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THE EFFECTS OF MEDIA TYPE AND PERSONAL RELATIONSHIP ON PERCEPTIONS OF SOCIAL PRESENCE

By

Chad M. Harms

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ABSTRACT

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Advancements in mediated communication technologies have greatly impacted our society. Understanding how interacting with another individual is changed by the medium is necessary in order to advance human communication and human-computer interaction. The perceived social presence of another is influenced not only by the medium, but by its interaction with the existing relationship between interactants. This study serves to empirically research how individuals' level of acquaintance measured by their perceived closeness to another interacts with various media to change their mutual social presence. Two hundred sixty-two participants interacted via differing channels (face-to-face, audio/video, audio only, and text) and completed a questionnaire regarding their perceptions of another individual (friend or stranger). Results suggest that the relationships between individuals explain differences in social presence more so than the medium used to interact. Future directions of this line of research are discussed.

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DEDICATION

This work is dedicated to my family. Your love and support has made all things possible. To my parents, Jerald and Laurie Harms, you have been the model parents. I love and respect you both so much and know that your love for each other and your family is responsible for all I have and will ever accomplish. To my grandparents, Laura and Martin Stecker and Harmka and Carl Harms, thank you for raising them so well and for your love. To my sister, Jere Bartolo, I've always looked up to you, even when I outgrew you. To Eric, Zach and Becca, I feel privileged to have you as family. To my brother, Matt, I am so thankful you are my brother. I have learned more from you than all the years of school combined. To my wife, Jill, thank you for always being there for me throughout this adventure and thank you for your love. To my son, Jensen, you are an inspiration and your laughter will comfort me all the days of my life. To my children not yet born, I can't wait to meet you. To God, from whom all things are given, thank you for your blessing. You have all taught me what love is and for that I am eternally grateful.

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LIST OF ABBREVIATIONS

FTF.....Face To Face

CMC.....Computer Mediated Communication

LOL.....Laughing Out Loud

MUDs.....Multiple User Dimensions

2D.....Two Dimensional

3D.....Three Dimensional

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INTRODUCTION

The transactional model of interpersonal communication holds that two individuals, simultaneously acting as both sender and receiver, exchange verbal and nonverbal messages via a channel while surrounded by noise in a particular context (Miller & Steinberg, 1975). Despite the simplicity of the model, human communication is a complex and quite intricate phenomenon (Berlow, 1960). The current research is concerned with the basic underlying function of this model; the interaction between interactants. The focus of this research is how interaction, at a perceptual level, is influenced by various mediated channels and the interpersonal relationship between interactants.

The presence of another individual during face-to-face (FtF) communication influences our behavior and communication (Goffman, 1969). It is a physical presence with individuals in bodily form as tangible entities. In FtF communication, the presence of the other is usually taken for granted. The other person is there without question. Their existence and presence are certain. Interactivity is assured.

Alexander Graham Bell's first telephone transmission on March 10, 1876, "Watson, come here; I want you." would diffuse throughout the world and as Thomas Edison once said, "[bring] the human family in closer touch." This was not the birth of mediated communication as the written word had transcended time and space for thousands of years prior to this historic event. But the technological advance that ensued is currently beyond comprehension. With this advance, numerous interactive technologies have blossomed. The Internet and the World Wide Web were "...perhaps

one of the most rapid diffusions of an innovation in the history of humankind" (Rogers, 2002, p.44).

Social interaction now exists in a variety of forms for innumerous functions. At the core of all interactions remains the perception of the other. When a form of media is utilized as the channel between interactants, however, that medium changes the interaction. Physical proximity is no longer required. Whereas several other aspects of the interaction are impacted and will be discussed, the removal of the tangible entity with which one is interacting presents a difference in how we perceive the other. This dissertation is concerned with how individuals using mediated communication technologies perceive the social presence of another entity.

Social presence theory was introduced by Short, Williams and Christie's (1976). Their original work assessed media according to the social presence they could afford to the user. Social presence with a perceived entity refers to the degree of initial awareness, allocated attention, the capacity for both content and affective comprehension, and the capacity for both affective and behavioral interdependence with said entity. Social presence established though communicative interactions between two humans or humans and nonhuman entities.

The pages that follow review various aspects and terminology related to communication technology and mediated human interaction. Next, social presence theory and definitions provide a foundation for the current research. The dimensions of social presence concerned here include co-presence, attentional allocation, perceived message understanding, perceived affective understanding, perceived affective interdependence, and perceived behavioral interdependence. The research agenda and hypotheses for this

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dissertation are outlined as well as the method employed to empirically test these. The results that follow describe the impact of the media and the interpersonal relationships between interactants on their perceived social presence. Finally, a discussion of the meaning and use of the information gained in this research is articulated.

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CHAPTER 1

COMMUNICATION TECHNOLOGY, MEDIA, AND HUMAN INTERACITON

Several aspects of communication technology have advanced in recent years. This chapter identifies and explores various constructs related to social presence in mediated human interactions. First, the synchrony of communication channel allows individuals options regarding the delivery and timeliness of their message. Next, various levels of symmetry influence the mutual social presence experienced by interactants. Also affecting media choice is how rich a media may be perceived. Immersion resulting from multiple sensory cues as well as the format may influence how communication is encoded and decoded by interactants. Lastly, the interactivity between two individuals or between an individual and the computer system they are engaging can differ. Each of these aspects of communication technology can interact with any or all of the other aspects portraying a complex matrix of various communication technology possibilities. Each distinction has the potential to change how individuals perceive others.

Synchrony

The time and location of a particular communication technology is a major distinction for users' choice of a communication medium (Johansen, 1992). Synchronous technologies require that both participants be simultaneously present for the technology to be utilized (i.e., telephone, instant messaging) whereas asynchronous technologies do not require same time participation (i.e., voice mail, e-mail).

Johansen (1992) described synchronous communication as happening at the same time. This meant that individuals could interact with each other in pseudo-real time in

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which the transmission of messages is immediate but subject to lag-time resulting from the networked channel. This is more apparent when individuals are located in the same place such as when students utilize computer systems in traditional classrooms to share information or collaborate (Alavi, 1994; Leidner & Fuller, 1996). Alavi, Wheeler, and Valacich (1995) found that individuals were satisfied with their interactions and felt connected to their group with regard to the learning climate established through group interaction. However, in a later study, Alavi, Yoo, and Vogel (1997) reported that participants were still more satisfied with face-to-face interactions than mediated interactions. Asynchronous communication occurs at different times, but can also take place in the same place or in a different place according to Johansen (1992). The choice allocated to interactants regarding when it is most convenient for them to send and receive messages is also evident in the richness of the media they utilize for engaging others. Mutual social presence can occur synchronous communication technologies are used. Social presence can occur using asynchronous communication technologies as well, though the individual is not engaged in a real-time interaction.

Symmetry

Prior to the push for convergence, interactive technologies required interactants to use symmetrical forms (i.e., telephone to telephone). The term symmetry has been used across a variety of disciplines to describe the balance of properties and functions. The balance of properties is an important distinction of communication technologies (Heeter, Gregg, Climo, Biocca, & Dekker, 2002; Thimbleby, 2002). Biocca, Harms, and Burgoon (2003) refer to this balance with regard to social presence as mutual social presence and suggest that it is intersubjective. Intersubjective phenomena can be characterized as

those involving some form of interdependence between the contents or processes of at least two conscious minds (Wegner, Giuliano, & Hertel, 1985). Social presence is not only concerned with the observer's perception of the other, but as evident in the description of each of the subscales, is also concerned with the other's perceptions of the observer.

Mutual Social Presence is assessed by determining two types of symmetry, within-interactant and between-interactant symmetry. Within-interactant symmetry is an index of the degree to which an individual perceives their sense of social presence to be equal or symmetrical to the other interactant's perception of social presence. Between-interactant symmetry is an index of the degree to which each of two or more interactants perceptions' of the other's level of social presence matches the other's own self-assessed social presence. Three ways in which symmetry can affect mutual social presence are (a) the cues afforded to the users, (b) the perspectives of the users, and (c) the transmission between the users.

Symmetry can differ in the cues afforded to the users of interactive systems (Thimbleby, 2002). An individual (person A) in an immersive virtual environment, one in which the output device is a 360 degree projection screen, can converse with another individual (person B) over a speaker phone. Person B can be talking on a telephone while sitting at a desktop computer observing and discussing the same virtual environment. Asymmetry exists in multiple ways in that person B can see person A's perceivable environment, but not vise-versa, person A sees a larger portion a 360 degree output display than person B is able to see on a standard monitor, and while communicating with each other, person A speaks and listens without requiring a

handheld input devise while person B is perhaps limited by the length of the phone cord. The cues afforded to the users can affect user's symmetrical awareness of another in virtual spaces (Nakanishi, 2004).

The perspective of the interactants can also differ in symmetry. Often video conferencing hardware and software allow an individual to interact with others across great distances. The mediated individual has a limited range of movement and visual capacity based on the system. Their experience with the other interactant(s) is asymmetrical (Heeter, Gregg, Climo, Biocca, & Dekker, 2002).

Finally, communication technology symmetry can differ in the speed and amount of information that can be sent and received. Different users may have differing systems such as a modem (56Kbps compared to a T1 connection). Some systems like the Asymmetrical Digital Subscriber Line (ADSL) allow users to download at 9Mbps and upload at 640Kbps. This asymmetry can result in latency during an interaction.

Each distinction of symmetry can influence the perception of the person or entity with whom an individual may be interacting. The ability to effectively understand the other's message or receive specific affective cues can dramatically differ between different situations.

Media Richness

Media richness was defined by O'Hair, Friedrich, and Shaver (1998) as the "ability of a communication channel to handle information or convey the meaning contained in a message" (p. 60). Change in media type affects the desired level of social interaction. According to Daft and Lengel's *Media Richness Theory* (Daft & Lengel, 1984), derived from Short, Williams, and Christie's *Social Presence Theory* (Short,

Williams, & Christie, 1976), individuals use various media based on the particular media's assessed instantaneous feedback, natural language, personal focus, and allowance of multiple cues. A rich media excels in each of these categories. Just as several social presence researchers suggested face-to-face (FtF) as the gold standard of social presence the media richness theory holds FtF as the richest medium for interaction. Accordingly, the richer the medium the more likely social presence will be assessed strongly.

Rice (1993) built upon Short, Williams and Christie's social presence theory and Daft and Lengel's (1984) media richness theory by testing the appropriateness of a media for a range of communication tasks thought to be influenced by a medium's social presence (i.e., decision making, generating ideas, persuasion, and maintaining relations). Perceptions of media appropriateness were only weakly associated with actual use of the media for the various tasks. Social factors had only minor effects on media richness perceptions. This supported earlier work (Fish, Kraut, Root, & Rice, 1992) that found video conference interactions differed from FTF interactions. Dramatic difference was found in time spent interacting (roughly 4 minutes in mediated compared to 36 minutes in FtF). Mediated interactions were brief and contained only communication necessary to accomplish particular tasks, whereas FtF interactions were reserved for more extended conversations. Tasks completed also differed between video (set meeting, acknowledgement) and FTF (problem solving, decision-making). Also, FTF was considered better for productivity, learning org culture, and fostering relationships than mediated interactions.

