



Criteria and scope conditions for a theory and measure of social presence

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Abstract

The need for a theory of social presence is more pressing as the Internet and virtual environments become increasingly social. With time we can observe an increase in social interaction not only among users, but also between users and computer agents. A robust and detailed theory and measure of social presence could contribute to our understanding and explaining social behavior in mediated environments, allow researchers to predict and measure differences among media interfaces, and to guide the design of new social environments and interfaces. The article reviews, classifies, and critiques existing theories and measures of social presence. A set of criteria and scope conditions is proposed to address weaknesses in past theories and measures and to provide clear criteria for a measurement theory of social presence.

DEFINITION OF THE PROBLEM OF SOCIAL PRESENCE

Connecting to other minds through technology

There is one often repeated claim of communication theory: the function of media is to collapse space and time to provide the limited illusion of *being there in other places* and *being together with other people* (Biocca, Kim, & Levy, 1995; Czitrom, 1982; McLuhan, 1964). The dream of this illusion has been pursued for centuries (Biocca et al., 1995). Commentators always believe they have it just within their grasp with every new medium be it perspective painting, photography, film, or virtual reality (Alberti, 1966/1945; Biocca, 1988; Biocca et al., 1995; Biocca, 1987; Gombrich, 1956).

Far less obvious is how the "being there" and "being together" provided by technological mediation filters and colors the psychological experience of the represented places and people. Theories of presence have arisen to understand, explain, predict, and control the phenomenal qualities of mediated experience and their cognitive correlates (Barfield, Zeltzer, Sheridan, & Slater, 1995; Heeter, 1992; Held & Durlach, 1992; IJsselsteijn, de Ridder, Freeman, & Avons, 2000, January; Lombard & Ditton, 1997; Loomis, 1992; Sheridan, 1992; Slater, 1999; Slater & Steed, 2000; Slater, Usoh, & Steed, 1995; Stanney, 1998; Steuer, 1995; Witmer & Singer, 1994; Zahornik & Jenison, 1998). Presence theory focuses on the effects of mediation on experience especially as our awareness of the mediation oscillates, flickers, and sometimes fades (Kim & Biocca, 1997; Slater & Steed, 2000). The implicit or sometimes explicit goal of engineering for presence is for mediation to disappear and for the sense of "being there" and "being together" (Akiyama, 1991; Alessi, 1988; Hays & Singer,

1989; Heilig, 1992/1995; Lombard & Ditton, 1997; McGreevy & R., 1991). At one extreme it becomes simply *being* (Biocca, 1996; Lauria, 1997).

Presence is frequently presented as consisting of two interrelated phenomena (Biocca, 1997b; Biocca & Levy, 1995; Heeter, 1992):

- ? telepresence, the phenomenal sense of “being there” and mental models of mediated spaces that create the illusion;
- ? social presence, the sense of “being together with another” and mental models of other intelligences (i.e., people, animals, agents, gods, etc.) that help us simulate “other minds”

Increasing network bandwidth, higher mobility, and more immersive designs promise to offer a better sense of access to real and virtual places, i.e., the sense of telepresence (Biocca, 2000). But the use of this bandwidth may rarely be focused on visiting places. More fundamentally, most telecommunication bandwidth is used to gain satisfying and productive access to others, the thoughts, emotions, and presence of real and virtual humans (e.g., Fischer, 1988). Because we are social beings, the most common purpose of physical presence is to increase the sense of social presence. Because the social presence of the other is mediated by telecommunication technology, it might be more accurately described as mediated social presence or social telepresence. In keeping with tradition in this area (Heeter, 1992; Palmer, 1995; Short, Williams, & Christie, 1976) we will use the phrase social presence to mean specifically interactions in mediated environments, even though the phrase also applies to non-mediated interactions. (Huguet, Galvaing, Monteil, & Dumas, 1999; Soussignan & Schaal, 1996) But what is social presence and how can we measure it? The problems of how to define, measure, and control-design physical presence and social presence have become both challenging and practical problems in communication theory (Biocca, in press; Lauria, 1997; Lombard & Ditton, 1997; Palmer, 1995), virtual environment design (Barfield et al., 1995; Held & Durlach, 1992; Short et al., 1976), and in psychological measurement (Draper & Blair, 1996; Ellis, 1996; Ellis, Dorigi, Menges, Adelstein, & Jacoby, 1997; Freeman, 1998; Ijsselstein, Ridder, Hamberg, Bouwhuis, & Freeman, 1998; Ijsselstein & de Ridder, 1998; Ijsselstein et al., 2000, January; Ijsselstein & al., 2001; Lessiter, Freeman, Keogh, & Daviddoff, 2000, March; Lombard et al., 2000; Murray, Arnold, & Thornton, 1998; Novak, Hoffman, & Yung, May 1998; Slater, 1999; Witmer & Singer, 1998).

Although we defined social presence as “being to-

gether with another” in the virtual environment, we consider this definition tentative. By the end of the article we hope to show that this kind of definition may be inadequate for the explication and measurement of social presence. In an effort to work towards a more sensitive, reliable, and valid measure, we end by outlining criteria and scope conditions for a conceptualization and measure of social presence

Why a theory of mediated social presence is needed

Why is a useful and insightful theory of social presence needed at this time? Why is it important that this theory be linked to a valid, reliable, and easily implementable measure of social presence?

