with which the medium responds to user inputs. The ideal interactive medium responds in "real time" to user input; the response or lag time is not noticeable. Although it accepts and responds to only audio input and uses only a limited frequency range, the telephone is highly interactive in terms of this criterion because interactions via telephone seem to occur in real time (except with calls over exceptionally long distances). On

the other hand, the computational difficulty of processing inputs related to the user's position can cause even an advanced virtual reality system to present images and sounds that lag quite noticeably behind user movements (Heeter notes that "based on their own experiences and observations of others," when forced to choose between "responsiveness to motion and resolution of images, [virtual reality] developers are choosing responsiveness as the more important factor" [p. 263]). See [\[Steuer \(1995\)\]](#) and [\[Zeltzer \(1992\)\]](#) for further discussion of the role of response time.

### *Obtrusiveness of medium*

For an illusion of nonmediation to be effective, the medium should not be obvious or obtrusive – it should not draw attention to itself and remind the media user that she/he is having a mediated experience. [\[Held and Durlach \(1992\)\]](#) argue that presence requires a virtual environment to be "free from artifactual stimuli that signal the existence of the display" (p. 110) (see also [\[Heeter, 1992\]](#)). When possible, the user should not see edges of displays, speakers, microphones, measurement devices, keyboards, controls, or lights. This idea applies to any medium; for example, Mitsubishi boasts that its television sets are "invisible except in brilliant sound and picture" ([\[Mitsubishi, 1992\]](#)). Glitches or malfunctions in the operation of the medium (e.g., computer malfunctions, projection problems in a movie theater) make the mediated nature of the experience obvious and interfere with presence. Medium-specific formal features such as the use of text to identify news anchors and graphic logos to identify channels or networks also draw attention to the artificial and mediated nature of the presentation. [\[Kim \(1996\)\]](#) suggests that noise, broadly defined as "information that is irrelevant to the intended communication regardless of the sensory channel through

which it is transmitted" (p. 10) discourages presence. The form of a media presentation/experience can encourage or discourage noise (and presence) in a number of ways: a virtual reality system can be set up in a quiet room or a noisy arcade, the operator of a movie theater can take steps to discourage patrons from talking during the film, a family can watch television with bright or dim ambient light.

### *Live versus recorded or constructed experience*

- Watching an event as it is happening is believed to give some indescribable fillip to the show, quickening audience concentration and interest, giving them a sense of participation... [The audience member] tends to experience various mixed feelings: curiosity, anxiety, anticipation, hope, and so on. These are not so much a direct result of the action, as his imaginative interpretation of its possible consequences [([Millerson, 1969, p. 200](#))].

We can experience a mediated event as it happens (e.g., "live" breaking news stories or sports events), as the event occurred at an earlier time ("recorded" talk or game shows), or as it never occurred (dramatic television programs, films, and music videos that are constructed from recordings of individual parts of the event that originally took place in a different sequence). The knowledge that a mediated event has been recorded or constructed may make it more difficult for users to perceive the experience as nonmediated.

### *Number of people*

A final media formal feature that may encourage a sense of

presence is the number of people the user can (or must) encounter while using the medium. [[Heeter \(1992\)](#)] suggests that "people want connection [with other people] more than any other experience. Placing more than one person in a virtual world may be an easy way to induce a sense of presence regardless of the other perceptual features of the world" (p. 270). A medium that allows, or requires in the case of the telephone, the user to interact with at least one other person may evoke presence more easily than others. The ability to interact with larger numbers of people (e.g., via multi-player virtual reality systems, video conferencing systems designed for interaction among large groups of people, and telephone conference calls) may lead to even greater presence [[Biocca & Levy, 1995](#); [Steuer, 1995](#)].

### Content variables

While the form or structure of a mediated presentation or experience plays a vital role in generating presence as invisible medium, the content – which includes objects, human and nonhuman characters and personae, tasks and activities, messages, stories, etc. – that is delivered within that form or structure also serves to encourage or discourage presence. Three characteristics of mediated content are identified here: social realism, use of media conventions, and nature of task or activity.

