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Mining for meaning: The use of unstructured textual data in information systems research

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Mining for meaning:
The use of unstructured textual data in information systems research

by
Janea Lynne Triplett

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

Major: Human Computer Interaction

Program of Study Committee:
Brian E. Mennecke, Major Professor
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Anthony M. Townsend

Iowa State University
Ames, Iowa
2012

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DEDICATION

I would like to dedicate this dissertation to my mentor and friend Max S. Wortman, Jr.

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CHAPTER 1. GENERAL INTRODUCTION

1.1. Objectives

The objectives of this research are to demonstrate how text was used in (1) developing a theory to examine collaborative interaction in virtual worlds, (2) creating a framework for improving the efficiency and effectiveness of dealing with large text datasets for social network analysis, and (3) approaching an understanding of the role of meaning individuals attribute to their mobile devices.

1.2. Rationale and Significance

Qualitative IS research makes use of textual data to study natural phenomenon occurring at all levels within the business context. Exemplars of IS papers using grounded theory to develop an understanding of an information systems (Orlikowski, 1993; Pace, 2004; Levina and Vaast, 2008; Berente et al., 2011). Information systems research is informed by studies in semiotics (Andersen, 1991; Barron and Chiang, 1999; Mendling et al. 2012), speech acts (Auramaki et al., 1988; Umapathy et al., 2008; Qiu and Benbasat, 2009; Jensen et al., 2011), and content and context analysis (Barrett and Walsham, 1999; Barrett and Scott, 2004; Bolchini, 2009). This dissertation explores first-person narrative as a data source while using methodological treatments such as linguistic anthropology, discourse analysis, and content analysis.

1.3. Literature Review

1.3.1. Discourse Analysis

Discourse is the written or spoken communication exchange between individuals intent on sharing or delivering ideas, knowledge, and experiences. The unit of analysis is the

conversation as a whole that is built from knowledge of related linguistics structures (i.e. morphology, syntax, semantics, and pragmatics). Discourse analysis “looks at patterns of language across texts and considers the relationship between language and the social and cultural context in which it is used.” (Paltridge, 2006, p. 2). Using discourse analysis as a theoretical and analytical framework, the researcher can investigate phenomenon related to communities (Swales, 1990; Saville-Troike, 1996), identity (Lakoff, 1975; Cameron and Kulick, 2003; Thomas, 2000/2004) and social networks (Labov, 1966; Milroy, 1987).

1.3.2. Corpus Linguistics

In linguistics, a collection of text representing a specific subject (i.e. context) is known as a corpus. The characteristics of a corpus-base analysis include computer-aided examinations of words that repeatedly occur with each other (i.e. collocations), word frequencies, and key words in context.

Large collections of corpora (i.e. general corpus, reference corpus) have been collected and are employed to understand the structure and usage of language (Biber et al., 2006) or to serve as a baseline (Reppen and Simpson, 2004) for the examination of linguistic features occurring in the English language (Sigley and Holmes, 2002)

A specialized, smaller corpus can also be collected and used to investigate specific research questions. Hunston (2002) explained that a specialized corpus could be found in text such as newspaper editorials, textbooks, academic articles, online conversations, or essays written by students. The use of a specialized corpus has been used to investigate transitions to another topic in academic lectures (Mauranen, 2001).

1.4. Authors' Roles

The authors of Chapter 2 entitled, “An Examination of a Theory of Embodied Social

Presence in Virtual Worlds” were Brian E. Mennecke, Janea L. Triplett, Lesya M. Hassall, Zayira Jordán Conde, and Rex Heer. Mennecke was corresponding author who set the research objectives and played a major role in conducting the research. Triplett played an integral role in literature review and writing and was the sole analyst who grounded theory development in data findings. Hassell and Jordan played a crucial role in reviewing literature and writing. Heer created visuals and edited the paper.

The author of Chapter 3 entitled “A Framework for Detecting Network Structures in Virtual Communities” was Janea L. Triplett. Triplett was the primary author and researcher of the manuscript.

The authors of Chapter 4 entitled “The Role of Meaning in Technology Acceptance” were Janea L. Triplett, Anthony M. Townsend, and Brian E. Mennecke. Triplett was the primary researcher, analyst and author. Townsend and Mennecke were responsible for data collection and editing the paper.