Immersion

The output devise directly affects the immersion of the user with regard to the technology. Biocca and Delaney (Biocca & Delaney, 1995) explain that the term immersive, "refers to the degree to which a virtual environment submerges the perceptual system of the user in computer-generated stimuli." (p. 57). Output devices provide visual, auditory, and other stimuli to captivate the senses and block out the physical world (Biocca & Delaney, 1995). Though less prevalent, haptic sensations (Sharma & Kesavadas, 2001; Basdogan et al., 2000), olfactory systems (i.e., *iSmell*©), and even the sense of taste (i.e., Food Simulator©) (Iwata, 2003) are available to engulf the senses. Though each sensation cue can detail intricate aspects of communication, visual and auditory cues are currently the primary signals utilized in mediated communication and exist in multiple formats. Social presence can be greatly affected by changes in immersion as physical world distractions become less noticeable and the perceived entities become more salient.

Format

The format of communication technologies can influence the interaction between individuals. Text is a symbolic visual cue of communication. Text is used in numerous forums such as instant messaging, newsgroups, and multiple user dimensions (MUDs). The written word provides a clear and retainable representation of the communication conversation between individuals. Text communication in mediated interactions can be both synchronous and asynchronous. Often in synchronous interfaces the communication is representative of an interactive or volleying style back and forth between interactants. In text-based environments, one person speaks, the other then reads the message sent and

types a reply. Text interaction differs as thoughts and responses overlap and can be encoded with simple acronyms (i.e., LOL = laughing out loud) (Suler, 1997). Nonverbal communication also is present, in limited forms, in text-based communication. Emoticons represent users' emotions by combining various keystrokes (i.e., happy :)). This function is so prevalent in our mediated interactions that while using Microsoft Word© the colon + parenthesis keystroke combination auto-corrects into ☺. Auditory nonverbal communication exists in text-based communication environments as well. There are a range of sound keys that allow a user to create the sounds of applause, a burp, or even laughter.

Digital representations of an interactant, avatars, represent another novel communication format. Users embody themselves and utilize this embodiment to interact with their environment (Taylor, 2002). Avatars often are used in combination with text communication. 2D and 3D avatars are available depending on the environment in which the interaction takes place. Avatars function to identify interactants and initiate communication. Anthropomorphism, the act of attributing human forms or qualities to entities which are not human (Nowak & Biocca, 2003), is prevalent in avatar construction, though non- anthropomorphic avatars do exist in innumerous forms. One can customize their avatar to express emotion by changing facial characteristics or adding accessories (i.e., heart). Group affiliation, confrontation, or closeness can be signaled by placement of one's avatar in relation to another's. This even can cause physiological changes in the corporeal user as user's experience a sense of invasion of personal space via their avatar (Becker & Mark, 2002). Avatars, as well as strictly text-based

representations, allow for complete anonymity and thus potential to recreate or lie about a user's identity.

Video formats allow streaming video to be transmitted between interactants. Often times it is accompanied with audio in video conferencing systems. Symmetry between interactants' perception can be impacted by differences in systems and perspective (Heeter et al., 2002). Though synchronous in nature, latency and skips can exist, causing external noise. Nonverbal expressions are afforded to the interactants through facial expression, orientation, and gestures.

Without the video steam, the audio format is referred to as telephony. Telephones can connect dyads or multiple interactants as is the case in teleconferencing. Latency is less noticeable in telecommunication systems. Paralanguage such as tone, volume, and pitch provide nonverbal communication to the interactants. The connection between individuals and their ability to interact are essential toward perceiving social presence.

Perhaps format more so than other aspects of communication technologies has been central toward understanding social presence. Change in format was the nature of Short, William, and Christie's (1976) original work and continues to be the focus media usage research work (Rice, 1993).

Interactivity

Interactivity is considered by many to have changed the direction of mediated communication research (Heeter, 1989, Rogers, 1986, Williams, Rice, & Rogers, 1988). Rogers (2002) suggested that it was interactive nature of new computing technologies that developed into the terminology, computer-mediated communication (CMC), which is regularly used in society today. Huang (2003) explained that the term interactivity

could be used to "broadly refer to interaction between senders and receivers in a communication process" (p. 8). Huang (2003) goes on to give a detailed account of several other definitions. Different perspectives have been drawn from to produce very different definitions. Rafaeli (1990) and Neuman (1991) viewed interactivity as a characteristic of the communication setting and not the medium. Rogers (1986) saw interactivity as the connection between the computer and the individual using the computer. Later Williams, et al, (1998) expanded the definition to include the controllability the user had over the system. Heeter (1989) categorized interactivity into six dimensions: (1) complexity of choice available, (2) effort required of users, (3) responsiveness to the user, (4) monitoring information for the user, (5) ease of adding information, and (6) facilitation of interpersonal communication.

Interactivity of a media system can impact the user's perceptions. Laurel (1991) found that users felt limited if the system restricted choices deemed important by the user. Visual response latency and restricted kinetic input impaired sensory immersion perceived interactivity (Laurel, 1991). The speed of the input as it is assimilated into the medium can be directly observed by the user. The extent to which that input in not perceived as natural and predictive, user's perceived interactivity is compromised (Steuer, 1995). This is evident in output as well as individuals are extremely capable of recognizing biological and simulated-biological motion (Pelphrey, Mitchell, McKeown, Goldstein, Allison, & McCarthy, 2003). Perceptions of another can also be attenuated by how the other is perceived as well as how personal and immediate the communication between individuals comes across to the user (Daft and Lengel, 1986), and how an individual is represented by his/her avatar (Nowak & Biocca, 2003). Accessibility to

another and the perceived sociability of another can also be directly connected to the interactivity of the medium (Biocca & Nowak, 2002). Interactivity will continue to change how social presence with computer generated entities is developed.

Each of the afore mentioned aspects of communication technology; synchrony symmetry, media richness, immersion, format, and interactivity, fundamentally change the model human communication. Their commonality with regard to the media channel separating individuals confounds assessments of social presence when varied. Understanding how subtle changes in media affect perceptions of and relationships with others will allow for a greater understanding of mediated communication and social presence.

CHAPTER 2

SOCIAL PRESENCE

Theory and Definition

Social Presence is a complex concept that since the mid 1970's has sustained several different perspectives and shifts in definition. Short, Williams and Christie's (1976) *Theory of Social Presence* hypothesized that different media allowed individuals to have greater or lesser social presence during mediated interactions. They defined social presence as, "The degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (Short, Williams, & Christie, 1976, p. 65). Whereas this definition suggests a user-based perceptual construction of the other and the mutual relationship, Short et al. were interested in measuring various media to determine their capacity to allow social presence to occur. Several other researchers (Steinfield, 1986; Rice, 1992; Rice, 1993; Sallnas, Rassmus-Grohn, & Sjöström, 2000) followed Short et al's (1976) lead and also measured the medium rather than the perception of the user. With the advent of the internet and studies of immersion, the construct was reexamined by numerous researchers (e.g., see Harms, 2003) and conceptualization and measurement of social presence shifted toward a social psychological view of social presence as a perceptual state of an individual. A complete review of the perspectives and definitions was captured by Harms (2003) and is beneficial in understanding the development of the concept.

Contemporary views and past definitions of social presence were summarized in a theoretical article by Biocca, Harms and Burgoon (2003), wherein they offered the following definition:

> Mediated social presence is the degree to which a user of a communication technology feels that another human being or intelligence is accessible and co-present via medium. The sense of social presence can vary within and across media technologies from the simple sense that a user is aware that "some body" is present via a mediated space, or that they are mutually aware of their mediated co-presence, to a sense that the mediated representation of the other enables some level of access to the other's attentional, cognitive, or affective states. (p.334)

This definition makes clear that social presence is not a property of the medium, but of the user. It emerges from the user's representation of the intentional states of a mediated other, but the other's actual presence via the medium is uncertain and can include interaction with artificial intelligences. In addition, the definition was weighed against and guided by several criteria and scope conditions (Biocca, et al., 2003).

Taking into account the original conceptualization, the development of the construct in the last three decades (Harms, 2003), and the contemporary insight (Biocca, et al., 2003); social presence for the purpose of the current research is defined in the following way:

> Social presence in a mutual interaction with a perceived entity refers to the degree of initial awareness, allocated attention, the capacity for both content and affective comprehension, and the capacity for both affective and behavioral interdependence with said entity.

This definition meets criteria established by Biocca, et. al (2003) (Appendix A). Thus, the current definition specifies social presence as multidimensional. These criteria

guide the conceptualization and measurement that can support generalizability across various research of mediated interaction and interface development.

Social Presence Research

Primarily research on social presence has focused on perceptions of different medias for allowing effective interaction between individuals. The original work by Short, Williams and Christie (1976) measured social presence using pairs of bipolar items which included *unsociable-sociable, insensitive-sensitive, cold-warm, and impersonal-personal.* "Media having a high degree of Social Presence are judged as being warm, personal, sensitive and sociable." (Short et al., 1976, p. 66). Their research had participants rate one of three media conditions (audio only, audio-visual, and face-to-face). They found dramatic differences between the perception of medias' capacity for social presence. FtF ranked the highest followed by video. These were not significantly different from each other. Audio followed and showed significant differences between stereo audio and monaural audio. In a second study individuals raked other media along the semantic differential. FtF ranked the highest, followed by television, stereo audio, telephone, and lastly a business letter. This early work, rank ordering different media, guided Daft and Lengel's (1984) explication of the media richness theory.

Several research studies followed using Short, Williams, Christie's (1976) items. de Greef and IJsselsteijn (2000) measured social presence using both Short, et al.'s items as well as 10 additional items (i.e. "It provides a great sense of realism. It was just as if we were in the same room."). Participants interacted with each other using a collaborative interface in either an audio-video condition or an audio only condition. Participants also took the role as either the presenter or viewer. Video substantially increased social

presence while the presenter/viewer role variable was not significant. Women were also noted to have experienced greater levels of social presence. Lombard, M., Ditton, T. B., Crane, D., Davis, B., Horvath, K., and Rossman, J. (2000) had participants experience either a high presence (Imax© dinosaur movie) or low presence (TV three's company rerun) condition and answer a variety of questions concerning the experience and certain questions involving perceived interactions. They used Short et al.'s (1976) bipolar items as well as new bipolar items (unemotional-emotional, inaccecible-accecible, dead-lively, dull-vivid, remote-near, removed-close, distant-immediate, unresponsive-responsive, informal-formal, unfriendly-friendly). In addition to these scales, perceptual realism was measured by asking participants, "how much did touching the people feel like it would if you had experienced them directly?", How much did it seem as if the people in the environment could touch you?, How much did it seem as if you could reach out and touch the people?, and How much did it seem as if you and the other people were together in the same place?" etc. More immersion resulted in a greater sense of perceptual realism for both object and people. Sallnas, Rassmus-Grohn, and Sjostrom, (2000) had subjects using audio/video/haptic connections (audio was used to communicate w/ each other) to arrange virtual blocks. Participants responded to Short, Williams and Christie's bipolar items as well as four others (i.e. negative-positive). Their results were inconclusive.