#### *Social realism*

As anyone who watches movies or television knows, the storylines, characters, and acting in some media content is more realistic than in others. In a dramatic film or an interactive video game if the story makes sense and doesn't depend only on coincidence, if the characters act in consistent and understandable ways, if the actors skillfully and convincingly create their personae, the experience is

more likely to “ring true” for consumers. Although it has not been empirically tested, this suggests that such socially realistic experiences are also more likely to evoke a sense of presence. To the extent that the content “rings false” the consumer is reminded of the mediated and artificial nature of the experience and the sense of presence should be destroyed. A number of different labels have been used to identify this concept, including social realism [([Dorr, Graves, & Phelps, 1980](#))], a component of perceived realism [([Potter, 1988](#))], verisimilitude [([Barker, 1988](#))], plausibility [([Elliott, Rudd, & Good, 1983](#))], and authenticity and believability (as indicated above, social realism is distinct from perceptual realism, which is a characteristic of media form rather than media content). While social realism is usually applied to traditional media content, a virtual world can also contain more or less social realism: a world with a green sky, flying trains, and misshapen animals that speak Chinese would surely seem more surreal than real, and therefore would be less likely to evoke presence.

### *Use of media conventions*

Another way media users are reminded of the true nature of their experience is through the use in media content of conventions that users have come to associate specifically with mediated presentations and experience. In film and television when the passage of time is represented by spinning hands on a clock, when the transition to a dream or flashback is represented with a distorted dissolve between images, when dramatic or emotional background music telegraphs the end of a segment, when credits and other text messages are superimposed over story action, when identification logos appear in the corner of the (television) screen, when an unseen narrator describes events, and when plots and dialogue follow predictable formulae, the media user is reminded that rather than having a nonmediated experience he or she is watching

having a nonmediated experience (i.e., she is watching something created and artificial). This realization is likely to interfere with a sense of presence.

### *Nature of task or activity*

For interactive mediated experiences an important part of the content, and most likely a factor in the generation (and effects) of presence, is the nature of the task or activity in which the user participates. As [\[Heeter \(1992\)\]](#) points out, the type of task may make it more or less difficult to establish presence: "Do the tasks of learning or playing or being excited or amused require more or less fidelity to achieve a sense of presence than the task of flying through a molecule to determine its structure?" (p. 264). [\[Sheridan \(1992\)\]](#) suggests that the difficulty of the task and the degree to which the control of the task is manual versus automatic may each influence presence. For media that allow social interaction, social presence and media richness theorists ([\[Perse & Courtright, 1993; Rice, 1992; Short, Williams, & Christie, 1976\]](#)) have shown that high presence media (e.g., visual media such as video conferencing) are judged more appropriate for personal tasks and low presence media (e.g., audio only media such as the telephone or written media such as a business letter) are judged more appropriate for simple information-transfer tasks. It seems likely that tasks and activities which involve ambiguous verbal and nonverbal social cues and sensitive personal information take greater advantage of a medium's potential to offer presence than do simple nonpersonal tasks. Consistent with this idea, the intensity and valence of emotion that occurs during mediated activities (e.g., as a result of conflict, strong empathy, sexuality, etc.) seem likely to affect presence. Very little is known about the influence of any of these task/activity variables, however.

### Media user variables

The identical media form and content might generate a sense of presence in one media user and not in another, or might generate presence in the same user on one occasion but not another one. Although almost no research has been conducted on the question, it seems clear that characteristics of media users are important determinants of presence. Two variables that are likely to be especially important in this regard are highlighted here: the media user's willingness to suspend disbelief and her/his knowledge of and prior experience with the medium.

### *Willingness to suspend disbelief*

A person participating in a videoconference, exploring a virtual environment, or watching an IMAX film or a television program has chosen to engage in the activity and knows that it is a mediated experience. She or he can encourage or discourage a sense of presence by strengthening or weakening this awareness. If we want to increase a sense of presence for ourselves we try to "get into" the experience, we overlook inconsistencies and signs that it is artificial, we suspend our disbelief that the experience could be nonmediated. When we want to decrease presence, as when we watch frightening or disturbing media content, we remind ourselves that "this isn't really happening; it's only a movie/TV show/game/etc." The idea of suspending disbelief has been applied to live theater, in which the belief that is suspended concerns the "pretend" nature of the characters and action (Coleridge, as cited in [[Laurel, 1991](#)]); literature, television, and film [([Bleich, 1984](#))]; computer games [([Laurel, 1991](#))]; and virtual reality [([Steuer, 1995](#))]. The willingness to suspend disbelief probably varies both across individuals (e.g., some people are so naturally curious about how a medium works that they simply can not suspend disbelief and enjoy the media experience) and within the same individuals across time (e.g., it may be more difficult to

