

**MEASURING PRESENCE:
A LITERATURE-BASED APPROACH TO THE DEVELOPMENT OF
A STANDARDIZED PAPER-AND-PENCIL INSTRUMENT**

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Although it is the focus of a growing number of scholars in communication, computer science, psychology, and cognitive science, there is little agreement concerning the nature and measurement of presence. Marvin Minsky (1980) used the term "telepresence" to refer to teleoperation technology that provides the user with a "remote presence" in a different location via feedback systems that allow her to "see and feel what is happening" there. In 1991, the term was adapted and shortened when the journal Presence (MIT Press) was founded to provide a forum for "current research and advanced ideas on teleoperators and virtual environments." By 1997 a review, by Lombard and Ditton identified six different conceptualizations of presence in a diverse set of literatures: presence as social richness (the "warmth" or "intimacy" possible via a medium), realism (perceptual and/or social), transportation (the sensations of "you are there," "it is here," and/or "we are together"), immersion (in a mediated environment), social actor within medium (e.g., parasocial interaction), and medium as social actor (e.g., treating computers as social entities). The authors incorporated all of these conceptualizations of presence into a single definition: "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 the literature suggests that presence is a multi-dimensional concept, little research is available to confirm the existence of, or the relationships among, the separate dimensions. Further, the lack of a consensus regarding a conceptual definition of presence is one of the reasons that there is no standard technique or instrument for measuring presence responses. This paper describes a study currently being conducted at Temple University in which paper-and-pencil measurement items corresponding to each conceptualization (dimension) in the presence literature are being developed and tested. The two primary goals of the study are 1) to test major theoretical conceptualizations of presence and its components empirically, and 2) to develop a short, standardized, paper-and-pencil measurement instrument for presence that can be utilized for research across diverse media, stimuli, and subject populations.

A review of the presence conceptualizations identified by Lombard and Ditton (1997) is followed by a description of the current study.

SIX DIMENSIONS OF PRESENCE

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).

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. 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. 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

Three related presence conceptualizations all involve the idea of transportation.

"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). 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). Virtual reality takes users to a virtual environment and leads to the "suspension of dis-belief that they are in a world other than where their real bodies are located" (Slater & Usoh, 1993, p. 222). Sheridan (1992a) 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." 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 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).

"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; Rockewell, 1997; and Waters & Barrus, 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). Psychological immersion occurs when users feel 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 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 para-social 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. Rubin, Perse, and Powell (1985) have developed the Parasocial Interaction Scale to measure these responses.

The phenomenon isn't limited to people on 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 Null," the computerized bartender/news anchor on MSNBC's "The Site"). Microsoft's Office 2000 features a personal assistant that can take one of several animated forms, creating 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). A number of computer programs are available in which users interact with virtual entities, including Microsoft's Office 2000 in which a personal assistant takes one of several animated forms, the virtual pets of Dogz: Your Computer Pet (Dogz, 1995), the cyberpet on a keychain called "The Tamagotchi" ("cute little bird") (Boccella, 1997), and a product called Princess Maker in which the user "raises" a female animated character (Coleman, 1996, p. D3).

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. Beginning with Alan Turing's "Turing Test" in 1950 there has been much debate about the potential of modern computers to mimic humans. 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. 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 (this 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.

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 itself as a social entity.

SYNTHESIS: PRESENCE EXPLICATED

While the conceptualizations discussed above vary considerably, they share a central idea. Each represents one or more aspects of a 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). This illusion of nonmediation can occur in two distinct ways: 1) the medium can appear to be invisible or transparent, with the medium user seeming to share the same physical

environment with the medium content (objects and entities); and 2) the medium can appear to be transformed into something other than a medium, a social entity.

A medium that becomes invisible 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 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).