1.5. Dissertation Organization

The dissertation has five chapters including this general introduction (Chapter 1), three article chapters (Chapters 2-4), and a general conclusion (Chapter 5). Each of the three article chapters is a separate manuscript that is either published or soon to be submitted excluding the general introduction (Chapter 1) and conclusion (Chapter 5). Chapter 2 is a theory development paper using grounded theory. Chapter 3 is a proposed framework for detecting network structures using discourse analysis and social network analysis. Chapter 4 is an exploration into the meaning of mobile technologies as interpreted from participant narrative and images. Chapter 5 is the concluding chapter offering a brief outline of the research as a whole.

CHAPTER 2. AN EXAMINATION OF A THEORY OF EMBODIED SOCIAL PRESENCE IN VIRTUAL WORLDS

A paper published in *Decision Sciences*

Brian E. Mennecke, Janea L. Triplett, Lesya M. Hassall,

Zayira Jordán Conde, and Rex Heer

Abstract

In this paper we discuss and empirically examine the importance of embodiment, context, and spatial proximity as they pertain to collaborative interaction and task completion in virtual environments. Specifically, we introduce the Embodied Social Presence (ESP) theory as a framework to account for a higher level of perceptual engagement that users experience as they engage in activity-based social interaction in virtual environments. The ESP theory builds on the analysis of reflection data from Second Life users to explain the process by which perceptions of embodied social presence are realized. We proceed to describe implications of embodied social presence for collaboration and other organizational functions.

2.1. Introduction

What does it mean to feel as though you are present in a place as you collaborate with another person? This is a question that has interested scholars studying information and

communication technologies (ICT) for more than three decades as they try to determine how best to align communication technologies with organizational needs. Fundamentally, communication is a joint activity that requires interaction and a sense of presence between two or more social actors. To succeed, the actors must possess an acute awareness of self, others, verbal and non-verbal cues, the place, and the context (Krauss and Chiu, 1998).

A rich body of literature has been developed to account for the collective nature of communication, importance of presence and co-presence, and effective alignment of ICT with organizational needs (e.g., Biocca, 1997; Lombard and Ditton, 1997). Investigations of presence and co-presence have centered on the nature and role of technology in shaping perceptions of social actors as they engage in communication activities (Daft and Lengel, 1986; Lombard and Ditton, 1997; Short, Williams, Christie, 1976).

In spite of prolific scientific inquiry, there is much urgency to understand how perceptions of presence and co-presence are mediated and impacted by new media and communication tools (Biocca, Harms, and Burgoon, 2003; Davis Murphy, Owens, Khazanchi, and Zigurs., 2009), including three-dimensional massively-multiplayer online role-playing games (MMORPGs) and virtual environments, like Second Life, and their unique affordances (avatars, shared spaces, and activities).

In this paper we discuss the ESP theory as a means to explicate how and why perceptions of presence and co-presence are defined by and through shared spaces, activities, and embodiment in multi-user virtual environments and other ICTs (Mennecke, Triplett, Hassall, Jordan, and Herr, 2010). Practical applications of the ESP theory have the potential to enhance the design and management of collaborative virtual environments by giving us a better understanding of how presence, co-presence, and ESP are evoked and nurtured for

productive collaborative functions.

We define virtual environments as computer-generated 3-dimensional spaces with unique affordances for communication activities. The spatial characteristics of such environments realistically simulate physical proximity, which enhances propinquity and fosters rich interaction by allowing users to perform activities collectively via the mediation of their virtual bodies. Through interactions with other social actors in a virtual environment, individuals perceive their own actions as more engaging, dynamic and satisfying (Csikszentmihalyi, 1998). While theories related to co-presence hint at these higher levels of engagement, they pay little attention to the role of activity-based interaction and embodiment and thus miss the deeper sense of engagement that is developed through joint interactions that are substantive and goal-directed. ESP theory posits that when social actors experience this higher level of embodied interaction, they more effectively encode, convey, and decode individual and collective communicative acts. A central tenet of the ESP theory is that an avatar, as an embodied representation of the social actor, is the nexus of communication. Within virtual environments all verbal and non-verbal communication acts and cues are filtered through this embodied representation of the user. The ESP theory suggests a communicative act in a virtual environment builds on the embodied sense of self and is realized through co-participation in a particular context that is defined, in part, by the symbolic meaning associated with the space that is shared and tools that are used. Thus, shifting the focus on these bodily representations (the avatar of self and the other) and their uses as tools for communication we can expose the value of virtual worlds for achieving organizational objectives.