suspend disbelief and escape to a mediated world when one is preoccupied by problems at home or at work). Of course, willingness to suspend disbelief is also influenced by many characteristics of media form and content.

### *Knowledge of and prior experience with the medium*

It should be easier for users unfamiliar with the nature of a medium and how it functions to experience presence while using the medium. An engineer can not help but notice flaws in a virtual environment or the image in a high definition television system because she/he either knows or wants to know what is responsible for the flaw; this knowledge reminds her/him that the experience is mediated. The situation is analogous to a magician who knows how a trick is performed and is therefore unimpressed with the illusion.

Closely related to this is the effect of experience with a medium. The first time a person uses an advanced medium capable of generating a sense of presence, especially interactive media such as virtual reality, she or he is unfamiliar with the medium, how it is used, the nature of the experience. This unfamiliarity likely discourages a sense of presence, but as the user becomes more expert at using and manipulating the medium and more comfortable with it in general, this effect should fade (see [Held & Durlach, 1991]). Continued experience may then either increase presence ("Having 'been there before' helps you believe you are there again" [[Heeter, 1992, p. 263](#)]) or decrease it as the well-known habituation effect causes an initially impressive and novel sense of presence to fade as users become more experienced.

### *Other user variables*

A number of other characteristics of media users are likely

to influence presence and deserve attention from researchers. [Heeter (1992)] suggests that personality type may be important. [Kim (1996)] found that subjects who liked the infomercial genre and for whom the advertised product (exercise equipment) was personally relevant reported that they experienced greater presence than other subjects. Other potentially important variables include a user's preferred representational system (visual, auditory, or kinesthetic) [(Slater & Usoh, 1993)], their cognitive style [(Richardson, 1977; Witkin & Goodenough, 1981)], the degree to which they "screen" complex stimuli [(Mehrabian, 1976)], their level of sensation-seeking [(Apter, 1992; Zuckerman, 1994)], their need to overcome loneliness, their mood before and during media use, and their age and gender.

### Causes of Presence as Transformed Medium

As discussed above, presence is defined here as a perceptual illusion of nonmediation in which the medium appears to become either invisible, or transformed into a social entity. We have discussed the research and speculation concerning the factors that encourage or discourage presence as invisible medium. We now turn to evidence and conjecture concerning the causes of presence as transformed medium. A series of studies has shown that media users "use social rules to interpret and respond to the behavior of computers and computer-based technologies" and that these responses are "easy to generate, commonplace, and incurable" [(SRCT, 1996)]. Some of the media and user characteristics that encourage these responses are the same as those discussed above while others are not. Key variables concerning media form, media content, and characteristics of media users that may encourage or discourage this type of presence are briefly mentioned in this section.

## Form variables

### *Interactivity*

To perceive a computer or other technology as not an artificial medium but a social entity, the user needs to be able to interact with it [([Nass & Sundar, 1996](#))]. There are two aspects of interactivity that are especially important: the number of previous user inputs that are acknowledged in the current response of the technology [([Rafaeli, 1988, 1990](#))], and the speed (or lag time) of the response to user input. A computer which appears to have no memory of recent events in an interaction, or one that is excessively slow in responding, should be less likely to evoke the illusion that the medium is a social entity.

### *Use of voice*

Computer-based technologies present information to users in text on a video screen and, increasingly, with voices (either recorded human voices or computer-generated ones). The use of voice is a potent social cue and has been shown to elicit perceptions that one computer is made up of multiple distinct entities [([Nass & Steuer, 1993](#))] and to evoke gender stereotypes [([Nass & Green, 1993](#); [Nass, Steuer, & Tauber, 1994](#))]. It seems likely that voices that sound more human (with higher audio realism and fidelity) enhance the illusion of interaction with a social entity.