In addition to research using Short, Williams, Christie's (1976) items, numerous studies attempted to assess social presence though alternative methods. The sense of being together (Ho, Basdogan et al. 2001) created by interaction through a collaborative online game was also measured. Haptic feedback added significantly to the sense of

togetherness. Degree of togetherness increased task performance. Similar to the finding of de Greef and IJsselsteijn (2000), females perceived a greater sense of togetherness than males. One last finding was that the sense of togetherness increased when the participant judged the other as having high social anxiety.

Social presence density, calculated by using a network analysis technique, compared two groups (Rourke, Anderson, Garrison, & Archer, 1999; Garrison, Anderson, & Archer, 2000). Social presence instances included in the content analysis on dyadic interactions quantified emotional expression, open communication, group cohesion, communicate information or ideas. They found that the longer the communication interactions were the more social presence instances occurred.

Bradner and Mark (2001) took a more qualitative approach, asking questions directly related to the sense of a social presence of another (i.e., I was aware of the presence of another person. I was aware that I was being observed). The results of this study highlighted the need of symmetry and suggested that visual feedback of a collaborating partner is not necessary to create a sense of social presence. No significant difference regarding awareness was noted between media.

Finally, research associated with social presence has been done without drawing any conclusions regarding how social presence impacts or is impacted. Some studies have measured social presence using simply one or two items. Muhlbach, Bocker, and Prussog, (1995) measured social presence by asking participants, "[It felt] as if we were all in the same room" and "[It felt] like a real face-to-face meeting". Zhang and Furnas (2002) looked at how avatar size affected spatial perception of self and other. Other studies assessed related concepts such as intimacy, involvement and immediacy

(Burgoon and Hale, 1987), immediacy of the medium (Gunawardena and Zittle, 1997), and homophily (Choi, 2000; Nowak, 2000).

Dimensions of Social Presence

Social presence has been conceptualized as including six sub-dimensions (Harms, 2003). These include co-presence, attentional allocation, perceived message understanding, perceived affective understanding, perceived affective interdependence, and perceived behavioral interdependence. See Table 1 for a summary of the dimensions.

Co-presence. Co-presence is the degree to which the observer believes he/she is not alone and secluded, their level of peripheral or focal awareness of the other, and their sense of the degree to which the other is peripherally or focally aware of them. Several researchers have identified co-presence (Goffman, 1959; Ciolek 1982; Nowak & Biocca, 2003) and co-location (Mason 1994; McLeod, Baron, Marti, & Yoon, 1997; Tammelin, 1998; Sallnas, et al., 2000) as the minimum level of interaction necessary for social presence. Although co-presence and social presence are often used interchangeably (e.g., Ho, Basdogan, Slater, Durlach & Srinivasan, 1998; Zhao, 2001), the sense of co-presence is necessary, but not sufficient, for social presence.

Attentional allocation. Attentional allocation addresses the amount of attention the user allocates to and receives from an interactant. Psychologists studying attention have often referred to attention as a resource that can be allocated as deemed necessary for the situation (Kahneman, 1973; Wickens, 1984). Goffman (1959) addressed this idea when he noted that a person must be, "close enough to be perceived in this sensing of being perceived." (p. 17). Heeter (1992) also discussed the awareness of another reacting

to the user. This reaction to another can vary in mediated interactions as it can in face-to-face interactions (Blascovich et al., 2002). In mediated interactions, attention can become very ambiguous depending on the cues filtered out by the medium.

Perceived message understanding. Perceived message understanding is the ability of the user to understand the message being received from the interactant as well as their perception of the interactant's level of message understanding. Savicki and Kelley (2000) attribute social presence to one's ability to make one's self known to another individual. Whereas social presence can exist between two individuals who are not able to comprehend the message being transferred between them, research in the usefulness of mediated communication (Rice, 1993; Daft & Lengel, 1984) suggests that comprehension allows interactants to better understand and positively relate to the other.

Perceived affective understanding. Perceived Affective Understanding is the user's ability to understand an interactant's emotional and attitudinal states as well as their perception of the interactant's ability to understand the user's emotional and attitudinal states. Both Rourke, Anderson, Garrison, and Archer (1999) and Savicki and Kelley (2000) discuss the transfer and understanding of an individual's affective state. The ability of one person to perceive and access another's affective state is closely related if not synonymous with empathy.

Perceived affective interdependence. Perceived Affective Interdependence is the extent to which the user's emotional and attitudinal state affects and is affected by the emotional and attitudinal states of the interactant. Often as one works to experience the world from the other's point of view, affective or emotional contagion, experiencing the same feelings other's are having (sadness, happiness) can result (Stiff, Dillard, Somero,

Kim, and Sleight, 1988). While interacting with another, individuals may not only empathically understand the emotions someone elicits or the mood someone is in, but may become affected by those emotions or that mood.

Perceived behavioral interdependence. Perceived Behavioral Interdependence is the extent to which a user's behavior affects and is affected by the interactant's behavior. The interdependence that can develop between two interactants may be minimal resulting in threads of communication or interdependent orientation toward the other. Interdependence may also be much greater with actions of one during a process depending on the actions of another in order for a system to work. As Palmer (1995) noted, social presence is not simply running into another individual, but "negotiat(ing) a relationship through an interdependent, multi-channel exchange of behaviors" (p. 291). Tu and McIsaac (2002) identified interactivity between individuals as a major component of social presence. Short, Williams and Christie (1976) referred to this interdependence as "the consequent salience of the interpersonal relationships" (p. 65).

Scale Construction

Initially, three categories of social presence research were identified. First, co-presence research dealt with the degree to which the observer believes he/she is not alone and secluded, their level of peripherally or focally awareness of the other, and their sense of the degree to which the other is peripherally or focally aware of them. Next, psychological involvement research identified the degree to which the observer allocates focal attention to the other, empathically senses or responds to the emotional states of the other, and believes that he/she has insight into the intentions, motivation, and thoughts of the other. Finally, behavioral interaction is the degree to which the observer believes

his/her actions are interdependent, connected to, or responsive to the other and that the other's perceived responsiveness are interdependent, connected to, or responsive to the observer's actions. From these categorizations of social presence research, the six distinct dimensions of social presence identified above were established.

An initial pool of eighty-eight items was created. The items were created to reflect the identified dimensions. Some items were based on existing measures or were modified to meet the criteria for cross media generalization identified by Biocca et al. (2003). As each item characterized a statement about the nature of the mediated social interaction, a Likert scale format would be used to measure each item.

The items were analyzed for their translation validity (Trochim, 2001), specifically the face validity and content validity. Items were determined as to how well they captured the underlying structure and scope of the conceptualization and dimensions of social presence. A set of 5 researchers in social presence reviewed the initial item pool and specifically eliminated trait oriented items. On the basis of face validity, sixty-nine out of the original eighty-eight items were retained. Nineteen items deemed problematic due to redundancy across items and confusing wording were removed. The sixty-nine item scale was tested in a pilot study (Biocca, Harms, & Gregg, 2001) using 76 participants. Although the results were inconclusive, analysis identified certain items as poor indicators and exit interviews suggested that additional items were problematic due to wording that caused confusion. This information was used to finalize 50 items. Each of the 50 items were reflected or mirrored to measure the observer's perception of the other's response. (e.g. My thoughts were clear to (my partner)./(My partner's) thoughts were clear to me.). The final result was a 100 item pool.

In a final testing by Harms (2003), 18 paired items were retained for a 36-item measure of social presence. Thirty-two paired items were removed due to low reliability of one or both items in order to optimize the scale size. Items Each subscale contains three subjective items and three corresponding intersubjective items.

Scale Validity

The factor structure of the measure reflected the theorized dimensional structure of the social presence construct. Each subscale was subjected to confirmatory factual analysis (Hunter & Gerbing, 1982) which supported a factor structure made up of six distinct factors. Each factor or subscale appeared to be internally consistent. Item reliability was consistent ($\alpha > .80$) across all factors. Consistent with predictions from theory, the social presence measure was able to distinguish overall between social presence experience of face-to-face interaction and mediated interaction. Perceived Message Understanding and Perceived Emotional Interdependence yielded null results however. The measure failed to identify differences between experiences in these two media. In fact, Perceived Message Understanding and Perceived Emotional Understanding indicated that the low affordance textual medium provided greater social presence than the high affordance medium. Three intriguing questions arose from the results: (1) why two of the six subscales failed to distinguish between social presence experiences in face-to-face and mediated interaction, (2) why none of the scales distinguished between two levels of mediated experience, and (3) why in two factors indicated that the low affordance medium produced a higher level of social presence.

CHAPTER 3

RESEARCH AGENDA AND PREDICTIONS

This research addresses a variable identified in the original definition of social presence forwarded by Short et al. (1976). As stated earlier, their original definition said that social presence was, "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (p. 65). However, to the author's knowledge, no social presence research measuring or controlling for the interpersonal relationship between interactants exists. The influence of the medium has been tested numerous times, but the potential interaction between medium and the closeness between interactants (i.e., their relationship) remains untested.

As dyads interact across different mediated communication channels, the cues afforded to them vary (Daft and Lengel, 1984). Short, Williams, and Christie (1976) theorized that as mediated channels diverged further from face-to-face interaction (FtF, video, stereo audio, monaural audio, speakerphone) so to did the social presence the medium would allow. This ordering replicates the media richness theory (Daft and Lengel, 1984), which suggested that media can be arrayed along a continuum by the amount of social cues afforded to the user. The inability of the internet to support interpersonal communication was a concern by early researchers due to the absence of many sensory cues and social interaction cues (Walther, 1996). On the basis of social presence theory, the highest level of social presence is believed to be face-to-face communication or when one appears as a real or non-mediated person (Garrison,

Anderson, and Archer, 2000; Gunawardena, 1995, Heeter, 1992). Based on past research (Harms, 2003), the medium will impact the perception of social presence.

H1A: Co-presence will be greater in face-to-face (FtF) interactions than mediated interactions.

H1B: Attentional allocation will be greater in FtF interactions than mediated interactions.

H1C: Perceived message understanding will be greater in FtF interactions than mediated interactions.

H1D: Perceived affective understanding will be greater in FtF interactions than mediated interactions.

H1E: Perceived affective interdependence will be greater in FtF interactions than mediated interactions.

H1F: Perceived behavioral interdependence will be greater in FtF interactions than mediated interactions.

According to Kenny (1994), interpersonal perception involves not only the perspective of both the perceiver and the target, but also that of the relationship. The second component of Short, Williams and Christie's (1976) definition of social presence referred to the "...consequent salience of the interpersonal relationships" (p. 65). Baxter (1987) described relationships as "mini-cultures" that exist within the dyad. Each relationship is unique and separate from the either individuals' relationships with others resulting in specific knowledge structures regarding specific individuals. Friends have a more extensive knowledge structure (Cantor, et al., 1982) than strangers allowing them to more accurately access each other's affective states Ickes, et al. (1990).

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Inferences of strangers or individuals of zero acquaintance become more difficult due to the "limitations of their knowledge structure" (Stinson & Ickes, 1992, p.794). This can directly impact individuals' ability to accurately interpret behavior and even empathize with the other. Despite the lack of knowledge about the other in an initial interaction, individuals do form impressions. Park and Judd (1989) state that, "when interacting with a new acquaintance, regardless of how briefly, one forms personality impressions" (p. 493). Common human or cultural experiences allow even total strangers to attain some degree of accuracy in inferring each other's thoughts and feelings with only minimal amount of shared information. Without specific information about the new acquaintance, individuals' often employ stereotypes called prototypes defined by Cantor (1981) as an "abstract set of features commonly associated with members of a category" (p.27).