The Internet is a social place. Because of growth in our telecommunicating infrastructure (Internet.com, 2001), many relationships and more and more interactions with others are mediated by the telecommunication system. We increasingly communicate and work with others via the telephone, email, chat rooms, virtual environments, and teleconferencing systems. The rise of true virtual communities involves rich relationships that never or rarely include face-to-face interactions (e.g., Rheingold, 1993).

Furthermore, an increasing number of quasi-social relationships are being created with new forms of intelligent beings, such as computers themselves and intelligent agents that inhabit virtual environments (Cassell, Sullivan, Provost, & Churchill, 2000; Chorafas, 1997; Franklin, 1997; Kushmerick, 1998; Petrie, 1996; Byron Reeves & Clifford Nass, 1996). Speech interfaces simulate social interaction with the computer (Yankelovich, Levow, & Marx, 1995). Users of the Internet find themselves interacting more frequently with virtual human agents as they increasingly are found as “office assistants,” as guides on websites, characters in social 3D virtual environments, and team members or opponents in computer games.

Social presence is what networked telecommunication systems and virtual human agents promise users. Increasing social presence is the goal of many specific refinements in the technology (e.g., Cassell et al., 2000; Byron Reeves & Cliff Nass, 1996; Singhal & Zyda, 1999; Slater & Wilbur, 1997). Social presence is what these systems purport to deliver (e.g., Fischer, 1988; Singhal & Zyda, 1999). How well do these systems work? The answer to this question has a technical form, but the real answer is social psychological in nature. How well did one person feel connected to another through an interface? What was the appropriate level of interaction

for the task? Did the user feel socially and psychologically connected to an intelligent “other” when interacting with the virtual human agent? The assessment of satisfaction with entertainment systems and with productive performance in teleconferencing and collaborative virtual environments is based largely on the quality of the social presence they afford.

Research in organizational communication indicates that media are selected to better accommodate activities affected by social presence (e.g., Palmer, 1995; Rice & Case, 1983; Steinfield, 1986). Respondents selected media to modulate social presence for a wide range of activities including exchanging information, problem solving and making decisions, exchanging opinions, generating ideas, persuasion, getting the other on one’s side of an argument, resolving disagreements or conflicts, maintaining friendly relations/staying in touch, bargaining, getting to know someone, exchanging confident information, and exchanging timely information.

But is social presence measured directly, reliably, or with valid measures? How might a theory and measure of social presence help researchers really understand and measure the performance of various social telecommunication systems? A theory and measure of social presence is required to:

- ? Understand the effect of various technological, task, and social variables on the perception of others and their interaction in telecommunication systems.
- ? Measure the user’s sense of satisfaction with the representation of others in networked technologies.
- ? Use social presence measurement as one key yardstick to compare the relative effectiveness of various mediated technologies, interface features, or agents.
- ? Determine whether social presence contributes to the efficiency and performance of collaborative teamwork, distributed learning, and networked relationships.

A strong theory of social presence might also provide us with insight into how people simulate and model “other minds” from the physical and communication cues provided by the bodies and actions of others (Carruthers & Smith, 1996; Dennett, 1987, 1996; Gordon, 1986; Premack & Premack, 1996). This article is part of effort to provide a conceptual explanation and measure for the phenomena of social presence. We called this the Networked Minds Social Presence effort, part of the Presence Initiative, a project that explores

various aspects presence at the Media Interface and Network Design Labs (*Embodied computing*, 2001). Elsewhere, we report on the latest version of measure and the related conceptualization we call the Networked Minds measure of social presence (Biocca, Burgoon, Harm, & Gregg, 2001) because it seeks to provide a metric to measure the degree to which individuals feel interconnected to each other through networked telecommunication interfaces.

CONCEPTUALIZATIONS OF COPRESENCE AND SOCIAL PRESENCE

Mediated social presence involves using a communication system to come to know the intentions, cognitions, emotions, and actions of another mind connected to you via a telecommunication system.

The fundamental theoretical question of how one comes to “know other minds” has a long, complex, but interesting history in the fields of philosophy and psychology (Carruthers & Smith, 1996; Dennett, 1987, 1996; Rosenthal, 1991). A theory of social presence, how we generate mental models of virtual others in mediated communication, is subset of this larger debate. We believe that a full understanding of social presence must be set within a larger theory of how we interpret physical signals to simulate and infer the content of other minds (Biocca et al., 2001).

The theorizing on social presence has roots most directly in social psychological theories of interpersonal communication. The influence of classic social psychologist, George Herbert Mead (Mead & Morris, 1934) on the “Other” (capitalized because of its role on human behavior and social identity) can be seen in very earliest formulations of social presence. In their influential text, Short, Williams & Christie (1976) drew more directly on the social psychological work of Argyle (Argyle, 1969; Argyle, 1975, 1965; Argyle & Cook, 1976), Birdwhistell (Birdwhistell, 1970) Mehrabian (Mehrabian, 1972) on the role of non-verbal communication in interpersonal interaction..