### *Medium size and shape*

Computers and television sets typically are moderate-sized boxes that contain a viewing screen that compels the user's primary visual attention; one could argue that the size and shape of these technologies are somewhat similar to those of small people and that the viewing screen is somewhat akin to a human face. This size and shape therefore seem more likely to evoke a sense of presence, and social

responses from users, than much larger and less self-contained media such as video conferencing systems, IMAX film screens, or virtual reality headsets.

## Content variables

### *Social realism*

To evoke presence as transformed medium and generate social responses, it is not storylines, characters, and acting that must be perceived as realistic but the behavior of the computer or other medium itself: when the computer provides plausible responses to user inputs and does not act erratically or break down ("crash"), it is more likely to be perceived not as a medium but as a social entity.

### *Use of media conventions*

Designers often give computers and computer-based technologies a characteristic manner of providing information. Computers often use "computer-ese" instead of more natural language. When computers look, sound, and behave like computers they follow conventions that remind users that they are human-made tools rather than social entities. A computer that uses natural and informal language should more easily evoke presence [([Nass & Steuer, 1993](#))].

### *Nature of task or activity*

We use computers to accomplish many tasks; some of these tasks have traditionally been performed only by computers (or other technologies) while others traditionally have been performed by humans. For example, database management and word processing are tasks we associate only with computers, while making financial transactions and teaching are tasks associated with human bank tellers and teachers. We may therefore be more likely to feel that we

are dealing with a social entity when we use (interact with) an automatic teller machine or an educational computer program than when we use a database or word processing program.

### Media user variables

#### *Knowledge of and prior experience with the medium*

Nass and his colleagues have found that even experienced computer users perceive and treat computers as social entities and not merely tools [([Nass & Moon, 1996a](#))]. Most of the subjects in their studies are undergraduate college students who have grown up using computers.

Nevertheless, extensive experience using a computer, knowing how it works, even understanding computer architecture and programming, may reduce a person's tendency to respond to it as a social entity.

#### *Other user variables*

Age may play a role in the degree to which people experience presence and perceive a medium as a social actor. [[Turkle \(1984\)](#)] noted that while adults dismiss computers as "just a machine," many young children she observed playing with interactive computer games treated them as a psychological entity; they "entered into 'social relationships' with the machine in which they [got] competitive, angry, and even vindictive" (p. 47) (see also [[Hall & Cooper, 1991](#)] regarding college students' anthropomorphism of computers). More recently [[Turkle \(1995\)](#)] wrote that adults in the mid-1990s are still less likely than children to grant that "advanced computer programs are even close to conscious," although they're more willing now to consider the possibility of a self-conscious machine (p. 84). Although a gender difference based on the male-dominated nature of computer design and use is apparently

fading [(Turkle, 1995)], gender may also influence presence. A number of personality characteristics (e.g., introversion/extroversion, locus of control, and dominance/submissiveness) may be relevant as well.

## The Effects of Presence

One of the most interesting aspects of the presence phenomenon concerns the physiological and psychological consequences of the perceptual illusion of nonmediation. Here again much of what can be said must be based on conjecture, but even with only a small minority of claims concerning the effects of presence tested and confirmed by researchers, the importance of the concept for those who design and use media technologies is already clear. First the physiological and then the psychological effects of presence as invisible medium are examined. Following this the psychological effects of presence as transformed medium are briefly considered.

### Physiological effects of presence as invisible medium

Effects of presence as invisible medium related to arousal, vection and motion sickness, and a number of other physiological changes are identified here.

#### *Arousal*

Films, video games, and virtual reality entertainment systems that evoke presence are often designed to be arousing, even exhilarating experiences. Evidence that the creators of these experiences succeed comes from the comments of media critics and creators. Film critics often note the arousing effects of viewing an action film, e.g., "'Speed' is an exhilarating shot of adrenaline" [(Gleiberman, 1994)] and "'The River Wild:' A Pulse Pounding Thrill Ride" [(Travers, 1994)]. Filmmaker Bed Shedd believes his and other IMAX movies "create a visceral more than visual

experience" [[Honan, 1990, p. C15](#)]. A small amount of survey and experimental research has provided evidence that is at least consistent with these observations [([Heeter, 1995](#); [Lombard, Reich, Grabe, Campanella, & Ditton, 1995](#))].