Most forms of communication aim to exchange information through either verbal or

non-verbal acts that are mediated by the bodies of the social actors. ICT is commonly designed to support communicative acts that are derivative of and based on stimuli present in proximate, face-to-face (FtF) or, body-to-body (BtB) communication. For example, to define the concept of presence, Lombard and Ditton (1997) reference “the perceptual illusion of nonmediation,” a non-mediated form of communication that implies a FtF interaction with verbal and non-verbal acts carried out and interpreted through the bodies of communicating social actors. ESP acknowledges the role of the body in communication activities and answers, at least in part, the call for a richer communication theory made by Biocca et al. (2003). Specifically, they observed that, “It may be that a full understanding of social presence may benefit from being informed by a larger theory of how we automatically interpret physical forms and nonverbal and verbal codes to simulate and infer the content of other minds” (Biocca et al., 2003, 472). The ESP theory provides a framework that is useful in extending theories of presence by focusing on embodied interactions and engagement with other social actors as driving forces that shape our perceptions of presence and co-presence (Benford, Bowers, Fahlén, Greenhalgh, and Snowdon, 1995; Bowers, Pycock, and O’Brien, 1995; Biocca, 1997; Gerhard, Moore, and Hobbs, 2004; Schroeder, 2006).

Furthermore, the theory builds on the written reflections of Second Life users who engaged in a variety of goal-oriented collaborative activities (discussions, lectures, and team design exercises) to dissect how perceptions of ESP are achieved in virtual environments. Analysis of such reflections offer a rich window into the experiences of and perceptions held by these users, and insights garnered from these data were used, in part, to guide the development of the ESP theory and to discuss the ramifications of the ESP phenomenon for organizational functions.

This paper is structured to first present a review of the presence, place, and embodiment literature to position ESP within the rich landscape of communication theories. Next, the analysis of Second Life user reflections on embodiment, collaboration, and engagement serves as an introduction to the tenets of the ESP theory. We conclude with a discussion of the results and implications.

2.2. Literature Review

The concept of presence has been examined in a number of disciplines and in a variety of contexts associated with interpersonal and organizational communication as well as in group and organizational studies of collaboration and decision making (e.g. media richness theory, social presence theory, media synchronicity theory, hyperpersonalization theory). Research as far back as the early 1980s examining group decision support systems (GDSS), for example, applied these and similar theories to frame predictions about how social actors would behave and perceive one another when collaborating using various forms of communication technologies. Much of this research examined perceptions related to the nearness, propinquity, and sense of social presence associated with team interactions. Thus, the role of presence and related concepts associated with perceptions about *being there* with others have been an important component of research examining group and organizational communications. This literature review is important in framing an analysis of the broader presence literature and for defining a context in which a more robust theory of ESP can be articulated. The next section reviews the presence literature as well as literature related to location and place, which are constructs that are important to consider together when examining the broader literature associated with ESP.

2.2.1. Presence and Place

One of the earliest theories describing perceptions of the presence of other social actors is social presence theory (Short et al., 1976), which suggests that different media have varying capacities for conveying cues that create in a user an awareness of other social actors. This theory, along with media theories such as media richness theory, has been used by organizational researchers to study teams, media choices, and organizational adoption of communication technologies (Daft and Lengel, 1986). One of the common themes associated with presence and copresence is the idea that the user is present with someone else in a place; therefore place is relevant to the concept of presence and to understand how we respond to virtual environments (Bowman and McMahan, 2008). In fact, a deconstruction of virtual world environments highlights two unique characteristics relative to other media: (i) the availability of a shared virtual space in which avatars, objects, actions, and higher level associations (e.g., meaning associated with a place) can be created and manipulated, and (ii) selective temporal persistence (i.e., places and objects remain when the user departs from a virtual locale).