Definitions of social presence

While definitions of social presence vary, they cluster around key themes. See Table 1 for outline of review of social presence definitions and theories presented below.

The non-definitional approach

Let us begin with examples of “non-definition.” Researchers in the area of presence might be little surprised, maybe even stunned, to find that for some social

Table 1
Definitions of Social Presence

Classification	Definition	Sample social presence research using the definition
Co-presence: co-location, mutual awareness		
Co-presence: sensory awareness of the embodied other (Goffman, 1959)	<p>??(un-mediated) “experiencing someone else with one’s naked senses, (p. 15)</p> <p>??“physical distance over which one person can experience another with the naked senses- thereby finding that the other is “within range” (p. 16)</p> <p>??“full conditions of copresence, however, are found in less variable circumstances: persons must sense that they are close enough to be perceived in whatever they are doing, including their experiencing of others, and close enough to be perceived in this sensing of being perceived.” (p. 17)</p>	(Biocca & Nowak, 1999, May; Biocca & Nowak, 2001; Ciolek, 1982; Nowak, 2000; Nowak & Biocca, 1999; Nowak & Biocca, 2001)
Co-location	<p>??“the feeling that the people with whom one is collaborating are in the same room” (Mason, 1994)</p> <p>??“Social presence refers to the feeling of being socially present with another person at a remote location.” (Sallnäs, Rasmus-Gröhn, & Sjöström, 2000)</p> <p>??“the degree of tangibility and proximity of other people that one perceives in a communication situation” (McLeod, Baron, Marti, & Yoon, 1997)</p>	(Mason, 1994; McLeod et al., 1997; Sallnäs et al., 2000; Tammelin, 1998)
Apparent existence, feedback, or interactivity of the other (Heeter, 1992)	<p>??“the extent to which other beings in the world appear to exist and react to the user” (Heeter, 1992)</p> <p>??“the degree to which a person is perceived as a ‘real person’ in mediated communication (Gunawardena, 1995)</p>	(Cuddihy & Walters, 2000; Culnan & Markus, 1987; Gunawardena & Zittle, 1997; Palmer, 1995)
Sense of being together	??“the sense of being together” (de Greef & IJsselsteijn, 2000; Ho, Basdogan, Slater, Durlach, & Srinivasan, 2001)	

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Psychological Involvement		
Perceived access to another intelligence (Biocca, 1997)	??"The minimum level of social presence occurs when users feel that a form, behavior, or sensory experience indicates the presence of another intelligence. The amount of social presence is the degree to which a user feels access to the intelligence, intentions, and sensory impressions of another." (Biocca, 1997)	(Huang, 1999; Nowak, 2000)
Saliency of the other (Short, Williams, & Christie, 1976)	??"The degree of saliency of the other person in the interaction and the consequent saliency of the interpersonal relationships...it is a subjective quality of the communications medium...(p. 65) ??"a single dimension representing a cognitive synthesis of all the factors" (p. 65). ??"attitudinal dimension of the user, a 'mental set' towards the medium" (p.65). ??"it is phenomenological variable...affected not simply by the transmission of single non.verbal cues, but by whole constellations of cues which affect the 'apparent distance' of the other." (P.157).	(Gunawardena, 1995; Huang, 1999; Rice, 1993; Riva & Galimberti, 1997, 1998; Tammelin, 1998)
Mutual understanding	??"social presence; that is, the ability to make one's self known under conditions of low media richness " (Savicki & Kelley, 2000)	
Behavioral engagement		
Interdependent, multichannel exchange of behaviors (Palmer, 1995)	"VR is compatible with interpersonal communication to the extent that individuals can encounter another 'social presence' or person (Heeter, 1992) in a virtual environment, and effectively negotiate a relationship through an interdependent, multi-channel exchange of behaviors" (p. 291) (Huang, 1999)	

psychologists, the concept of social presence is used in a underdefined and unproblematic manner. One can easily find recent social psychological studies that prominently feature social presence in their titles but where social presence itself is largely undertheorized (Huguet et al., 1999; Soussignan & Schaal, 1996). In these studies of unmediated interactions social presence is treated as self-evident: the other simply is or is not present. This binary "non-definition" is used. We see this even though there are studies going back almost sixty years that indicate the mere thought of someone else in other room or the suggestion that someone is watching has influence on behavior (Dashiell, 1935; Wapner & Alper, 1952)

Co-presence

It is clear that in mediated interaction social presence is problematic. The mediated other is not simply "here or not-here," but is present to a lesser or greater degree along some definable continuum. Even in unmediated interactions, the simple binary, here-not here approach to social presence is unsatisfactory. Nowhere is this made more obvious than in the seminal and insightful work of Ernest Goffman (Goffman, 1959, 1963).

Sensory awareness of the embodied other

Goffman presents a subtle theoretical analysis of what he called "copresence." The concept of copresence is grounded on the basic sensory awareness of other.