The interdependence resulting from their close relationship (Kelley, et al., 1983) allows them to understand each other more easily than strangers which rely on social interaction cues (Walther, 1996). Friends are thus capable of understanding and relating to each other when those cues are absent because they have greater predictive power (Berger & Calabrese, 1976), Mediated interactions tend to filter out social interaction cues prevalent in face-to-face interactions (Walther, 1996).

Each of the six factors identified by Harms (2003) did not vary with media in the same way. It is expected that the level of acquaintance will impact each factor differently as well. Copresence is a measure of awareness of the other. As this experiment places individuals into dyadic interactions and asks them to communicate with each other,

awareness of the other in the interaction should remain steady. No empirical research has been found to suggest that the relationship with the other should change interactant's awareness.

H2: Level of acquaintance will have little or no affect level of co-presence.

We know more about our friends than we do about stranger we encounter Norman and (Stinson & Ickes, 1992). When we interact with individual we do not know we try to reduce our uncertainty about them by paying close attention to various social and environmental cues (Berger & Calabrese, 1976). With less knowledge about the other, strangers will rely on all perceivable information (i.e., social interaction cues) to supplement their perceptions of the other. Fiske and Neuberg (1990) described four categories of impression formation. The first was an automatic categorization while the last three required more cognitive processing. Level of categorization is affected both stimulus characteristics (the amount and degree of details available) and by task demands that influence motivation and attention (Brewer, 1988). Without specific information about the other, strangers must pay greater attention to the other in order to understand meaning on both a content and affective level.

H3: Friends will report lower levels of attentional allocation than strangers.

The amount of time spent with another often increases the amount of communication that transpires between two individuals. As we decode more messages from a particular other our ability and accuracy is expected to get better. Stinson and Ickes (1992) stated that "Friends greater content accuracy derived from knowledge structures activated by the specific content of the interaction" (p.793). As opposed to making lucky guesses, our relationship to the other and the knowledge structure built

with regard to that other enable us to be more accurate. Ickes et al. (1990) determined that content accuracy was affected by the individual's interest or attraction to the other. The closer individuals are to each other the greater their ability to accurately understand each should be regardless of the medium through which the are communicating. However, individuals with lower knowledge structures will rely more heavily on the available information in order to more accurately decode a message. Nonverbal communication has been extensively noted for the great amount of additional information it provides to communication messages (Burgoon, 1994). With reduced cues, both visual and auditory, strangers will be less accurate in their understanding of the other.

Text as a written form of communication may also promote greater understanding of the message. Max Weber promoted the use of the written word as opposed to verbal communication within organizational settings as it reduced the uncertainty and gave clear understanding to the message (Aron, 1970; Coser, 1977). Harms (2003) found that text promoted greater levels of message understanding than other forms of media. The textual medium allows for a less distracted, less complex exchange resulting in greater understanding of the message. This perspective differs from assumptions Daft and Lengel (1986) make about the order in which media impact communication, but unfortunately research between text and other forms of communication is lacking.

H4: Media and level of acquaintance will interact to affect perceived message understanding such that perceived message understanding should remain constant for acquainted relationships regardless of medium. But perceived message understanding should be higher in face-to-face interactions than mediated interactions for less acquainted relationships.

Closeness between individuals in a relationship is associated with greater skill at decoding nonverbal cues of emotions. Friends are significantly better than strangers at correctly guessing the senders' affective state. (Kelley, et al.,1983). Ickes, Stinson, Bissonnette and Garcia (1990) found that empathic accuracy increased as friends spent more time with each other. Empathic accuracy (Stinson and Ickes, 1992) requires that the perceiver's cognitive activity be based in large measure on real knowledge of the other and of his of her circumstances and not merely on supposition, analogy, or projection. By implication, empathic accuracy also requires the expressive skills of the target to convey an otherwise private experience through verbal or nonverbal behavior. Fiske and Cox (1979) contend that this information is very specific and through continued interaction and "specific occurrences in the past" (Baldwin, 1992, p.467) individuals' understanding of the other is greater. Through their history of interaction, the participants should acquire a store of mutual knowledge that provides them with understanding of each other's private experiences (Stinson and Ickes, 1992, p 787-788).

Interpreting affective communication across differing media can present a problem to individuals based on a lack of cues (Walther, 1996, Culnan & Markus, 1987) Stinson and Ickes (1992) found male friends were significantly better in their empathic accuracy than male strangers. Friends showed more involvement resulting in "greater accuracy in inferring the content of each other's thoughts and feelings" (Stinson and Ickes, 1992, p.793). The increased intimacy between friends (Kurth, 1970) results in more accurate perceptions of each other (Paunonem, 1989; Funder & Colvin, 1988)

H5: Friends will report higher levels of perceived affective understanding than strangers.

Behavior is reciprocated between friends (Clark, 1983). Kelley et al.(1983) said close relationships have greater interdependence than superficial relationships. The expectation of future interaction with another, increases the likelihood that individuals will coordinate future behaviors. This difference can result in a different perception by interactants regarding their behavioral (communicative) reliance on the other in an interaction. Close relationships not only have an increased sense of interdependence (Berscheid, Snyder & Omota, 1989; Kelley et al.,1983), they also have greater intimacy (Kurth, 1970).

H6: Friends will report higher levels of perceived behavioral interdependence than strangers.

Text-based interactions are differ from other types of interactions in that a staccato style of communication develops where one person says something, waits for a reply, and then comments again. This interaction differs from the transactional model of communication that allows simultaneous feedback. Text-based interactions require coordination between interactants. When a person writes a message, they are likely to express information that they would not typically express in FtF situations due to the need to clarify exactly what they mean (Barak, 2003). This information is curtailed to meet the needs of the interaction with a specific other. This is consistent with how students use written language versus spoken language in educational settings. Bowman (2003) suggests that students pay greater attention to messages in written form in online courses. Though research on interdependence resulting from text-based is extremely limited, a study by Harms (2003) found that text-based interactions produced a greater sense of behavioral interdependence.

H7: Text will have higher scores in behavioral interdependence than other mediated conditions (i.e., audio only and audio/video).

Affective interdependence should be influenced in a similar fashion. Baldwin, (1992) noted that relational schemas can trigger associated affective responses. The closer we are to another the more likely their affective state will have an impact on our affective state. Herman (1992) found that coworkers were much more likely to experience emotional contagion. Friends have mutual influence of each others' self schemata, both how they see themselves and how they feel about themselves (Deutsch and Machesy, 1985). The closer individuals are the more similarity or homophily they perceive between them (McCroskey, Richmond, & Daly, 1975). The increased intimacy between friends (Kurth, 1970) results in more accurate perceptions of each other. A positive main effect for acquaintance was found friend's abilities to create accurate perceptions of other's personality traits (Paunonem, 1989; Funder & Colvin, 1988).

H8: Friends will report higher levels of perceived affective interdependence than strangers.

CHAPTER 4

METHOD

Participants

Two hundred sixty-two students enrolled in communication courses at a large Mid-western university participated in this study for extra-credit and a $5 gift certificate for a local pizza restaurant. The 131 dyadic pairs were all same-sex partners (56 male pairs, 75 female pairs). They ranged in age from 18 to 41 with an average age of 21-years old.

Design

The design was a 2 X 4 independent groups experimental design where relationship is crossed with interaction conditions. Participants were randomly assigned to one of four media conditions: (1) face-to-face, (2) audio/video (3) audio-only and (4) text. Participants were also randomly assigned to interact with either a friend or a stranger.

Materials

This study required four computers, each with a monitors, mouse configurations, two web cameras with two monitors, and two microphones and speakers. The placement of the participants with respect to their partner was determined by the condition to which they were randomly selected. In the face-to-face condition participants were seated across a table from their partner. In the audio/video, audio, and text condition participants were seated in front on their computer while their partner sat in front of their

own computer. Partners were separated to ensure that they could not hear or see each other.

Procedure

Participants were instructed to sign up for the extra-credit study at an on-line scheduling site. Students chose a 1-hour time slot that would work with their schedule. One hundred thirty-one participants asked a friend to also participate with them in the study. Twenty-four hours prior to their experiment time they were sent a reminder over e-mail. Four dyads were scheduled for identical research participation times and upon arriving at the research location are randomly assigned to a partner, either a friend (the person they brought with them to the research study) or stranger (an individual that they did not accompany to the research study). That is, sometimes the participants are paired with friends and sometimes they are paired with strangers. The strangers had come to the research study independent of each other and had no prior relationship.

Upon entering the lab, participants were greeted and seated. Participants were then given a consent form and instruction sheet. The instruction sheet had five steps. First students were instructed to read through and sign the consent form. Second, students were informed that they would be randomly selected to interact with another student. The third point instructed the participants that they would work together with their partner to accomplish a task and that they should communicate with each other during the interaction in order to complete the task efficiently. The fourth point had participants complete the task together. The final step instructed participants that they would asked to complete a questionnaire. All research participants were physically isolated away from both their assigned partner and all other participants except for those

in the face-to-face condition. Those individuals interacting face-to-face did so across from each other at a table and then turned away from each other to complete their questionnaires. The task partners completed was entitled the desert survival task (Lafferty & Eady, 1974). The instructions read:

> You are on a reconnaissance mission in the desert when your jeep crashes, killing several members of your group. The rest of you are uninjured. The nearest outpost is forty-five miles east. When you don't report back for the evening, others will know you are missing and know generally, but not specifically, where you are. The terrain is dry and rugged. A nearby shallow water hole is contaminated by worms, animal leavings, and dead mice. The temperature will reach 108 degrees, and you are dressed in lightweight summer clothes with hats and sunglasses. The remaining survivors are able to salvage the following items. First, on your own, rank these items according to how important they are to your survival, with 1 for the most important to 12 for the least important. Then, work with your partner to develop a final ranking between the two of you.

The items that individuals ranked were: magnetic compass, 20-by-20 foot piece of heavy-duty, light blue canvas, book, Plants of the Desert, rearview mirror, large knife, flashlight (four-battery size), one jacket per person, one transparent plastic ground cloth (6 feet by 4 feet) per person, loaded .38-caliber pistol, one 2-quart plastic canteen per person full of water, an accurate map of the area, and a large box of kitchen matches. The time it took to complete the task was recorded.

After the task was completed, a post test questionnaire containing measures of co-presence, attentional allocation, perceived message understanding, perceived affective

understanding, perceived affective interdependence, perceived behavioral interdependence, and communication satisfaction was completed. Participants were instructed to answer the questions with regard to the task interaction they just comleted with their assigned partner. These questionnaire items were answered on a 1-7 Likert scale, from strongly agree to strongly disagree. Also on the questionnaire were questions regarding individuals' familiarity, comfort, and frequency of use for the various media. These questionnaire items were answered on a 1-5 Likert scale, from agree to disagree.

Once the questionnaire was completed, participants were thanked and escorted out. Any questions about the purpose of the experiment were answered at that point.