In this context, we see that place is important in framing a context for shared activity in a virtual environment. This is because place-based features in virtual environments are similar to those features we associate with real-world places. As such, the concept of place creates a structure where the milieu of place-based features and accoutrements creates a richer mix of perceptual associations than one would expect if one simply considered a virtual space as a mere virtual geographic location. To examine place in the context of virtual environments, Turner and Turner (2006) applied theories from geography (Relph, 1976), environmental psychology and sociology (Gustafson, 2001), and psychology (Canter, 1997) to examine

sense of place and presence. They suggest that the literature on place and sense of place can be enriched by considering the issue from a first-person perspective (i.e., individual attitudinal and perceptual constructs), which is consistent with much of the presence literature as well as literature from the information systems (IS) field that has often considered ICT from the first person perspective.

When considering places in virtual environments, it is useful to recognize that these virtual spaces have meaning just as do real-world places. The attachment of meaning with a place was described by Relph (1976) as *place identity*. Place identity suggests that place represents more than merely objects in space; rather, place associates objects and places as contexts where activity and events happen. For example, we might associate home with comfort, sleep, family, and other elements identifying a particular place with the feelings and things that are located there. Relph (1976) specifically suggests that individuals often develop a place identity by associating physical locations with meanings and activities that are historically associated with those settings. Gustafson (2001) expanded this concept by identifying three factors associated with place identity: environment, self, and others (Figure 2.1). In this context where self and others are considered together with environment, we see how place identity offers an important framework for understanding how and why place is relevant in more than just the geographic sense of being a physical (or virtual) space. Specifically, people assign meaning to places, even places they have not previously visited, and this provides an important context for their understanding of themselves, others, and the shared actions they undertake. To understand presence, and particularly embodied social presence, one must develop an understanding of those factors that influence users of virtual worlds as they develop a sense of place and comprehend its meaning within a context. We

will expand on this contextual role of place as we elaborate on ESP below.

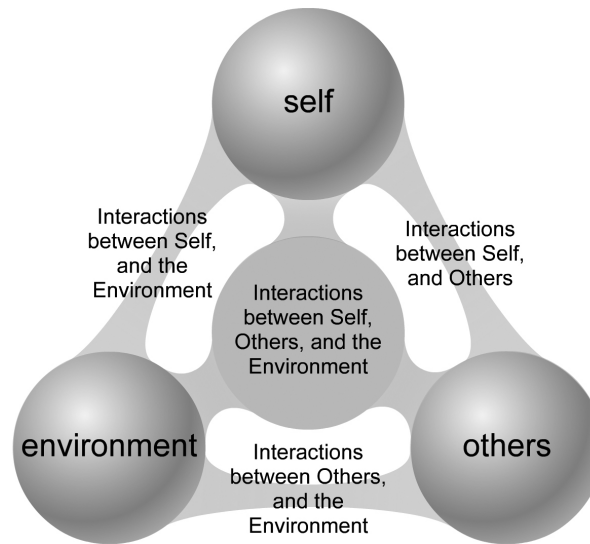


Figure 2.1 Factors influencing the meaning of place (adapted from Gustafson, 2001).

2.2.2. Presence and Copresence

Two primary perspectives related to presence have been offered by researchers examining ICTs: presence and copresence. We first review concepts associated with presence and follow this with a review of the concept of copresence.

In their thorough review of the presence literature, Lombard and Ditton (1997) provide a useful summary of the literature on presence, including the six types of presence defined in the literature (Table 2.1), the causes of presence, and the effects that presence engenders in those who experience this phenomenon. They note that presence has been used by scholars in different fields to imply slightly different concepts that have in common the idea that the user of the communication medium is captured by an illusion that there is no mediation in the communication channel. This illusion can be manifest in multiple ways, via various media, for different reasons, and it is dependent on how one frames the task context. Because several

of these diverse concepts associated with presence are relevant to our discussion of ESP, we summarize these six forms of presence below.

Table 2.1 The types of presence (adapted from Lombard and Ditton, 1997).