MEASURING PRESENCE

The literature suggests that these conceptualizations represent separate types or dimensions of presence, but this has not been tested empirically. The lack of a standardized conceptual definition of presence is one reason there is also no standardized measurement instrument for the concept. Many researchers (Barfield & Weghorst, 1993; Barfield, Zeltzer, Sheridan, & Slater, 1995; Prothero, Parker, Furness, & Wells, 1995a; Sheridan, 1992a) have called for the development of a standardized measure of presence. Systematic research on a number of important research fronts can not proceed without a measure or measures that permit comparisons across media, stimuli, and subject populations.

One possible approach to the measurement of presence is the use of physiological measures such as skin conductance, blood pressure, heart rate, muscle tension, respiration, posture, ocular responses, and so on. However, Prothero, Parker, Furness, and Wells (1995a) point out that "there is currently no evidence that physiological measures correlate well with presence. Sheridan (1992b) notes that "telepresence (or virtual presence) is a subjective sensation, much like mental workload, and it is a mental model -- it is not so amenable to objective physiological definition and measurement" (p. 209). Still, these (and other) "objective measures" would logically be appropriate to assess presence when subject responses can be predicted to mirror certain physiological responses that would occur if the mediated experience had been nonmediated (in some cases such comparisons might actually be made). For example, a person riding a roller coaster should respond in somewhat predictable ways that might be mirrored during a virtual roller coaster ride. Sheridan (1992a) proposes a related behavioral measure: when "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?" (p. 121).

Another possibility is the use of "direct" or "Class A" measures of presence (Prothero, Parker, Furness, & Wells, 1995a). Subjects are presented with virtual and real cues which conflict (e.g., real inertial oscillation that conflicts with virtual visual cues); the degree to which subjects respond to the virtual cues rather than the real ones indicates presence perceptions. Although such measures may prove reliable and valid, they are expensive and limited to studies of specific media.

Most measures used in studies of presence involve subjective, paper-and-pencil questionnaire items. Although there is evidence that such measures can be reliable and valid (see Prothero, Parker, Furness, & Wells, 1995b), currently different researchers use different items, often based on different conceptualizations, to test different hypotheses in a variety of different contexts, making comparisons among studies difficult. What is needed is a paper-and-pencil measurement instrument that could be used (with nominal adjustments) across different media, stimuli, and subject groups. At the same time, we need empirical evidence regarding the validity of and relationships among, the different presence conceptualizations. The study described below is one attempt to accomplish these goals.

METHOD

To assess the literature-based conceptualizations of presence and develop a standardized measurement instrument, a questionnaire was designed and is being administered to approximately 300 subjects in each of two conditions, high presence and low presence.

Stimulus Preparation and Description

The characteristics of the high and low presence conditions were selected based on values of variables identified in the presence literature as encouraging and discouraging presence responses among media users. Because of the exploratory nature of the study, the conditions were limited to non-interactive audio-visual presentations. Print stimuli were excluded because the processing strategies it invokes are arguably distinct; stimuli involving motor interaction with virtual environments or stand-alone media such as computers were excluded given the exploratory nature of the study, the difficulties of characterizing the likely ability of relatively low image quality (resolution) and high interactivity to evoke presence responses, and the practical limitations of testing a large number of potential measurement items (a followup using interactive stimuli is planned).

In the high presence condition subjects viewed a presentation of the IMAX 3-D film "T-Rex: Back to the Cretaceous" at the Sony IMAX Theater in New York (Sony Lincoln Square, Broadway at 68th Street, Manhattan). The presentation was expected to maximize viewers' presence responses because it featured:

- high resolution images
- large image/field of view
- color
- 3D
- normal to loud volume levels
- multi-channel surround sound audio
- unobtrusive medium/environment (dark room)
- relatively high social realism
- relatively little use of media conventions
- subjective camera angles

The film "showcases a break-through for IMAX and IMAX 3D technology. Photo-realistic, 3D stereoscopic dinosaurs are brought to life, incorporating the most up-to-date scientific knowledge about the creatures from the deep past of more than 65 million years ago. The film features the visual special effects wizardry of Blue Sky / VIFX under the guidance and supervision of L-Squared Entertainment. Many of the three-dimensional effects appear to exist not only in the film frame but also in the area in front of the movie IMAX 3D movie screen, even closer to the audience for a thoroughly immersive IMAX Experience" (<http://www.independentproject.com/WFH/TREX/Tprod.html>). For a description of the film's storyline see <http://www.imax.com/t-rex/Tthestory.html>.