We know that people use television viewing to increase or decrease their arousal levels [([Zillmann, 1991](#))] and it seems likely that the range of this manipulation is expanded with media that evoke presence: A virtual environment can be filled with highly arousing violent or sexual content on the one hand or highly relaxing content (e.g., a deserted beach or forest) on the other. If an interactive experience inside one of these environments seems to be nonmediated, this should increase its potential to arouse or relax the user.

### *Vection and simulation sickness*

When presence is evoked with rapid point-of-view movement in virtual reality, video games, film, and even television, media users can experience the illusion that they are actually moving through the mediated environment. This illusion of self-motion is called vection. After watching short video segments featuring rapid point-of-view movement subjects in one study [([Lombard, Reich, Grabe, Campanella, & Ditton, 1995](#))] reported experiencing an enjoyable sense of physical movement as they seemed to be riding a roller coaster, speeding through twists and turns in a bobsled course, or taking a lap around the Indianapolis 500 race track. While this type of motion effect is often enjoyable, there are a number of unpleasant motion effects that can result when presence is combined with the illusion of movement. An important concern among designers of virtual reality systems is how to minimize simulation sickness (a kind of motion sickness) and its symptoms: dizziness, eyestrain, disorientation, dysphoria, standing and walking unsteadiness, even nausea [([Bianca, 1997](#))].

walking unsteadiness, even nausea [([Green, 1997](#), [Kennedy, Fowlkes, & Lilienthal, 1993](#); [Kennedy, Lane, Berbaum, & Lilienthal, 1993](#))]. In some cases these symptoms occur because the media experience is very similar to a nonmediated experience in which participants typically have the same responses (e.g., in a flight simulator or simulation theater). In other cases they occur because of time lags between user inputs and computer responses or discrepancies between seeing images that suggest movement but experiencing no actual physical movement (e.g., in IMAX theaters or virtual reality systems) [([Azar, 1996](#))].

### *Other physiological effects*

Automatic responses such as flinching, ducking, and tightly grasping one's chair are also potential effects of presence. And a number of subtle aftereffects of using presence-invoking technologies have been noted even as long as two weeks following use, including reduced eye-hand coordination, and "flashbacks, illusory sensations of climbing and turning, and reduced motor control" [([Azar, 1996, p. 25](#))].

### Psychological effects of presence as invisible medium

The focus of much of the interest in presence as invisible medium concerns a wide range of psychological effects said to result from this perceptual illusion. Despite interest in these effects, research concerning them has only just begun. Presence in general is thought to have an intensifying effect on media users, increasing or enhancing enjoyment, involvement, task performance and training, desensitization, persuasion, memory, and parasocial interaction. Each of these effects is discussed briefly below.

### *Enjoyment*

Perhaps the most prominent psychological impact of presence is enjoyment and delight. Technologies that provide a strong sense of presence, including simulation rides, IMAX theaters, and virtual reality entertainment, are increasingly popular with the public and financially lucrative for those who design and market them. The reasons for this popularity seem to go beyond novelty and fad – the experiences these media provide are highly entertaining and, simply put, fun. There is remarkably little research available concerning the effect of presence on enjoyment, perhaps because we tend to take this effect for granted. In one study [(Heeter, 1995)], however, users of a virtual reality entertainment system reported that they enjoyed the experience and those who said they felt they had “entered another world” reported significantly greater enjoyment.

### *Involvement*

Media experiences that evoke presence tend to be highly involving. While we might be interested in, and even cognitively and emotionally engaged by, mediated information that we perceive as mediated, such information is likely to seem more distant, abstract, dry. Presence implies a direct and natural experience rather than just the processing of symbolic data and is therefore likely to be more compelling. In an analysis of survey responses from 312 users of the BattleTech virtual reality game, [Heeter (1995)] found that involvement (made up of the items “fun,” “exciting,” “competitive,” “addictive,” and “intense”) was the highest rated (8.7 out of 10) of several factors. Although part of the involvement effect is likely due to the interactive, and therefore active rather than passive, nature of high-presence media, there seems to be more at work. Individuals who have “passively” viewed an IMAX film can confirm that this effect of presence is not limited to interactive media. Obviously involvement also depends on the media content and the interests and experiences of the

user.