Type of Presence	Description of Presence
Conveyance of Social Cues	The degree to which any given medium has the capacity to transmit information that is perceived by a participant and used in the interpretation of the message
Fidelity of Representation	The degree to which a communication medium creates imagery and other sensory input that has high fidelity relative to the target person, place, or thing that is the focus of communication
A Transport Mechanism	The degree to which a medium can give a user a sense that they are transported elsewhere (i.e., “you are there”) or bring a place or objects to the user’s location (i.e., “it is here”)
Immersion in a Space	Either physical immersion (i.e., immersing sensory organs into physical devices like head mount displays and headphone) or psychological immersion (i.e., creating a sense that one is inside the space)
Social Actor in a Medium	When an observer treats a character in a medium as a social actor regardless of whether that actor can respond or is controlled by a human actor (e.g., watching and talking back to a TV anchor)
Computers as Social Actors	When people to treat inanimate objects that do not resemble human actors (e.g., computers) in a socially sound manner

2.2.2.1. *Conveyance of social cues*

First, Lombard and Ditton suggest that presence has been used in communications studies, such as those examining ICT in the IS field, as a construct that focuses on the media's conveyance of social cues (the degree to which any given medium has the capacity to transmit information used by a participant to perceive and process the social cues exhibited by others in the communicative transaction). In general, these theories assume that a medium has a capacity for conveyance of these cues and therefore they have been used to predict that

the use of any given medium will have certain predictable, as well as consistent, set of outcomes associated with the act of communication. As noted earlier, the two theories that are representative of this perspective are media richness theory (Daft and Lengel, 1986) and social presence theory (Short et al., 1976). The notion that much of communication is centered on, at least in part, the social acts and cues is important for virtual worlds and the concept of ESP. Furthermore, while controversial (Dennis, Fuller, and Valacich, 2008), the idea that each medium has a given capacity for conveying certain types of information is relevant to identifying a threshold capacity that is required for a medium to enable ESP.

2.2.2.2. *Fidelity of representation*

A second type of presence relates to the degree to which a communication medium creates imagery and other sensory input that has high fidelity relative to the target that is the focus of communication. In other words, is the medium producing a realistic representation? Of course, while this concept of presence is quite pertinent to the electronics industry, it is also an important concept at a theoretical level and for other practical reasons related to where and how the medium is used. As Lombard and Ditton (1997) point out, this concept of realism is multidimensional with a distinction being drawn between what they call social and perceptual realism. Social realism refers to the plausibility of the communication content while perceptual realism refers to the degree to which the imagery possesses an accurate representation of the content of the communications.

2.2.2.3. *Transport mechanism*

The third type of presence identified in the literature is related to the notion that the user of the medium can function as a transport mechanism (Lombard and Ditton, 1997). Media can create different perceptions in the user related to relocation and transportation. In

particular, a medium can give a user a sense that they are transported elsewhere, it can bring a place or objects to the user's location, or one user can be brought to a "place" to which another user has been transported with the result that they share a space and experience copresence. This notion of transportation is common in both the literature and in popular conceptions of media with high levels of realism. For example, HDTV and other products are often marketed with a focus on the high levels of realism and the promise that you will feel like you are there (or it is here). This concept, primarily a psychological phenomenon, is not limited to technologies that offer high realism, however. For example, storytelling and other non-visual forms of communication (e.g., surround sound) can take the observer to other places even when their eyes are closed (Gerrig, 1993) (i.e., users can experience imaginal presence). Much of the literature related to virtual worlds and, particularly, immersive VR systems (e.g., VR caves) has been focused on creating virtual mockups of real places to support training, desensitization, and decision making (e.g., decision making simulations) with the goal of improving the learning and performance of the participant in the real world (e.g., Benford et al., 1995; Waller, Hunt, and Knapp, 1998; Benyon, Smyth, O'Neill, and Conroy, 2001; Lee, 2004; Lathrop and Kaiser, 2005; McCall, and Carroll, 2006; Sandamas and Foreman, 2007). While a high degree of realism (i.e., via visual, auditory, and other channels) is not necessary for ESP to be manifest, an important criterion for a user to develop a sense of copresence and, therefore, ESP, is for sufficient realism to exist to enable the user to suspend disbelief and allow himself to perceive that he is present in a space (Turner and Turner, 2006).