In the low presence condition, subjects are viewing an episode of the American situation comedy "Three's Company" on a 12-inch black and white television set in a well lit office on Temple U.'s campus. The presentation was expected to minimize viewers' presence responses because it featured:

- low resolution images
- small image/field of view
- black and white images
- 2D images
- normal to quiet volume levels
- single-channel, non surround sound audio

- obtrusive medium/environment (lit room not typical for viewing)
- relatively low social realism (unrealistic situations, corny dialogue)
- use of media conventions (e.g., laugh track)
- no subjective camera angles

Dependent Measures

To develop a questionnaire to measure presence a list of items used by other researchers was compiled and refined (to download an MS Word file containing this list, [click here](#)). A questionnaire containing a set of 103 items measuring presence responses corresponding to each of five conceptualizations of presence (the sixth dimension was excluded; see discussion above) and additional items measuring subjects' tendency to suspend disbelief, considered a critical individual difference variable, was administered in both conditions. Other items asked subjects to report an overall evaluation of the viewing experience and of the quality of the picture and sound; their prior experience with the medium and content, the screen size of the television they watched most often, and the distance from which they typically watched that television; their prior experience with and knowledge of 3D IMAX technology, video games and interactive virtual reality; and their age, race, and gender (to download an MS Word file containing the complete questionnaire, [click here](#))

Participants

The 307 volunteers who participated in the high presence condition were between 16 to 76 years of age ($M = 36$, $SD = 12$). One hundred forty-nine of the subjects were men and 150 were women. Fifty-seven percent ($n = 175$) were white, 16.9 percent ($n = 52$) were Hispanic, 10% ($n = 31$) were Asian, 6% ($n = 19$) were African American, and the remainder indicated they were of other races. Low presence volunteers are being recruited from staff and students at Temple University (beginning during fall 1999). Since data collection is not complete the characteristics of the low presence volunteers are not yet compiled.

Procedure

In the high presence condition each potential volunteer was approached by a member of the research team prior to their entering the IMAX theater and asked to participate for a chance to win a variety of media related prizes (a TV, handheld computer, or cash, and a 'movie night out for two'). Immediately after exiting the theater, the volunteers were given the questionnaire, a clipboard, and a pen and directed to one of several benches in a relatively self-contained area of the theater lobby. When they returned the completed questionnaire (which took from 10 to 30 minutes) they filled out a raffle ticket for a later prize drawing. To see photographs of the theater and administration of the questionnaire, [click here](#).

In the low presence condition volunteers are being sought via classroom visits, posted and distributed flyers, and announcements distributed with university paychecks and in university publications. Participants are offered the same opportunities to win media related prizes as those in the high presence condition. The one to three volunteer(s) who agree to participate at a given time is/are met by a member of the research team and escorted into a small brightly lit office that contains a television, a video cassette recorder, three chairs, a desk and shelving units. The chairs are placed such that all viewers can view from the same distance from the screen (60 inches from the front of the screen; this translates to a visual angle of 11.42 degrees). The experimenter explains that the subject will view an episode of a situation comedy and then complete a questionnaire seeking their reactions to the show. The entire procedure takes approximately 55 minutes.

RESULTS

As of this writing (February 22, 2000) data entry and preliminary analysis for the high-presence condition is complete and data gathering for the low-presence condition is proceeding. The analysis plan is as follows:

Exploratory factor analyses on all 103 presence measures across all approximately 600 subjects to determine which factors (dimensions) emerge.

Analysis of mean differences for all 103 presence measures for the two groups of subjects (high and low presence) to identify items that distinguish between the two conditions and thereby establish item validity.

Separate sets of exploratory factor analyses on all 103 presence measures for the approximately 300 high presence subjects and for the approximately 300 low presence subjects to identify similarities and/or differences in the factors (dimensions) that emerge.