Measures

The Networked Minds Social Presence Inventory (Harms, 2003), made up of 36 items, was the main focus of the questionnaire. This scale contained six reliable sub-factor scales including co-presence, attentional allocation, perceived message understanding, perceived affective understanding, perceived affective interdependence, and perceived behavioral interdependence. The alpha reliabilities of the earlier study were as follows. The *Co-presence* sub-factor scale items yielded an alpha reliability of .83. *Attentional Allocation* yielded an alpha reliability of .81. *Perceived Message Understanding* yielded an alpha reliability of .87. *Perceived Emotional Understanding* yielded an alpha reliability of .86. *Perceived Emotional Interdependence* yielded an alpha reliability of .85. Lastly, *Perceived Behavioral Interdependence* yielded an alpha reliability of .82 (Harms, 2003). See APPENDIX A.

The interpersonal solidarity scale (Wheeless, 1978) was used to measure level of acquaintance. Wheeless (1978) found that interpersonal solidarity was an effective

measure of closeness within a relationship and that it correlated highly with both self-disclosure (Altman & Taylor, 1973) and trust. Further validation came from Bell and Healey (1992) as they utilized a scale Wheeless (1978) constructed to determine perceived closeness with relationships. This scale measured the perceived closeness between individuals and was shown in past studies to be reliable with a coefficient alpha of .90. See APPENDIX B.

The final scale used was the interpersonal communication satisfaction inventory (Hecht, 1978a). This scale was reliable for measuring interactions with friends at .93 and with strangers at .96 according to Hecht (1978a). See APPENDIX C.

CHAPTER 5

RESULTS

Level of Acquaintance Manipulation Check

Participants were randomly selected to participate with the friend that accompanied them to the study or a stranger. In order to test the friend/stranger manipulation was successful the interpersonal solidarity scale (Wheeless, 1978) was used to measure the perceived closeness between individual. Friends were significantly more close (M = 5.68, SD = .82) than strangers (M = 2.77, SD = .70), $t(260) = 41.67$, $p < .001$, eta^2 = .79, demonstrating the validity of the level of acquaintance manipulation. The effectiveness of the acquaintance induction can also been seen the bimodal distribution in closeness scores presented in Figure 1. In addition, participants were asked the length of time that they knew their partners. Friends ranged length of time from 1 month to 249 months (+20 years) with an average length of time of (M = 22.98, SD = 38.31). All strangers reported that they knew their partners 0 months.

Descriptive Analyses

Several questions were asked of the participants to determine their frequency of use, familiarity, and comfort using computers and the specific interfaces employed in the study. All responses are based on a 5-point Likert scale with 5 signifying agreement and 1 signifying disagreement. In general, participants were very comfortable using a computer (M = 4.93, SD = .37). With regard to frequency of use, text messaging was the most frequently used (M = 3.79, SD = 1.55), followed by audio conferencing (M = 2.14, SD = 1.45), and video conferencing (M = 1.47, SD = .96). This trend continued with

familiarity; text messaging familiarity (M = 4.79, SD = .74), audio conferencing familiarity (M = 3.01, SD = 1.64), video conferencing familiarity (M = 2.38, SD = 1.57) and comfort; text messaging comfort (M = 4.64, SD = .90), audio conferencing comfort (M = 3.45, SD = 1.43), video conferencing comfort (M = 2.93, SD = 1.47). Finally, when asked if they found the communication technology in the experiment difficult to use, participants reported they did not (M = 1.61, SD = 1.06), and they reported they would use the same technology again (M = 4.33, SD = 1.08). See Table 2.

Looking at the responses based on condition specifically there are some interesting results. Participants were similarly familiar and comfortable with text messaging regardless of if they used it in the study. Individuals that used both audio conferencing and video conferencing interfaces reported being more familiar and comfortable with their respective interface than others that did not use that particular interface. Both however remained lower than text messaging. Users of the audio conferencing interface considered it the most difficult to use (see Figure 2) and least likely to use again in the future (see Figure 3).

Confirmatory Factor Analyses

Confirmatory factor analysis was used to test the internal consistency of each of the six specified sub-dimensions. In total 7 out of the 36 items were deleted. One item from *Co-presence* (I noticed my partner), one item from *Attentional Allocation* (I was easily distracted from my partner when other things were going on), two items from *Perceived Message Understanding* (My thoughts were clear to my partner, My partner's thoughts were clear to me) and three items from *Perceived Behavioral Interdependence* (The behavior of my partner was often in direct

response to my behavior, I reciprocated my partner's actions, My partner reciprocated my actions) were deleted. The remaining items were generally consistent with the specified model. Three deviations from internal consistency were observed in the *Co-presence* and the *Perceived Affective Interdependence* subscales. However, these deviations were small (i.e., < .20), not confined to particular items, and reliability analyses show that further reduction in items detracted from scale reliability. Therefore, no additional items were dropped and the retained items were averaged to create measures of their respective constructs.

Scale Reliability

The scales used in the current study yielded similar alpha reliabilities to earlier studies (e.g., Harms, 2003; Hecht, 1978a, Wheeless, 1978). In the current study, the *Co-presence* sub-factor scale items yielded an alpha reliability of .82. *Attentional Allocation* yielded an alpha reliability of .79. *Perceived Message Understanding* yielded an alpha reliability of .83. *Perceived Emotional Understanding* yielded an alpha reliability of .89. *Perceived Emotional Interdependence* yielded an alpha reliability of .88. Lastly, *Perceived Behavioral Interdependence* yielded an alpha reliability of .82 (Harms, 2003). The interpersonal solidarity scale (Wheeless, 1978) yielded an alpha reliability of .98. Finally, after two items were removed, the interpersonal communication satisfaction inventory (Hecht, 1978a) yielded an alpha reliability of .89.

Intraclass Correlations

To determine whether the appropriate unit of analysis should be the individual or the dyad, the intraclass correlation was calculated for each sub-factor of social presence.

The intraclass correlation tests if members of each dyad responded independently of one another. Statistically significant intraclass correlations signify non-independence of observations and require that the dyad be the unit of analysis. Alternatively, if the intraclass correlations are small and not statistically significant, then the individual can be used as the unit of analysis without violating the independence assumption in the analysis of variance.

Co-presence had an intraclass correlation of $r = .12$, $F(130, 260) = 1.26$, $p = ns$. *Attentional Allocation* had an intraclass correlation of $r = .10$, $F(130, 260) = 1.21$, $p = ns$. *Perceived Message Understanding* had an intraclass correlation of $r = .12$, $F(130, 260) = 1.27$, $p = ns$. *Perceived Affective Understanding* had an intraclass correlation of $r = .28$, $F(130, 260) = 1.77$, $p < .01$. *Perceived Affective Interdependence* had an intraclass correlation of $r = .11$, $F(130, 260) = 1.25$, $p = ns$. *Perceived Behavioral Interdependence* had an intraclass correlation of $r = .20$, $F(130, 260) = 1.51$, $p < .05$. Given that all the intraclass correlations were positive; these findings indicate that members of the same dyad were more similar in their responses than those in different dyads. Because most intraclass correlations were relatively small, it was reasoned that using the entire data set was appropriate.

Normality

Before analyzing the data, each sub-dimension was checked for normality. Analysis was conducted using the adjusted data. Summed sub-factor scale responses more than two standard deviations out were considered outliers and removed for the adjusted analysis (cf. McClelland, 2000).

Hypotheses 1A-F

Hypotheses 1A-F were concerned with whether or not each sub-factor shows significant differences between face-to-face and mediated interactions. Averages for mediated interactions were calculated by combining text, audio-only, and video/audio conditions. There was no significant difference for *Co-presence* between FtF interactions (M = 6.07) and mediated interaction (M = 5.95), $F(1, 260) = 1.35, p = ns$, $eta^2 = .01$. *Attentional Allocation* had no significant difference between FtF interactions (M = 6.08) and mediated interaction (M = 5.96), $F(1, 260) = 1.41, p = ns$, $eta^2 = .01$. There was a significant difference for *Perceived Message Understanding* between FtF interactions (M = 6.03) and mediated interaction (M = 5.74), $F(1, 260) = 4.74, p < .05$, $eta^2 = .02$ supporting Hypothesis 1C. Also, a significant difference for *Perceived Affective Understanding* was observed between FtF interactions ($M = 5.46$) and mediated interaction (M = 5.05), $F(1, 260) = 7.28, p < .01$, $eta^2 = .03$ supporting Hypothesis 1D. There was no significant difference for *Perceived Affective Interdependence* between FtF interactions (M = 5.27) and mediated interaction (M = 4.99), $F(1, 260) = 3.45, p = ns$, $eta^2 = .01$. Finally, for *Perceived Behavioral Interdependence* no significant difference between FtF interactions (M =5.13) and mediated interaction (M = 5.10), $F(1, 260) = 0.02, p = ns$, $eta^2 = .00$ was found. Cell means are presented inTable 3.

Hypothesis 2

No support was found for the second hypothesis predicting that level of acquaintance would not affect the co-presence sub-factor. *Co-presence* had a significant positive correlation with level of acquaintance at $r(254) = .24, p < .01$. There was a significant difference between friends' (M=6.18) and strangers' (M = 5.91) in perceived

co-presence at $F(1, 257) = 17.60, p < .01$, $eta^2 = .06$. No interaction between medium and relationship on Co-presence was evident, $F(3, 253) = 1.67, p = ns$, $eta^2 = .02$, nor a main effect for medium $F(3, 253) = 0.87, p = ns$, $eta^2 = .01$. There was a main effect for relationship at $F(1, 253) = 15.22, p < .01$, $eta^2 = .06$. Time to complete the task also showed little influence $F(1, 253) = 0.39, p = ns$, $eta^2 = .00$. A split-case analysis within relationship type produced no main effect for medium on *Co-presence* among friends $F(3, 131) = 1.23, p = ns$, $eta^2 = .03$, nor strangers $F(3, 121) = 1.69, p = ns$, $eta^2 = .04$. A summary of the medium by relationship ANACOVA with time as a covariate is presented in Table 4.

Hypothesis 3

The third hypothesis that attentional allocation would be greater among strangers ($M = 5.90$) than friends ($M = 6.11$) was not supported. The finding was statistically significant in the opposite direction $F(1, 251) = 6.08, p < .05$, $eta^2 = .02$. *Attentional Allocation* had a positive correlation with level of acquaintance at $r(254) = .15, p < .05$. No interaction between medium and relationship, $F(3, 251) = 0.96, p = ns$, $eta^2 = .01$, was observed nor was there an effect for time required to complete the task $F(3, 251) = 2.98, p = ns$, $eta^2 = .01$. A main effect for medium $F(3, 251) = 4.86, p < .01$, $eta^2 = .05$, and a main effect for relationship did result $F(1, 251) = 6.41, p < .01$, $eta^2 = .02$. A split-case analysis for media on *Attentional Allocation* showed no significant differences either between friends $F(3, 129) = 0.90, p = ns$, $eta^2 = .02$, and strangers' $F(3, 121) = 2.10, p = ns$, $eta^2 = .05$. A summary of the medium by relationship ANACOVA with time as a covariate is presented in Table 5.