First, sight begins to take on an added and special role. Each individual can see that he is being experienced in some way, and he will guide at least some of his conduct according to the perceived identity and initial response of his audience. Further, he can be seen to be seeing this, and can see that he has been seen seeing this. Ordinarily, then, to use our naked senses is to use them nakedly and to be made naked by their use. (Goffman, 1959, p.16)

Emphasis on the senses makes this approach very amenable to mediated interaction. In mediated interactions the senses of the user are extended to some degree by the technology so that a representation of the other makes some minimal level of sensory impression. Goffman makes the additional point that the copresence "implies the reception of embodied messages" (p. 15). In mediated interactions the other is frequently embodied by some avatar, agent, or simpler representational device (Biocca, 1997a; Biocca & Nowak, 2001).

Even though he focuses on un-mediated percep-

tion, Goffman sees each sensory channel as a medium for experiencing social presence. He is also sensitive to the fact that social presence is influenced by subtle properties of the environment in which the interaction takes place:

The physical distance over which one person can experience another with the naked senses—thereby finding that the other is "within range"—varies according to many factors: the sense medium involved, the presence of obstructions, even the temperature of the air. (p. 17).

When one emphasizes being in the same space, the notion of co-presence is similar to presence. A number of researchers use some variation of social presence as the notion of being in the same location, space, room, etc. (Mason, 1994; McLeod, Baron, Marti, & Yoon, 1997; Sallnas, Rasmus-grohn, & Sjostrom, 2000).

Of all the work defining co-presence, Goffman's is by far the most subtle, elaborated, and developed even though it dates back to early 1960s. Goffman's definition of co-presence influences the work of many that follow. In the area of social presence Goffman's emphasis on the sensory accessibility of the embodied other can be found explicitly in some social presence work (Biocca & Nowak, 1999, May; Biocca & Nowak, 2001; Nowak & Biocca, 1999; Nowak & Biocca, 2001).

Mutual Awareness

Goffman suggests that co-presence involves some level of mutual awareness: "copresence renders persons uniquely accessible, available, and subject to one another" (p.22). The definitions of co-presence move into mutual awareness when they emphasize that the sensory awareness of the other is true for both user/observer and mediated other. The user is aware of the mediated other, and the other is aware of user. In Heeter's (Heeter, 1992) definition awareness of the "existence of the other" is accompanied by the other's reaction to the self or user. In these definitions the reaction of the other to the user validates that "they are there" and aware.

This tends to flow directly into broader, if somewhat weakly explicated versions of co-presence that simply suggest mutual awareness with the phrase "being together" (de Greef & IJsselsteijn, 2000; Ho, Basdogan, Slater, Durlach, & Srinivasan, 2001)

Psychological involvement

The simple presence of another body or even awareness of it is for many not satisfactory to signify

social presence. For example, it is clear that a corpse may be physically present, but not socially present. In virtual environments there can be many inert bodies, representations that are not "inhabited" by intelligence, human or artificial. Definitions that tend towards mutual awareness suggest the importance of an element we can label psychological involvement. Biocca's definition picks up the key defining element of intentionality (Dennett, 1987, 1996) to emphasize that social presence is definable by the sense that one has "access to another intelligence" (Biocca, 1997b). For Biocca social presence is activated as soon as a user believes that an entity of the environment displays some minimal intelligence in its reactions to the environment and the user. Using this definition it is easy to accommodate the social interactions that have been documented with common computer interfaces (Byron Reeves & Clifford Nass, 1996).

In one of most influential works on social presence, Short, Williams and Christie (1976) suggest some attentional requirements by emphasizing social presence as the degree of "salience of the interpersonal relationship" (p. 65). This suggests a definitional need that gets at the degree of psychological involvement with the other. Working from his inherently social theory of "media appropriateness" Rice echoes this aspect of psychological involvement by echoing Short, Williams and Christie's claim that social presence "is fundamentally related to two social psychology concepts; intimacy and immediacy" (Rice, 1993, p. 72). In a similar fashion, Palmer links presence to aspects of psychological involvement with the other:

Although these terms (immediacy, intimacy and involvement) are typically used to describe behaviors, it is not difficult to imagine that they also describe a cognitive state in which individuals feel more or less directly 'present' in the interaction and in the process by which relationships are being created (Palmer, 1995, p.284).

Cognitive states associated with social presence may inevitably involve some form of mental model of the other. In the context of social presence theory, Biocca and his colleagues (Biocca, 1997b; Biocca & Nowak, 2001; Nowak, 2000; Nowak & Biocca, 2001) have emphasized that a substantial mental model of the other is activated immediately upon detection of another intelligence. Like the primitive activation of approach and avoidance reactions, some modeling is necessary to reduce the uncertainty and to model the intentions of the other towards the environment and the user.

Seeing social presence as the developing mental model of the other suggests that with interaction there should be some sense that one has some understanding of the other, and in cases of higher social presence that this understanding is mutual. For Savicki (Savicki & Kelley, 2000) the definition of social presence emphasizes the ability to project a sense of self through the limitations of a medium.