### *Task performance*

Many presence-evoking media technologies, especially video conference systems and teleoperation systems, have been developed so that people can accomplish tasks with great efficiency. While these technologies often make it possible to do something (e.g., conduct a meeting, treat or operate on patients, or explore the environment) in a new way, there is limited research available to indicate whether these new ways are more effective or efficient (even excluding cost considerations) than the old ways. In discussing teleoperation, [[Sheridan \(1992\)](#)] notes that what is most important in performing a task is having enough information in the proper form; he asks: "Is [a] sense of 'presence' simply a concomitant benign phenomenon, or even a distraction? Or is the quality of 'presence' the critical psychological indicator of physical stimulus sufficiency?" (p. 120). [[Held and Durlach \(1992\)](#)] suggest that presence should enhance performance in teleoperator situations "in which the tasks are wide ranging, complex, and uncertain" because in those cases the operator needs to be able to extend her/his adaptive sensory-motor and problem-solving skills to another physical environment. In one study, [[Pausch, Shackelford, and Proffitt \(1993\)](#)] demonstrated that greater immersion in a virtual environment causes subjects to perform search tasks more efficiently, but more research is needed to identify the characteristics of tasks (and then the specific tasks) for which presence enhances performance.

### *Skills Training*

One of the most important groups of tasks for which presence-evoking media have been designed and used involves skills training. Virtual reality systems have been

used to train aircraft pilots, air-traffic controllers, military ground troops, and surgeons, and while questions about the advantages of this training over more conventional methods can and should be asked, there are obvious benefits of this approach. For example, it certainly seems likely that pilots learn more effectively from flight simulator experiences than from low presence media such as textbooks, although [[Biocca and Delaney \(1995\)](#)] note that if the forces a pilot encounters in a simulator differ from the ones she/he encounters in actual flight the difference may pose an important danger). The skills that could be taught in high-presence media are nearly unlimited. [[Azar \(1996\)](#)] reports that researchers at the Army Research Institute (ARI) in Orlando, Florida found that people who were trained using virtual reality to navigate routes in a real building performed much better than those who were trained with photographs and only slightly worse than those who trained in the actual building. [[Regain and Shebilske \(1992\)](#)] report that subjects who used a virtual reality system to learn how to navigate a large environment found the experience more engaging and performed more accurately than those trained with a two dimensional representation of the same environment.

### *Desensitization*

A medium that can mimic nonmediated experience may be particularly effective in desensitizing users to various stimuli, with positive or negative consequences. For example, virtual reality has recently been shown to be useful in treating people who have a fear of heights [[\(Rothbaum, Hodges, Kooper, Opdyke, Williford, & North, 1995\)](#)]. The desensitizing effects of exposure to violent and sexual content in other media [[\(Fenigstein & Heyduk, 1984; Zillmann & Bryant, 1982\)](#)], in which users become less sensitive and more callous after prolonged exposure, might

also be accelerated or increased by presence.

### *Persuasion*

Much of the content media users encounter, especially in more traditional media, is intended to persuade them (usually to purchase a product or service). [Kim (1996)] investigated the role of presence in the success of such persuasion attempts by having subjects view a 15 minute infomercial in a visually immersive or nonimmersive setting and then indicate their preference for the advertised brand of the product (an exercise machine) or another brand, as well as their confidence in this choice. Subjects who reported a greater sense of presence (conceptualized by Kim as "arrival" in the mediated environment) expressed more confidence in their brand selection. More research is needed of course, but the possibility that under some circumstances presence can enhance the persuasiveness of media content is provocative.

### *Memory and social judgment*

Some studies have suggested that presence, or characteristics of media that are thought to encourage presence such as image size, may improve memory for media content [(Detenber & Reeves, 1996; Ditton, 1997; Kim, 1996; Reeves, Lombard, & Melwani, 1992)]. On the other hand, it has also been suggested that mediated experiences high in presence may lead to difficulties for our memory, especially our memory for the source of stored information [(Ditton, 1997; Kim 1996; Shapiro & Lang, 1991; Shapiro & McDonald, 1995)]. These mediated experiences may be encoded into memory in a manner so similar to nonmediated experiences that when they are later retrieved errors in attributing the source of the memory (source-monitoring errors) occur.