Hypotheses 4

Partial support was found for hypothesis 4. Level of acquaintance correlated with *Perceived Message Understanding* at $r(249) = .15, p < .05$. *Perceived Message Understanding* did significantly differ across media during friend interactions $F(3, 127) = 4.32, p < .01$, $eta^2 = .09$. Interestingly, the average *Perceived Message Understanding* per medium was: FtF ($M = 6.26$), Audio/Video ($M = 6.10$), Audio ($M = 5.69$), and Text Messaging ($M = 6.17$).

Perceived Message Understanding scores amongst strangers in FtF interactions were significantly higher than in mediated interactions $F(3,120) = 4.60, p < .05$, $eta^2 = .03$. However, the mean for FtF ($M = 6.07$) was greater than all media combined ($M = 5.76$), and text messaging had the highest mean for *Perceived Message Understanding among media type:* Text Messaging ($M = 5.90$), Audio/Video ($M = 5.69$), and Audio ($M = 5.69$). A split-case analysis of *Perceived Message Understanding* showed a main effect for medium among Friends $F(3, 127) = 4.32, p < .01$, $eta^2 = .09$, but not strangers' $F(3, 120) = 2.10, p = ns$, $eta^2 = .05$. Time needed to complete the task did not have significant effect $F(1, 251) = 2.98, p = ns$, $eta^2 = .01$. A summary of the medium by relationship ANACOVA with time as a covariate is presented in Table 6.

Hypothesis 5

Hypothesis 5 stated that level of acquaintance and *Perceived Affective Understanding* would have a positive relationship. This hypothesis was consistent with the data. The *Perceived Affective Understanding* correlation with level of acquaintance was significant at $r(250) = .42, p < .01$. Friends recorded an average of ($M = 5.64$) while the strangers' average was ($M = 4.89$), $F(1, 249) = 52.62, p < .01$, $eta^2 = 18$. For

Perceived Affective Understanding, a main effect for relationship was found $F(1, 249) = 59.33, p < .01$, $eta^2 = .19$. Also, a main effect for medium $F(3, 249) = 4.14, p < .01$, $eta^2 = .04$ was found. No interaction effect between medium and relationship resulted $F(3, 249) = 1.70, p = ns$, $eta^2 = .02$, nor was the effect of time required to complete the task significant $F(3, 249) = 2.61, p = ns$, $eta^2 = .01$. A split-case analysis of resulted in no media effect for friends $F(3, 127) = 1.69, p = ns$, $eta^2 = .04$, but a significant media effect for strangers $F(3, 120) = 4.45, p < .01$, $eta^2 = .10$. A summary of the medium by relationship ANACOVA with time as a covariate is presented in Table 7.

Hypothesis 6

Level of acquaintance and *Perceived Behavioral Interdependence* were significantly and positively correlated at $r(248) = 0.24, p < .01$. Friends recorded an average of ($M = 5.48$) while the strangers' average was ($M = 5.06$), $F(1, 247) = 14.62, p < .01$, $eta^2 = .06$. Therefore, the data were consistent with hypothesis 6. Finally, with regard to *Perceived Behavioral Interdependence,* the data did not provide evidence of an interaction effect between medium and relationship $F(3, 251) = 0.34, p = ns$, $eta^2 = .00$. The data did show a main effect for medium $F(3, 251) = 4.42, p < .01$, $eta^2 = .05$, a main effect for relationship $F(1, 251) = 16.02, p < .01$, $eta^2 = .06$, and for time it took to complete the task $F(1, 251) = 4.94, p < .05$, $eta^2 = .02$. The split-case analysis resulted in no main effect for medium between friends $F(3, 127) = 2.04, p = ns$, $eta^2 = .05$, but a significant difference between strangers $F(3, 119) = 6.29, p < .01$, $eta^2 = .14$. A summary of the medium by relationship ANACOVA with time as a covariate is presented in Table 8.

Hypothesis 7

Text (M = 5.27, SD = .98) did not have significantly higher scores than audio (M = 5.20, SD = .84) and audio/video (M = 5.37, SD = .84) combined (M = 5.29, SD = .82) in *Perceived Behavioral Interdependence* $F(1, 184) = 0.02, p = ns$, $eta^2 = .00$.

Hypothesis 8

The last hypothesis stated that level of acquaintance would be positively associated with *Perceived Affective Interdependence.* This hypothesis was supported with a Pearson's correlation of $r(252) = .23, p < .01$. Friends recorded an average of (M = 5.37) while the strangers' average was ($M = 4.95$), $F(1, 251) = 14.22, p < .01$, $eta^2 = .05$. The data were not consistent with an interaction effect between medium and relationship $F(3, 251) = 0.34, p = ns$, $eta^2 = .00$. A main effect for relationship $F(1, 251) = 16.02, p < .01$, $eta^2 = .06$, for medium $F(3, 251) = 4.42, p < .01$, $eta^2 = .05$, and for time required to complete the task $F(1, 251) = 4.94, p < .05$, $eta^2 = .02$, did result for *Perceived Affective Interdependence.* However, a split-case analysis across relationship produced no significant differences by media between friends $F(3, 129) = 1.78, p = ns$, $eta^2 = .04$, and strangers $F(3, 121) = 1.86., p = ns$, $eta^2 = .05$. A summary of the medium by relationship ANACOVA with time as a covariate is presented in Table 9.

Additional Analysis

Additional analyses were run correlating the familiarity, frequency of use, and comfort with the technology medium with the dimensions of social presence. The purpose of assessing perceptions toward technologies was to assure that differences were not overtly affecting results of the study. The responses show that the typical participant had little to no discomfort with any of the technologies, though they may have used a

particular technology less frequently. Audio was considered less desirable than the other media. An average score was used to represent the different media which represented the culminating perception toward the medium. This score was computed by adding responses to questions of frequency of use, familiarity, and comfort and then dividing by the number of questions. Results can be seen in Table 10.

In a previous test of the sub-factors (Harms, 2003), four out of the six sub-factors showed significant differences between face-to-face and mediated interactions. That study had a larger N and effect sizes were generally significant and larger. When analyzing the media effect across all conditions, results are slightly different than when mediated interaction means were calculated and analyzed. In comparing the media effect resulting from the two studies, *Co-presence* $F(3, 253) = 0.87, p = ns$, $eta^2 = .01$ in the current study did not fare as well as it did in the preliminary study $F(2, 239) = 16.08, p < .01$, $eta^2 = .12$. The media effect on *Attentional Allocation* was significant in both the current study $F(3, 251) = 4.86, p < .01$, $eta^2 = .05$, and the preliminary study $F(2, 239) = 7.42, p < .01$, $eta^2 = .06$. *Perceived Message Understanding* in the current study had a significant main effect for media $F(3, 248) = 4.86, p < .05$, $eta^2 = .05$, as did the preliminary study $F(2, 239) = 11.68, p < .01$, $eta^2 = .09$. *Perceived Affective Understanding* showed a significant effect for media in the current study $F(3, 249) = 4.14, p < .01$, $eta^2 = .04$, and the preliminary study $F(2, 239) = 14.18, p < .01$, $eta^2 = .11$. Next, *Perceived Affective Interdependence* resulted in a main effect for medium in the current study $F(3, 251) = 4.42, p < .01$, $eta^2 = .05$, as in the preliminary study $F(2, 239) = 1.62, p = ns$, $eta^2 = .01$. Finally, the main effect for media for the *Perceived Behavioral Interdependence* dimension was significance for the current study $F(3, 251) =$

4.42, $p < .01$, $eta^2 = .05$, as in the preliminary study $F(2, 239) = 4.21$, $p < .05$, $eta^2 = .03$. Therefore, large differences were evident for *Co-presence*, but findings were similar for *Attentional Allocation, Perceived Message Understanding, Perceived Affective Understanding, Perceived Affective Interdependence, and Perceived Behavioral Interdependence*.

CHAPTER 6

DISCUSSION

The focal point of social presence research has been mediated interaction. How does one medium allow for the sense of social presence compared to another one? In human communication, however, the medium is not the message, it is the channel. The message still exists within the interactants. Social presence does differ, but the results of the present research suggest that the difference rests more in the relationships between interactants and less in the medium they utilize to interact, at least with the synchronous media used here.

Face-to-face communication has often been held up as the "gold standard" (Gunawardena, 1995; Gunawardena and Zittle, 1997) and appropriately is used as a yardstick by which mediated interactions are measured. In the current study, face-to-face interactions produced the higher scores on social presence than mediated interactions for each of the six sub-factors of social presence as hypothesized. However, only *Perceived Message Understanding* and *Perceived Affective Understanding* resulted in differences between face-to-face interactions and mediated interactions that were significant. This calls into question the sensitivity of the scales.

The remaining hypotheses served as the primary focus of this study. Though in their original work Short, Williams, and Christie (1976) defined social presence as "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships," (p. 65). To date, this is the first known study to attempt to measure that interpersonal relationship in relation to differing media. The media tenet

surrounding social presence produced numerous studies (Short et al., 1976; Steinfield, 1986; Rice, 1993; de Greef & IJsselsteijn, 2000; Lombard, et al., 2000; Sallnas, Rassmus-Grohn, & Sjostrom, 2000) concerned simply with differences in media and cues allowed by those media. Each of the six sub-factors was positively related to level of acquaintance (friend or stranger) between interactants. This suggests that the knowledge set we have of others strongly influences of perceptions of those others and a lack thereof weakens that perception (Neisser, 1976; Taylor & Crocker, 1981). Care should be taken not to assume that the six sub-factor scales, though developed from various representative theoretical perspectives of social presence, give a complete assessment of social presence. Bente (2004) pointed out that self-report measures only paint a partial picture of true social presence, a concern outlined by Biocca, Harms, and Burgoon (2003) in their article regarding theoretical development of the concept.

Co-presence significantly differed between friends ($M = 6.18$) and strangers ($M = 5.91$). This did not support hypothesis 2 which stated no difference would be evident between the two groups. Item analysis paints no clear picture to the rationale behind this finding. The fifth item used to measure co-presence, "(My partner) caught my attention" resulted in the greatest difference between friends ($M = 6.13$) and strangers ($M = 5.69$). Perhaps the wording suggested different meaning to friends than it did to strangers. "Caught my attention," often has ties to a sense of attraction in common usage. This was one of the few items that significantly differed between males ($M = 5.76$) and females ($M = 6.03$), $F(1, 253) = 7.27, p < .01$, $eta^2 = .03$,. Perhaps the vividness of ones' close friend influenced the judgment.

The third hypothesis that strangers would allocate more attention to each other than friends was not supported. In retrospect, this hypothesis was poorly constructed lacking theoretical support. The common sense argument that guided that hypothesis was that if individuals knew less about each other they would pay more attention to one another in order to reduce their uncertainty. Given the right context, this may very well be accurate. However, the task at hand in this experiment had little to do with getting to know one another, which may have induced the hypothesized results, and had more to do with collaboratively working together to produce something.