Behavioral engagement

Some definitions of social presence include implicit or explicit references to some level of behavioral engagement, especially behavioral interaction or synchronization as an element of social presence. Most social presence research until the mid-1990s dealt mostly with low bandwidth media textual media or teleconferencing systems (e.g., Rice, 1993; Rice & Love, 1987; Rice & Tyler, 1995; Rice, 1992; Short et al., 1976; Steinfield, 1986; Tidwell & Walther, 2000; Walther, 1992; Walther, Anderson, & Park, 1994; Walther & Burgoon, 1992; Walther, 1996). Most behavior was limited and rarely extended beyond verbal and non-verbal communication behavior. Most tasks were highly symbolic relying heavily on verbal interaction. Nonetheless, while social presence like presence itself is largely a phenomenal state, it is sometimes defined as including a behavioral component. Reference is made to levels of behavioral engagement such as eye contact, non-verbal mirroring, turn taking, etc.

Immersive virtual environments and computer games have opened a much wider range of potential channels for behavior interaction. Writing in the context of VR Palmer's (Palmer, 1995) definition of social presence builds on Heeter's (Heeter, 1992) emphasis on reaction and interactivity. These seem to acknowledge the desire to include a behavioral component in the definition. For Palmer, the definition of social presence includes "effectively negotiate a relationship through an interdependent, multi-channel exchange of behaviors" (Palmer, 1995).

MEASURES OF SOCIAL PRESENCE

While various measures have been proposed, there is as yet no widely accepted measure of social presence. In our analysis below, we suggest that a more robust definition and explication of social presence may be required to support the development of a measure that has satisfactory content and construct validity.

Subjective social richness of the medium: Social presence

Short, Williams & Christie (Short et al., 1976) popu-

Table 2
Scales Used to Measure Social Presence

Classification (key cite)	Description	Example social presence studies
Perceived social richness of the medium		
Social Presence (Ho et al., 2001)	<p>??Social presence is measured using the semantic differential technique (Osgood, Suci, & Tannenbaum, 1957). Pairs of items included unsociable-sociable, insensitive-sensitive, cold-warm, and impersonal-personal.</p> <p>??"Media having a high degree of Social Presence are judged as being warm, personal, sensitive and sociable." (Short et al., 1976)p.66</p> <p>??Multiple conditions (FtF, audio/video, audio only, written)</p>	(Rice, 1992; Sallnäs et al., 2000; Steinfield, 1986)
IPO Social Presence (de Greef & Jsselsteijn, 2000)	<p>??Measured social presence according to Short et al. by using a semantic differential technique on bipolar items such as as (in)/sensitive, cold/warm, (im)/personal, (un)/sociable, including items which Short et al. (Short et al., 1976) called aesthetic appeal (small-large, closed-open, colourless-colourful, ugly-beautiful</p> <p>??7-point Likert scale on agreement with users comments (see Appendix X)</p>	
Involvement, Immediacy, or Intimacy		
Immediacy, Intimacy, & Involvement (Burgoon & Hale, 1987)	<p>??Likert, five point items items in three scales of indicators for intimacy, involvement and immediacy. Measure whether the other is perceived to be involved, interested or emotional about the conversation.</p> <p>??Tends to be oriented toward conversational interaction and includes items on whether or not the interaction partner made the conversation seem superficial or created a sense of distance between the interaction partners.</p>	(Nowak, 2000)
Immediacy of the medium (Gunawardena & Zittle, 1997)	<p>??Longitudinal study using Short et al. (1976) bi-polar scales to measure "intimacy" of the medium. "...social presence scale...embodied the concept of "immediacy" as defined in the literature" p.8</p> <p>??Questionnaire items in the social presence scale (see Appendix X)</p>	

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Social judgments of the other		
Social attraction: Homophily (McCroskey, Richmond, & Daly, 1975)	<p>??7-point metric measures homophily, or social attraction was modified for the purposes here.</p> <p>??Includes questions about the extent to which they feel the other person could "be a friend," was "pleasant or offensive" and whether or not the participant "desired a future interaction."</p>	(Choi, 2000; Nowak, 2000)
Single or two item measures		
Sense of being together (Ho et al., 2001)	<p>??Subjects interacted through a collaborative online game with a confederate</p> <p>??Measured "sense of being together" with the two items 1-7 scale (see Appendix X)</p>	
SAM Social Presence (Lang, 1999)	<p>??Single item graphical measure. Shows two circles for self and other at various levels of distance until they substantially overlap. Subject indicates which one best represents the perceived interaction with the other.</p>	
Behavioral Measures		
Choice behavior (Heeter, 1992)	<p>??Measured the percentage of participants who preferred games against the computer only, with or against another person and what type of experiences respondents would prefer other social entities.</p>	

larized the use of the term social presence in telecommunication research in an elaborate book on the topic. It is not surprising, therefore, that the most used measure of social presence was created by them.

They use a measure of “the subjective quality of the communications medium” (p. 65) to measure social presence. The approach uses a set of semantic differential scales that capture some of social and emotional capabilities of the medium. It is important to note that users are not asked to judge the experience of the other to indirectly assess the effect the medium. The use of indicators that ask the respondent to assess the “experience” rather than the “medium” is more typical of presence measures. Rather, the respondent is asked to directly pass judgement on the medium itself. Short, Williams, and Christie appear to believe that they are measuring a relatively stable “‘mental set’ towards the medium” (p. 65). The equivalent approach for a presence measure would be to ask: How realistic is this medium? as opposed to “How realistic was the experience?” We will return to this important distinction in the section on limitations.