[Ditton (1997)] tested whether watching a mediated

[Pittori \(1997\)](#) tested whether watching a mediated presentation on a 52-inch, color television enhanced with Dolby surround-sound (enhanced condition) would lead to greater evaluations of presence and to more source-monitoring errors than when viewers watched on a 5-inch, black and white television with monophonic audio (limited condition). Subjects viewed 13 short scenes from films that portrayed a wide variety of events (e.g., a woman in Blood Simple defends herself against a would-be rapist). Source-monitoring errors were indicated by changes in subjects' agreement with a series of statements about these events (e.g., "Women are able to successfully defend themselves against attackers"). After controlling for propensity to screen stimuli [([Mehrabian, 1976](#))], results indicated that subjects who watched in the enhanced condition reported a greater sense of presence ("participation" and "involvement") in the mediated environment than those in the limited condition. And significant and sustained social judgment change was found, even for subjects who reported they were not aware that they used the information portrayed in the fictional scenes to make the social judgments. Errors in attributing source appeared to lead subjects to unknowingly apply knowledge gained from the fictional scenes to judgments about the real world (akin to effects discussed in Gerbner's Cultivation Analysis).

### *Parasocial interaction and relationships*

A large literature in communication studies [(e.g., [Horton & Wohl, 1956](#); [Houlberg, 1984](#); [Levy, 1979](#); [Perse & Rubin, 1989](#); [Rubin & McHugh, 1987](#); [Rubin, Perse, & Powell, 1985](#))] has shown that viewers perceive and in some cases respond to people on television as social entities in what has been termed parasocial interactions and parasocial relationships. Other, less empirical evidence (see above) suggests that the same phenomenon extends to our responses to computer characters and agents. By making

the mediated experience seem more natural and “real,” presence may intensify these parasocial phenomena among at least some media users. For example, it might be quite difficult to remember that a character with whom one interacts in a sophisticated virtual reality system is actually just a sophisticated set of computer-generated images and sounds.

### Psychological effects of presence as transformed medium

When presence leads users to perceive a medium (e.g., a computer) as a social entity, at least some of the users' perceptions, thought processes, and emotional responses are similar or identical to those found in human-human interaction. The psychological effects of this kind of presence are therefore potentially as diverse as those generated by nonmediated social interaction. Computer users recognize a computer's “personality” as submissive or dominant and, as in human-human interaction, respond more favorably to one with a personality similar to their own [([Nass & Moon, 1996b](#); [Nass, Moon, Fogg, Reeves, & Dryer, 1995](#))]. Users apply gender-stereotypes to judgments of computers: they prefer computers with female voices for teaching about love and relationships and computers with male voices for teaching about technical subjects, and they believe self praise more readily from female-voiced computers and other praise more readily from male-voiced computers [([Nass, Steuer, & Tauber, 1994](#))]. As in human-human interaction, users perceive a computer that is labeled as their teammate as providing better information and being more cooperative than a computer without the label [([Nass & Moon, 1996a](#))]. As technologies become more sophisticated and we more regularly find ourselves perceiving and interacting with them as social entities, we also may feel an increasingly strong need to view humans as superior to, or at least different from, machines [([Nass,](#)

[Lombard, Henriksen, & Steuer, 1995; Turkle, 1995](#)]].

## Future Presence Research

This review of research, theory, and conjecture concerning the intriguing and important phenomenon of presence demonstrates that research on presence is in its infancy. We know relatively little about the characteristics of a medium's form and content and the characteristics of medium users that encourage a sense of presence, and we know relatively little about the effects of presence once it is evoked. Given the practical and theoretical importance of the concept, what is needed is a systematic program of research to investigate the many aspects of presence.