Hypothesis 4 was partially supported. Friends *Perceived Message Understanding* was significantly influenced by the difference in medium. The media conditions did not follow the theorized order however. The second part of Hypothesis 4, which suggested strangers understanding would benefit from face-to-face interactions was supported. In fact, it produced some of the most interesting results. The mediated conditions that would be considered greater in media richness (Daft & Lengel, 1984) ranked the lower than text messaging. The text messaging condition ($M = 5.90$) had a higher average than both the audio condition ($M = 5.69$) and audio/video ($M = 5.69$). Nonverbal cues, other than paralanguage in the audio condition, which individuals use to apply meaning to messages, were factored out. This is consistent with earlier results on the same sub-factor between low (text messaging) and high (video conferencing) affordance media (Harms, 2003). A possible explanation may be that in lieu the nonverbal cues (i.e., facial expressions) clarifying meaning, their presence makes meaning more ambiguous.

The fifth hypothesis that *Perceived Affective Understanding* would be greater amongst friends than strangers followed supporting literature that individuals that have a

closer relationship are more attuned to each others' emotional states (Fiske & Cox, 1979; Baldwin, 1992). This same line of thought, that individuals with closer relationships would be more connected, was also evident in hypothesis 6. Support was found for friends having greater *Perceived Behavioral Interdependence* than strangers.

Hypothesis 7 stemmed from previous research (Harms, 2003) that found text messaging produced greater results for *Perceived Behavioral Interdependence* than audio/video conferencing. This hypothesis was not supported.

The final hypothesis which followed the rationale of hypotheses 5 and 6 that friends, due to their closer bond, would be more in tune with each other was supported. Friends' *Perceived Affective Interdependence* was greater than that of strangers. For a comparison between friends and strangers average responses across media and all 6 sub-dimensions see Table 11.

Frequency, Familiarity, and Comfort with Media

Most participants felt comfortable using a computer. This result was expected due to the fact that participants were university students. Text was quite popular, scoring highest in frequency, familiarity, and comfort. Though they had not frequently used audio-conferencing or video-conferencing systems, participants felt these systems were easy to use and responded positively to using them again. Interestingly, audio-conferencing was the least favored communication technology. Given the current popular trend of personal cellular phones, the seemly bulky computer telephony may explain individuals' lack of enthusiasm toward this channel of communication.

Video-conferencing had not been frequently used by participants; however comments after completing the experiment suggested that they thoroughly enjoyed the new media. Participants considered no media difficult to use. See Table 2 for average responses.

Informal Qualitative Observations

Friends were more likely to make obscenities toward each other. Often times male-male friends would, upon becoming aware of their friend in the video conferencing condition, raise their middle finger at each other. Though the gesture is typically used to tell someone off; its meaning amongst male-male friends is one of bonding. It was often reciprocated by the other friend along with a chuckle or emotion suggesting the recipient found the gesture humorous. Rather than an offensive response it is nonverbally considered appreciation of the friendship.

Individuals found the experiment to be an enjoyable experience. The task was generally considered fun and individuals seemed to enjoy working together. Individuals that used video conferencing to complete the task often expressed their positive impression from using a simple video conferencing system for the first time.

Limitations

The first limitation deals with the interaction between participants. Though participants were isolated from one another, their common physical presence was very evident to them. They were all aware of each other in the waiting area. This time varied as pairs of participants showed up at different times and often had to wait a short while before the experiment actually began. This limited amount of physical social presence may have influenced what resulted in attenuated effect of the media. They also had a clear understanding that their partner was located relatively close to their physical

location. Mediated interaction typically finds interactants separated by miles as apposed to meters.

Another limitation of the current study was the low N. Due to interdependence between individuals; half of the participants' were not taken into account. Though the results did not differ between the whole data set and the half that were used, the estimates became less stable. The only difference between analyzing the whole data set versus half of the data was that *Perceived Message Understanding* and *Perceived Affective Understanding* were significantly different between FtF and mediated interactions.

Next, the type of media used in the condition (i.e., audio, audio/video) was confounded by the sensory channels (auditory, visual). Assessing differing sensory channels separately may prove useful in future research.

Lastly, a limitation identified in the current study is the over-thinking that went into the hypotheses. Parsimony did not exist. Rather, micro-analysis of the dyadic interactions and heavy reliance on theoretical perspectives clouded basic common sense as to how individuals truly interact with one another. Also, hypotheses such as H3 should have been readdressed after adjustment of the experimental task.

Of the four conditions, the audio condition was the least liked by the participants. An audio condition simply had participants talking in a similar fashion to a hands-free telephone. Though it was never a problem for participants to complete the task, it appeared to be more awkward then the other conditions.

Future Directions

The 6 social presence sub-factor scales need additional testing. First, similar human-to-human interactions should be carried out across other media. The conditions

utilized in the current study reflect relatively common communication technologies with the exception, perhaps, being video conferencing. Conditions using two-way communication devices, a standard land-line telephone, or one's own cellular phone may provide interesting findings. Interactions that utilize abstract and anthropomorphic avatars similar to a study by Nowak (2003), text or audio communication, and both 2D and 3D formats should be explored. Virtual environments may be used that allows the user autonomy to interact with multiple individuals and experiencing the basic sense of co-presence like that of walking down a virtual street, seeing an entity and engaging them. Interfaces that offer multiple perspectives and/or portals rather than a single window to the user could be compared. Additional dyadic relationships should be tested. Organizational relationships, such as co-workers, superior-subordinate, or customer relations could benefit from a greater understanding of how their choice of media and interpersonal communication is perceived. Parent-child, romantic partners and various other close relationships may potentially want to be looked at in the future.

In addition to human-to-human interactions, human-to-agent interactions need to be subjected to testing. What are important characteristics of agents? How can a computer communicate more effective and efficiently with humans? How will increased direct verbal communication change the way we interact with computers? How will philosophical question like those surrounding the Turing Test (Turing, 1950) change?

Another future perspective to research is how changes in communication models might impact our understanding of mediated interactions. Variations to components of the transactional model of communication such as noise, latency and contexts may

effectively change the model. Analysis of the interaction from a co-orientation model could shed light on the simple complexity of dyadic interactions.

Lastly, future studies in this area need to continue to develop a greater understanding of interaction analysis methods. The social relations analysis (Kenny, 1994) is one such attempt to scientifically investigate complex group interactions. Statistical models that incorporate multiple forms of data will eventually change how interactions are studied and understood. Multiple modes of measure, both behavioral and physiological should be used to build supporting data. An eye tracking system could teach us a lot about what individuals attend to in different conditions. New less obtrusive systems exist that would allow for natural behavior. Qualitative observation techniques should be performed as well to identify subtle phenomenon that may not be picked up by self report measures or computer assisted software.

Conclusion

In conclusion, the current study shed some light on the intricate process of mediated communication. The relationship between interactants seems to a necessary factor to consider in determining how individuals will attend to and understand each other across various media. The media itself also requires further investigation. The type of media utilized for a particular task may fare completing different when negotiating interpersonal relationship. The common face-to-face model of communication seems to become more complex as we attempt to simplify our efforts to stay connected to those around us.

TABLES

TABLE 1

SIX DIMENSIONS OF SOCIAL PRESENCE

Dimension	Dimension Definition
Co-presence	This construct serves to distinguish a user's sense of being alone compared to being aware of an existing interactants agency. The capacity of interaction is determined by perceived reciprocal awareness.
Attentional Allocation	This construct addresses the amount of attention the user allocates to and receives from an interactant.
Perceived Message Understanding	The ability of the user to understand the message being received from the interactant as well as their perception of the interactant's level of message understanding.
Perceived Affective Understanding	The user's ability to understand the interactant's emotional and attitudinal states as well as their perceptions of the interactant's ability to understand the user's emotional and attitudinal states.
Perceived Affective Interdependence	The extent to which a user's emotional and attitudinal states affect and are affected by the emotional and attitudinal states of the interactant.
Perceived Behavioral Interdependence	The extent to which a user's behavior affects and is affected by the interactant's behavior.

TABLE 2

PERCEIVED FREQUENCY, FAMILIARITY AND COMFORT WITH MEDIA

Question	Mean	Std. Deviation
I frequently use instant messenger to communicate with others.	3.79	1.554
I am familiar with using instant messenger to communicate with others.	4.79	.736
I am comfortable using instant messenger to communicate others.	4.64	.904
I frequently use audio-conferencing to communicate with others.	2.14	1.453
I am familiar with using audio-conferencing to communicate with others.	3.01	1.637
I am comfortable using audio-conferencing to communicate others.	3.45	1.426
I frequently use a video-conferencing to communicate with others.	1.47	.963
I am familiar with using video-conferencing to communicate with others.	2.38	1.568
I am comfortable using video-conferencing to communicate others.	2.93	1.466
I found the communication technology in this experiment difficult to use.	1.61	1.060
I would use the communication technology I used in this experiment again.	4.33	1.078

Note: 1 is low and 7 is high on a 7-point scale.

TABLE 3

MEANS OF SOCIAL PRESENCE SUB-FACTORS ACROSS MEDIA

N = 261	Face-to-face	Video/Audio	Audio only	Text
Co-presence	M = 6.07 SD = .69	M = 6.14 SD = .50	M = 5.86 SD = .50	M = 6.86 SD = .81
Attentional Allocation	M = 6.08 SD = .72	M = 5.95 SD = .59	M = 6.01 SD = .78	M = 5.91 SD = .74
Perceived Message Understanding	M = 6.03 SD = .86	M = 5.83 SD = .83	M = 5.53 SD = 1.07	M = 5.87 SD = .95
Perceived Affective Understanding	M = 5.46 SD = .84	M = 5.24 SD = .92	M = 4.98 SD = 1.22	M = 4.93 SD = 1.23
Perceived Affective Interdependence	M = 5.27 SD = 1.08	M = 5.17 SD = .86	M = 4.83 SD = 1.16	M = 4.98 SD = 1.10
Perceived Behavioral Interdependence	M = 5.29 SD = 1.15	M = 5.27 SD = .99	M = 4.91 SD = 1.23	M = 5.15 SD = 1.17

Note: 1 is low and 7 is high on a 7-point scale.

TABLE 4

SUMMARY ANOVA TABLE FOR CO-PRESENCE

Effect	*F*	*p*	eta^2
Relationship	15.22	.01	.06
Media	0.87	ns	.01
Relationship * Media	1.67	ns	.02
Time to complete task	0.39	Ns	.00

TABLE 5

SUMMARY ANOVA TABLE FOR ATTENTIONAL ALLOCATION

Effect	*F*	*p*	eta^2
Relationship	6.42	.01	.02
Media	3.14	.03	.04
Relationship * Media	0.59	ns	.01
Time to complete task	2.98	ns	.01

TABLE 6

SUMMARY ANOVA TABLE FOR PERCEIVED MESSAGE UNDERSTANDING

Effect	*F*	*p*	eta^2
Relationship	6.08	.01	.02
Media	4.86	.01	.05
Relationship * Media	0.96	ns	.01
Time to complete task	.19	ns	.00

TABLE 7

SUMMARY ANOVA TABLE FOR PERCEIVED AFFECTIVE UNDERSTANDING

Effect	*F*	*p*	eta^2
Relationship	59.33	.01	.19
Media	4.14	.01	.04
Relationship * Media	1.70	ns	.02
Time to complete task	2.61	ns	.01

TABLE 8

SUMMARY ANOVA TABLE FOR PERCEIVED BEHAVIORAL INTERDEPENDENCE

Effect	*F*	*p*	eta^2
Relationship	14.53	.01	.06
Media	0.48	ns	.01
Relationship * Media	0.72	ns	.01
Time to complete task	0.35	ns	.00

TABLE 9

SUMMARY ANOVA TABLE FOR PERCEIVED AFFECTIVE INTERDEPENDENCE

Effect	*F*	*p*	eta^2
Relationship	16.02	.01	.06
Media	4.42	.01	.05
Relationship * Media	0.34	ns	.00
Time to complete task	4.94	.03	.02

TABLE 10

CORRELATION MATRIX OF SOCIAL PRESENCE DIMENSIONS AND INDIVIDUALS' TECHNOLGY DEMOGRAPHICS

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Co-presence	r	1									
	p										
	N										
2. Attentional Allocation	r	.45*	1								
	p	.00									
	N	261									
3. Perceived Message Understanding	r	.48*	.53*	1							
	p	.00	.000								
	N	261	261	261							
4. Perceived Affective Understanding	r	.50	.43*	.48*	1						
	p	.000	.00	.000							
	N	261	261	261	261						
5. Perceived Affective Interdependence	r	.40*	.27*	.29*	.63*	1					
	p	.00	.00	.00	.00						
	N	261	261	261	261	261					

* Correlation is significant at the 0.05 level (2-tailed).