Involvement, Immediacy, and Intimacy

Short, Williams, and Christie made explicit reference to the class literature in interpersonal communication. This literature specifically identified features of interpersonal communication which they labelled as involvement, intimacy (Argyle, 1965), and immediacy (Wiener & Hehrabian, 1968). While they referred to this literature, Short Williams and Christie did not claim to explicitly measure these constructs. Measures of these constructs have been used in interpersonal communication literature (e.g., Burgoon & Hale, 1987). Respondents use Likert-scale items to judge statements about their partner in an interaction. In the typical study two or more strangers meet in a room to discuss a topic or complete a task while some aspect of the interaction is manipulated.

If one considers all social presence to be variable whether mediated or not, then measures from face-to-face communication should be useable for mediated communication. Nowak (Nowak, 2000) adapted the Burgoon and Hale measure explicitly for use in mediated communication in virtual environments.

Gunwardena (Gunawardena & Zittle, 1997) measures intimacy by blending the kinds of semantic differential scales used by Short, Williams, & Christie, but structuring them to focus on the intimacy construct.

In general, it is important to note that some of these measures reflect their origin in face-to-face inter-

personal communication: the language of items assumes a vocal interaction and emphasizes judgements of the other.

Social judgements of the other

While measures of involvement, intimacy, and immediacy involve judgements of a specific interaction or the other’s general communication abilities, some measures are very explicitly attributional measures of the other or broad evaluations of the relationship with the other.

In an effort to specifically move away from judgements of the medium, Nowak (Nowak, 2000) and Choi (Choi, 2000) used a measure of social attraction, labeled homophily (McCroskey, Richmond, & Daly, 1975) to measure the user’s perception of avatars and agents in virtual environments. This measure attempts to capture the sense of feeling similar or close to the other.

Behavioral measures

Behavioral measures are common in studies of face-to-face interactions. Some of the verbal markers or non-verbal indicators such as facial expression may be indicative of social presence. More commonly non-verbal behaviors such as proximity to the other are used as dependent variables or independent variables in studies of social interaction.

We can find few examples of the use of behavioral measures *explicitly* as a measure of social presence. Heeter’s study of choice behavior was explicitly interested media selection as an indicator of social presence.

LIMITATIONS OF CONCEPTUALIZATIONS AND MEASURES OF SOCIAL PRESENCE.

This article started had its origins in a lab review conducted in preparation to developing the Networked Minds Measure of Social Presence. We searched for:

(1) More detailed and comprehensive definition and conceptualization of social presence, one that might provide a more robust and insightful tool for comparing media and assessing social interaction in mediated environments.

(2) A robust measure of social presence that would meet the “design requirements” of all criteria and scope conditions listed below for a theory of social presence and,

(3) measures that exhibit reliability, content and construct validity.

To move forward, we needed to assess limitations in current theories and measures of social presence. What follows is our evaluation.

Limitations in definitional explication and measurement specification

While intuitive, the concept of social presence can be hard to define in a way that best supports the range of phenomenon and the needs of measurement. A common limitation appears to be definitions of social presence that are stated too broadly and too vaguely to provide adequate guidance on the measurement of social presence. For example, we and others have sometimes defined social presence as “the sense of being with another” or the “sense of being together” in a virtual environment. While this can be useful as a shorthand communication, it is inadequate as a definition. It merely restates the idea of social presence in different words without significant concept explication. Such definitions add marginally to our understanding of the concept. Their lack of explication and detail fails to provide guidance to prepare and delimit the scope of the concept for measurement.

The opposite problem, of course, is to claim almost all aspects of social interaction and judgement to be “social presence.” We address this issue below in the section on “Confounding of boundary between social presence and the correlates or effects of social presence.”

Limitations in the technological scope of social presence theorizing or measurement.

Most researchers would agree that social presence is phenomenon that is independent of a specific technology and that one can experience some level of social presence with most media. But many theories and measures of social presence are constructed by researcher to address an issue in a specific technology: F2F interaction, email systems, teleconferencing systems, or virtual environments. Researchers may create a theory, or more typically, develop a measurement instrument that is specifically suited to the technology they are studying.

The fundamental problem with these measures is that the items are constructed so that they make assumptions about technology:

?????Assumptions about sensory channels supported by the technology (display devices) (i.e., “How well did you **see** the other.” “I could see the other on the

screen.”)

?????Assumptions about input devices (i.e., “The other **listened** do what I said.” Assumes audio input).

?????Assumptions about the virtual environment. (i.e., “I felt close to the others in the virtual room.”)

These items and measures constructed from them cannot be easily generalized to use other media. Most importantly they effectively preclude cross-media comparisons, and therefore defeat one of the key goals of the social presence theory and research.

Limitations in the scope of interactions that can be accommodated by the theory and measure.