Systematic research on presence requires first standardized conceptual and operational definitions of the term. We have provided a conceptual definition here which we hope will at least serve as a starting point. Research is needed to determine whether the complex variety of characteristics of medium and user suggested here and elsewhere contribute to one identifiable type of perceptual illusion or experience, which then leads to a complex variety of influences, again depending on characteristics of medium, user, and context. Based on this research we can begin to determine whether "presence as invisible medium" and "presence as transformed medium," as well as the six conceptualizations discussed above, represent distinct dimensions in a multidimensional concept of presence (or distinct experiences and therefore distinct concepts). In any case thorough understanding of the phenomena and research findings discussed here can only come with a thorough and systematic conceptualization of presence.

Many researchers [[Barfield & Weghorst, 1993](#); [Barfield, Zeltzer, Sheridan, & Slater, 1995](#); [Sheridan, 1992](#)] have called for the development of a standardized measure of

presence; to our knowledge only [\[Kim \(1996\)\]](#) has taken up the challenge. Following [\[Sheridan \(1992\)\]](#) and [\[Held and Durlach \(1987\)\]](#) we suggest that the instrument developed contain both subjective measures that could be administered via a questionnaire and objective measures that would assess media users' physiological and behavioral responses during media use. Many examples of subjective questionnaire items have been mentioned here; others should be created and all of them carefully tested to determine their validity and reliability as measures of presence. Physiological and behavioral measures (e.g., "If a virtual object is suddenly seen (and/or heard binaurally) to be on a collision course with one's head, does the subject blink, or duck?") [\[\(Sheridan, 1992, p. 121\)\]](#) may also be valuable. Measures of skin conductance, blood pressure, heart rate, muscle tension, respiration, and dysphoria can be applied both as subjects observe a mediated presentation or participate in a mediated activity and as they observe or participate in the same experience in a nonmediated setting (although the "same" experience might be quite difficult to arrange); the degree to which the measurements correspond would be one indication of presence.

We also need to standardize our manipulations of the variables thought to encourage presence, including the specific stimuli used in experimental research, as well as our measures of the consequences of presence. An example of the problems that a lack of standardization can cause can be found in studies of the effects of image size [\[\(Lombard, Grabe, Reich, Campanella, & Ditton, 1996\)\]](#). The authors of these studies used different display technologies (resulting in different and unusual framing of images), different screen sizes (both 10 and 35 inch screens were labeled "small"; both 42 and 90 inch screens were labeled "large"), and equipment that unintentionally produced pictures of

different quality (even within the same study). And the subjects in these studies all were shown different types and amounts of media content. All of this makes comparisons across studies difficult and has slowed our exploration of this key variable.

There are many important and interesting questions that systematic research on presence should address: what and how great a role does each variable identified as a potential contributor to presence play in the phenomenon? Which are most important? How do they interact? Can they be manipulated together to control the extent and nature of presence? How many distinct dimensions of presence are there? Which are the most important causes and consequences of each of these? Which are the most reliable effects of presence? How can they be modified to maximize enjoyment, learning, and performance?

Finally, research on presence may also help us answer some of the most provocative and philosophical questions raised by traditional and especially new technologies that offer us mediated experiences that seem increasingly like nonmediated ones. Is presence necessarily a good thing? Are there situations in which presence is too intense for users (should technologies be designed with a user control of presence)? Can presence contribute to psychoses and other psychological problems (see [[Cartwright, 1994](#)])? Why do we get a sense of presence from relatively primitive cues? Is it, as [[Reeves and Nass \(1996\)](#)] have suggested, a result of our long evolution that has prepared us to initially treat all objects and people in our environment as potential threats rather than symbolic reproductions? And why do we so strongly desire a sense of presence? Is it to experience dangerous or socially unacceptable events without danger or social sanction? Is it to experience events that we otherwise could not experience, such as those in our past and our many possible futures? Is it part of humankind's

and our many possible futures: Is it part of fulfilling our well-known desire to control our environment? Or is it just for convenience and efficiency – the best way to get things done? And how will our essentially social human nature lead us to use technologies that allow us to have seemingly nonmediated experiences – will we interact with created characters or real people in these media? If we choose the latter, will presence help break down stereotypes and misunderstandings in what will seem like a neighborhood rather than a global village? Regardless of the answers to these and many other questions, a fascinating and rewarding exploration awaits us.

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