TABLE 10 CONT.

CORRELATION MATRIX OF SOCIAL PRESENCE DIMENSIONS AND INDIVIDUALS' TECHNOLGY DEMOGRAPHICS

6. Perceived Behavioral Interdependence	r	.35*	.22*	.28*	.52*	.71*	1				
	p	.00	.00	.00	.00	.00					
	N	261	261	261	261	261	261				
7. I feel comfortable using a computer.	r	.0	.10	.07	.10	.14*	.12	1			
	p	.12	.10	.26	.10	.03	.05				
	N	261	261	261	261	261	261	261			
8. Combined Audio/Video	R	.02	.05	.04	.09	.03	.00	.03	1		
	p	.76	.41	.49	.15	.66	.95	.60			
	N	261	261	261	261	261	261	261	261		
9. Combined Audio	R	.03	.05	.12	.03	.04	.02	.01	.54*	1	
	p	.62	.40	.06	.62	.49	.75	.89	.00		
	N	261	261	261	261	261	261	261	261	261	
10. Combined Text	R	.03	.02	.01	.01	.05	.04	.04	.11	.09	1
	p	.66	.78	.89	.93	.41	.57	.57	.09	.16	
	N	261	261	261	261	261	261	261	261	261	261

* Correlation is significant at the 0.05 level (2-tailed).

TABLE 11

FRIEND AND SRANGER AVERAGE RESPONSE ON MEDIUM AND SOCIAL PRESENCE SUB-DIMENSIONS

N = 261	Face-to-face	Audio/Video	Audio only	Text
Co-presence				
Friend	6.25	6.26	6.03	6.14
Stranger	5.85	6.01	5.68	5.57
Attentional Allocation				
Friend	6.21	6.04	6.06	6.12
Stranger	5.96	5.86	5.96	5.68
Perceived Message Understanding				
Friend	6.18	6.03	5.61	6.10
Stranger	5.90	5.63	5.45	5.61
Perceived Affective Understanding				
Friend	5.85	5.61	5.44	5.68
Stranger	5.10	4.88	4.50	4.12
Perceived Affective Interdependence				
Friend	5.51	5.41	5.11	5.26
Stranger	5.05	4.93	4.54	4.67
Perceived Behavioral Interdependence				
Friend	5.51	5.60	5.10	5.29
Stranger	4.77	4.93	4.72	5.00

FIGURES

FIGURE 1

MANIPULATION CHECK BETWEEN FRIENDS AND STRANGERS ON PERCEIVED CLOSENESS

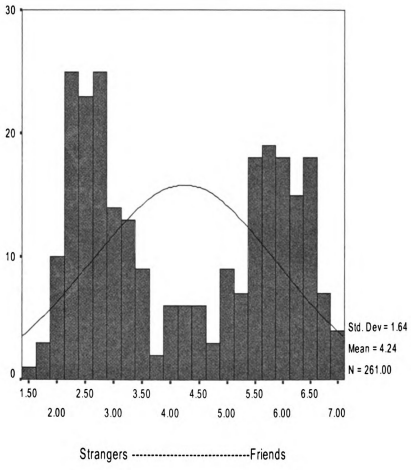


FIGURE 2

PERCEIVED DIFFICULTY OF USE FOR MEDIA

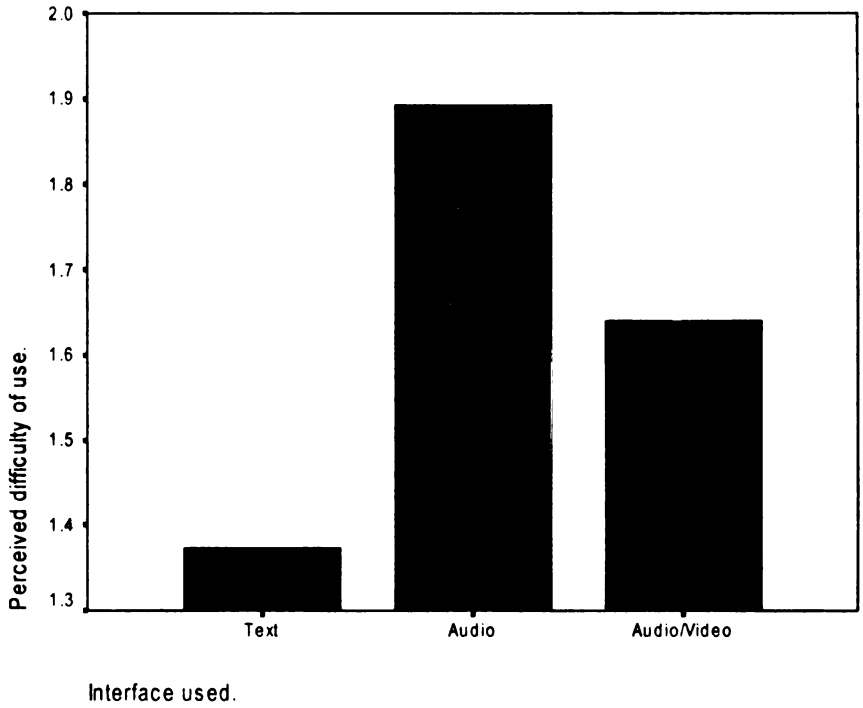
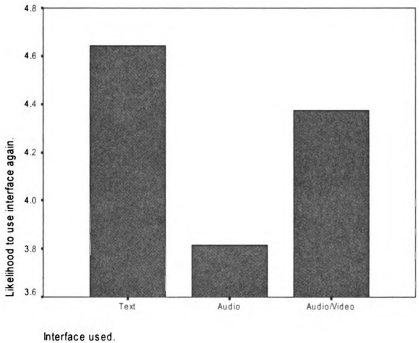


FIGURE 3

LIKELIHOOD TO USE MEDIA USED IN THE EXPERIMENT AGAIN



APPENDIXES

APPENDIX A

Instructions: The following questions are concerned with your interaction with {your partner). For each one, please select a number from 1 to 7, depending on the degree to which you agree or disagree with the statement. A 7 means that you *strongly agree*, a 6 means you *agree*, a 5 means you *slightly agree*, a 4 means that you are *neutral or unsure*, a 3 means that you *slightly disagree*, a 2 means you *disagree*, and a 1 means you *strongly disagree*. You may select 1, 2, 3, 4, 5, 6, or 7.

SOCIAL PRESENCE

Co-presence

1. I noticed (my partner).
2. (My partner) noticed me.
3. (My partner's) presence was obvious to me.
4. My presence was obvious to (my partner).
5. (My partner) caught my attention.
6. I caught (my partner's) attention.

Attentional Allocation

7. I was easily distracted from (my partner) when other things were going on.
8. (My partner) was easily distracted from me when other things were going on.
9. I remained focused on (my partner) throughout our interaction.
10. (My partner) remained focused on me throughout our interaction.
11. (My partner) did not receive my full attention.
12. I did not receive (my partner's) full attention.

Perceived Message Understanding

13. My thoughts were clear to (my partner).
14. (My partner's) thoughts were clear to me.
15. It was easy to understand (my partner).
16. (My partner) found it easy to understand me.
17. Understanding (my partner) was difficult.
18. (My partner) had difficulty understanding me.

Perceived Affective Understanding

19. I could tell how (my partner) felt.
20. (My partner) could tell how I felt.
21. (My partner's) emotions were not clear to me.
22. My emotions were not clear to (my partner).
23. I could describe (my partner's) feelings accurately.
24. (My partner) could describe my feelings accurately.

Perceived Affective Interdependence

25. I was sometimes influenced by (my partner's) moods.
26. (My partner) was sometimes influenced by my moods.
27. (My partner's) feelings influenced the mood of our interaction.
28. My feelings influenced the mood of our interaction.
29. (My partner's) attitudes influenced how I felt.
30. My attitudes influenced how (my partner) felt.

Perceived Behavioral Interdependence

31. My behavior was often in direct response to (my partner's) behavior.
32. The behavior of (my partner) was often in direct response to my behavior.
33. I reciprocated (my partner's) actions.
34. (My partner) reciprocated my actions.
35. (My partner's) behavior was closely tied to my behavior.
36. My behavior was closely tied to (my partner's) behavior.

APPENDIX B

Interpersonal Solidarity Scale

1. We are very close to each other.
2. This person has a great deal of influence over by behavior.
3. I trust this person completely.
4. We feel very differently about most things.
5. I willingly disclose a great deal of positive and negative things about myself, honestly, and fully (in depth) to this person.
6. We do *not* really understand each other.
7. This person willingly discloses a great deal of positive and negative things about him/herself, honestly, and fully (in depth) to me.
8. I distrust this person.
9. I like this person much more than most people I know.
10. I seldom interact/communicate with this person.
11. I love this person.
12. I understand this person and who s/he really is.
13. I dislike this person.
14. I interact/communicate with this person much more than with most people I know.
15. We are *not* very close at all.
16. We share a lot in common.
17. We do a lot of helpful things for each other.
18. I have little in common with this person.
19. I feel very close to this person.
20. We share some private way(s) of communicating with each other.

APPENDIX C

Interpersonal Communication Satisfaction

1. The other person let me know that I was communicating effectively.
2. Nothing was accomplished.
3. I would like to have another conversation like this one.
4. The other person genuinely wanted to get to know me.
5. I was very *dissatisfied* with the conversation.
6. I had something else to do.
7. I felt that during the conversation I was able to present myself as I wanted the other person to view me.
8. The other person showed me that he/she understood what I said.
9. I was very satisfied with the conversation.
10. The other person expressed a lot of interest in what I had to say.
11. I did *not* enjoy the conversation.
12. The other person did *not* provide support for what he/she was saying.
13. I felt I could talk about anything with the other person.
14. We each got to say what we wanted.
15. I felt that we could laugh easily together.
16. The conversation flowed smoothly.
17. The other person changed the topic when his/her feelings were brought into the conversation.
18. The other person frequently said things which added little to the conversation.
19. We talked about something I was *not* interested in.

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