A lot of research on social presence is done in settings in which impression formation or organizational tasks such as collaboration are the norm. As a result some theories and measures assume a specific class of interactions: collaboration, goal of “liking” the other, etc. The measurement of social presence is designed to assume a specific kind of goal, social interaction, or task. Therefore, the same theories and measures cannot be used to measure social presence in other types of interactions, goals, or tasks. For example, is it not possible to feel that the other is very socially present in hostile or competitive interactions such as those found in some computer games. For example, if someone is five feet from you in a immersive virtual environment, sneering, and pointing a gun directly at your head, can we say that the individual was not “socially present” because the measure indicated that you, the respondent, did not “like them” “feel as if you could cooperate with this person” “would like to repeat this interaction” etc. Such conceptualizations and their measures fail to satisfy the content and construct validity of social presence.

Confounding of boundary between social presence and the correlates or effects of social presence.

Some theories seem to have a unclear boundary between the sensation of social presence, for example an awareness and focus on the co-location of a mediated other, and some effects or correlates of social presence, for example, liking the other (i.e., mutuality). We assume that like presence, social presence is a phenomenal state varying during the course of interaction. It is a temporary judgement of the nature of interaction with the other as limited by the medium.

But clearly there is a boundary between this temporary and fluctuating state over the course of an interaction, and some longer-term judgement one might make about the other. What one feels, for example, about the President of the United States should be independent on how present you might feel with him should you have the fortune of communicating with him via an email, a telephone call, a teleconference, or a face-to-face meeting. Measures of longer-term attitudes about the interaction agent, in this case the President, need to be kept somewhat independent of temporary judgments of social presence with the interactant.

While we do not pretend that the boundary is clear, some measures that we ourselves have used, such as the homophily measure (how similar you feel to the other) clearly cross the line towards variables that are likely to be correlates or effects of social presence.

Problems and limitations in measures that rely on direct evaluation of the medium

When we measure social presence, what are we measuring?: (1) the fluctuating phenomenal properties of a communication interaction, or (2) the stable properties of a medium. Many telecommunication and human-computer interaction researchers are interested in the latter. But we would submit that we are measuring the former, a fluctuating phenomenological state that varies with medium, knowledge of the other, content of the communication, environment, and social context.

Short Williams and Christie (1976) is by far the most cited reference in this area and the measure is the most widely used. But the approach to measurement used by Short Williams and Christie may have some limitations and flaws. The measure reflects the goals of their original funded studies. The UK post office, Department of Transportation, General Electric, and other organizations funded their earlier studies to determine the relative effectiveness of different media channels for social communication. In some ways, they conceptualized the measure as a business consumer's "attitude about a medium" and its use for negotiation, persuasion, and other forms of organizational communication. This is based on the fair assumption that individuals have certain attitudes towards media channels and what they consider appropriate for social presence. They considered social presence to be unidimensional "quality of the medium" and not the interaction of individual differences, task, and environmental context:

(Social presence) is conceived of as unidimensional but considered to be 'a perceptual or attitudinal dimension of the user...{and thus is} a subjective qual-

ity of the medium.' (Short et al., 1976 p.650)

Therefore, the measure asks respondent to directly evaluate the properties of medium for social presence. But does this approach lead to sensitive and reliable measure of social presence. It has been demonstrated in several studies (e.g., Nichols, 1984) that respondents cannot reliably identify what is the cause of their attitudes. It is not clear that they can directly introspect to make a judgment of how well a medium "causes their social presence." If the goal is to get a direct measure of the medium, it is likely that such a measure would be valid. Various other aspects of the interaction are likely to color the respondents perception of the "social presence capabilities" of the medium.

This measure appears to be concerned with the extent to which a person perceives a medium as capable of allowing a sense of social presence. The judgment being made is to what extent did you perceive the medium as unsociable-sociable, insensitive-sensitive, cold-warm, and impersonal-personal. Media appropriateness (Rice, 1993) appears on face value to be a more accurate fit than social presence.

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This suggests that a measure of social presence should be based on items that measure phenomenal state of social presence, that is properties of the communication interaction specifically rather than direct attributions about medium per se.

CRITERIA, SCOPE CONDITIONS, AND GUIDING SCENARIOS FOR A THEORY OF SOCIAL PRESENCE

Above we suggested that a theory and measure of social presence is needed to help us understand, explain, and measure the sense of connection of users with real and artificial others in networked environments. We have reviewed some of the conceptualizations and measures of social presence and discussed some possible limitations. Many of the limitations can be traced to problems in defining the scope and nature of the phenomenon of social presence as it pertains to telecommunication.