Item analysis and scale construction for each dimension identified in the factor analyses to build an efficient set of presence scales and/or indices.

Analysis of mean differences for all presence scales and/or indices to establish scale/index validity.

Preliminary factor analysis of the responses of the 307 subjects in the high presence condition have yielded results that are consistent with Principal Components (PC) and Principal Axis Factoring (PAF) extraction methods, with oblimin and varimax rotation, and with solutions requiring different numbers of factors. The seven dimensions that emerge are:

1. **Immersion:** Items that measure media users' sense of immersion, involvement, and engagement in the mediated environment (what some may consider 'traditional presence').
2. **Parasocial interaction:** Items related to crossing the border between the actual physical environment and the mediated environment in order to interact with people in real time (these items do not measure parasocial relationships, which occur at times other than during media use).
3. **Parasocial relationships:** Items from the standardized measure of parasocial phenomena concerning about feelings of friendship, etc. toward people in the mediated environment.
4. **Physiological responses:** Items from the Simulator Sickness Questionnaire (Kennedy, Lane, Berbaum, & Lilienthal, 1993) that measure physiological responses to the mediated environment.
5. **Social reality:** Items related to comparisons between how the portrayed events would or could occur in the nonmediated world.
6. **Interpersonal social richness:** Items about how well the media user was able to observe various interpersonal communication cues (these items concern one-way observation rather than interaction, which distinguish them from the parasocial interaction dimension).
7. **General social richness:** Items traditionally used to measure social richness (Short, Williams, & Christie, 1976), such as unemotional/emotional, unresponsive/responsive, impersonal/personal, etc.)

These results are very preliminary; analyses to be completed by the Presence 2000 Workshop will be considerably more detailed. These results will be compared with those a related project by [Lessiter, Freeman, Keogh, and Davidoff](#) at the Presence 2000 Workshop, and plans call for syntheses of these and hopefully other results to guide future research projects designed to establish the conceptual structure of, and build standardized measurement instruments for, presence.

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A measuring instrument is a device to measure a physical quantity. In the physical sciences, quality assurance, and engineering, measurement is the activity of obtaining and comparing physical quantities of real-world objects and events. Established standard objects and events are used as units, and the process of measurement gives a number relating the item under study and the referenced unit of measurement. Measuring instruments, and formal test methods which define the instrument's use, are the A Unified Approach to Measuring u^* . Richard K. Crump, Federal Reserve Bank of New York Stefano Eusepi, University of Texas at Austin Marc Giannoni, Federal Reserve Bank of Dallas AyÅÿegÅ¼l Åžahin, University of Texas at Austin.Â We build on this insight and use a forward-looking Phillips curve linking inflation to the unemployment gap and expectations of future inflation, which is based on a structural equation in an underlying micro-founded model. Importantly, the forward-looking nature of this Phillips curve implies that inflation depends not only the contemporaneous unemployment gap but also the entire path of expected future unemployment gaps. The literature contains many different definitions of presence and many proposed measures for it. This article reviews many of the definitions, measures, and models of presence from the literature. We also review several related constructs. CONTINUE READING. View on ACM. doi.org. Save to Library. Create Alert. Cite. Launch Research Feed. Share This Paper. Top 3 of 74 Citations. View All. [DC] Case-studies of Contemporary Presence Theory: Towards More Objective and Reliable Measures of Presence. Johannes Schirm 2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR) 2019.Â Measuring presence: a literature-based approach to the development of a standardized paper-and-pencil instrument. A literature review is a survey of scholarly knowledge on a topic. It is used to identify trends, debates, and gaps in the research.Â Writing a literature review involves finding relevant publications (such as books and journal articles), critically analyzing them, and explaining what you found. There are five key steps.Â If you are writing the literature review section of a dissertation or research paper, you will search for literature related to your research problem and questions. If you are writing a literature review as a stand-alone assignment, you will have to choose a focus and develop a central question to direct your search. Unlike a dissertation research question, this question has to be answerable without collecting original data.