What we propose is the need for a theory of social presence that explicates and operationalizes the con-

Table 3
Scope Conditions for a Theory of Social Presence

Criterion	Scope and boundaries	Guiding Scenarios
<p>Media-centered Theory: Focus on Technologically Mediated Interpersonal Interactions</p>	<p>To support human-computer interaction studies and mediated communication studies, the theory of mediated social presence should be primarily theory of how differences in technological connection, representations, and mediated access affects, distorts, or enhances the perception (mental model) of others' intentional, cognitive, and affective states. Nonetheless, a theory of mediated social presence is likely to make use of philosophical and psychological theories of other minds and theories of interpersonal communication, and be able to contribute to these areas.</p>	<p>??Researcher wants to classify interfaces according to the degree to which they facilitate social presence.</p>
<p>Measurement Orientation</p>	<p>To achieve a metric of communication effectiveness a theory of social presence should be tied to measurement. Therefore, the theory should define the phenomenon of social presence in way that is suitable to measurement.</p>	<p>??Researcher wants to directly compare the performance of two interfaces on how users perceive their communication with the collaborator using the different systems.</p>
<p>Span different classes and generations of communication technology.</p>	<p>Ideally, the same measurement instrument should be able to measure social presence across a very wide range of media from the least interactive (e.g., pictures, voice recordings), to high-bandwidth telepresence systems that simulate face-to-face interaction. To insure the ability to support cross-media and cross-interface comparisons, the social presence measure should be useable without need for significant alteration or adaptation to be used with any interface old, new, or not yet created.</p>	<p>??A person feels a change in social presence from cell phone to video teleconferencing. ??Individual feels social presence while observing a sculpture. ??An individual feels enhanced social presence in a face-to-face interaction while wearing technology that gives them access to the physiological responses of the other such as their heart-rate, blood pressure, skin-conductance, etc.</p>

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<p>Accommodate various kinds of mediated interactions</p>	<p>The theory and associated measure should accommodate and measure social presence for a wide range of interactions: from the casual-and-passing to the formal-or-intimate; from collaboration-to-struggle; from one-to-one, as well as one-to-many interactions, etc.</p> <p>The measure should not break down at the extremes of interaction such as social presence in very familiar or intimate interactions such as two lovers communicating in an immersive environment or in highly hostile interactions such as a predator-prey interaction with a virtual character in a computer war game.</p>	<p>??A work team tries to get to know each other at the beginning of a project.</p> <p>??A child feels terror at the presence of a monster in a computer game.</p> <p>??Two old friends meet in an immersive virtual environment.</p> <p>??A tactile device is used in a mediated-sexual interaction.</p>
<p>Span interactions with human and non-human others</p>	<p>Media transmit representations of all kinds of seemingly intelligent entities. Therefore a theory and measure of social presence should accommodate an individual's sense of social presence with all forms of mediated intelligence: humans, humanoid artificial intelligence, robotic devices, non-humanoid characters, agents, and beings.</p>	<p>??User feels social presence when interacting with automated ticketing agent at an e-commerce website.</p> <p>??A user feels that his or her computer has "intentions" and a typo-here personality.</p>
<p>Apply to "real" and "illusory" social interactions.</p>	<p>A theory and measure of social presence should be applicable to an individual's sense of social presence not only in willed social interactions, but even when there is no interaction, when the individual is "communicating" (parasocial interaction) with an imagined other or when "no other" or no intelligence is objectively aware, present, or responding to the interactant.</p>	<p>??An individual talks to his TV set.</p> <p>??An individual continues to feel an avatar is interacting when the human controlling the avatar is no longer connected to his embodied shell.</p> <p>??A use feels she is communicating a "God" or being (or any entity that may or may not be there).</p>

cept in such a way that it provides the basis for understanding, explaining, predicting, measuring, and controlling (designing) social presence. A theory of social presence cannot pretend to answer fundamental epistemological issues in the knowledge of other minds (Carruthers & Smith, 1996; Dennett, 1987, 1996; Gordon, 1986; Premack & Premack, 1996), although a robust theory of social presence should certainly engage these issues.

If the goal is a theory that supports a robust measure of social presence, it might be valuable to specify criteria and scope conditions. By scope conditions we mean:

- ? specify the range of phenomenon we seek to understand,
- ? delimit the range of causal relationships of the phenomenon we seek to explain,
- ? determine what behavior or attitudes the theory and measure may seek to predict
- ? determine the range of the theory and predictions,
- ? and, finally, suggest how the theory may provide guidance for design of environments that control qualities of social presence users experience.

In the table below we set out to define what might be the scope conditions of a theory of social presence in mediated environments. These might be thought of a "design criteria" for a theory and measure of social presence.

To flush out and better specify these criteria, we provide definitions and "guiding scenarios." The "guiding scenarios" are examples of interactions that illustrate the fully range or the kinds of interactions that need to be understood and the level of social presence that would need to be measurable. These guiding scenarios represent "boundary cases" that specify the range of condition, interactions, and experiences that a theory of social presence should allow us to explain and measure.

SECTION SUMMARY AND CONCLUSIONS

We have identified a need for a theory of social presence in a technological environment where the Internet and virtual environments become increasing social. A robust and detailed theory and measure of social presence could contribute to our understanding and explaining social behavior in mediated environments, allow researchers to predict and measure differences among media interfaces, and guide the design of new social environments and interfaces. The article re-

viewed, classified, and critiqued existing theories and measures of social presence. We ended by proposing a set of criteria and scope conditions to address weaknesses in past theories and measure and to provide clear criteria for a measurement theory of social presence.

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