2.2.2.4. *Immersion in a space*

Lombard and Ditton's (1997) fourth categorization of presence is related to the notion of

immersion within the space or environment represented within or through the communication medium. Immersion can refer to either physical immersion (i.e., immersing sensory organs into physical devices like head mount displays and headphone) or psychological immersion (i.e., creating a sense that one is inside the space). Of course, psychological immersion is generally the objective of creating VR environments (e.g., caves and head mounted displays), virtual worlds, and big-screen televisions. But physiological immersion is not necessary to create psychological immersion. In fact, immersion has been conceptualized as something that can happen to varying degrees depending on the level of physical immersion and the characteristics of the user. For example, Lee (2004) observed that too much physical immersion can be problematic when, for example, it leads to disorientation, motion sickness, dizziness, and other problems (Biocca, 1993; Azar, 1996; Biocca and Rolland, 1998); however, a minimum level of physiological immersion is thought to be needed to achieve a perception of immersion (Isgro, Trucco, Kauff, and Schreer, 2004). The concept of psychological immersion is important in virtual worlds because a user must develop minimal perception of psychological immersion in order to develop a sense of copresence and ESP.

2.2.2.5. *Social actor in a medium*

The fifth type of presence offered by Lombard and Ditton (1997) relates to treating a character in a medium as a social actor regardless of whether that actor can respond or is controlled by a human actor. In other words, when observers talk back to the news caster on the television or to a computer-generated character in a video game they are behaving in a manner suggesting that they perceive some degree of social presence with the medium generating the stimuli. People frequently treat what they know to be inanimate objects, even objects with little or no resemblance to the human form, as though they are other social

actors. In a study to examine the effect of anthropomorphic realism of an avatar in a virtual reality system as well as the perceived agency of the avatar (i.e., whether the subject thought the avatar was controlled by a computer or human agent), Nowak and Biocca (2003) found that subjects responded to both perceived computer and human agents as social actors. Furthermore, when the anthropomorphism represented in the avatar was either low or high the subjects developed lower perceptions of copresence and social presence compared to when anthropomorphism was moderate. This is supportive of the notion that perceptions of presence, copresence, and ESP can be achieved in virtual environments with lower levels of realism and where the identity of other avatars is not known.

2.2.2.6. *Computers as social actors*

The last categorization of presence addresses the tendency of people to treat inanimate objects that do not resemble human actors in a socially sound manner. In this respect, Nass and Moon's (2000) research supports the notion that human behavior toward computers responds to a "mindless" application of social rules to computers. In an effort to reject the notion that individuals' social actions and reactions to computers can be caused by anthropomorphism, they argue that we tend to overuse our learned social scripts. That is, when devices such as the computer provide certain cues that are construed as intelligent behavior, we tend to extend the way we behave with humans to these devices. The cues that seem to trigger this response include the elicitation of language, the potential for interaction, and the replacement of humans by technological implements.

As this review highlights, presence is a concept that is multidimensional and encompasses multiple literatures. Our focus will be primarily on the psychological perceptions of presence and the relationship of this variable to the more comprehensive

concept of ESP. These definitions of presence do not require that a user be with or engage in activities with other human or computer-agent entities. In other words, presence can occur when a user is in a space, such as a Second Life island, when no one else is present. When a user visits a virtual space, interacts with objects, and perceives that he is there, the user has developed a sense of presence. This raises a question, what features of a shared place are important in fostering a sense of presence and how do other avatars influence these perceptions?

Copresence extends the concept of presence because most ICTs where presence has been studied are also designed to enable social communication. So, while these concepts are related, they are unique constructs and most of the literature has treated them as unique phenomena (e.g., Biocca, 1997; Durlach and Slater, 2000; Slater, Sadagic, Usoh, and Schroeder, 2000; Regenbrecht and Schubert, 2002; Nowak and Biocca, 2003; Slater, 2003; Zhao, 2003; Gerhard et al., 2004; Chen and Börner, 2005; Bailenson , Yee, Merget, and Schroeder, 2006; Schroeder, 2006).

Zhao (2003) notes that copresence has been used by researchers to refer to two distinct interactive contexts. First, copresence can mean being together in physical proximity in a physical environment (Slater et al., 2000). Alternatively, copresence can include the act of “being together” with someone in a technology-mediated environment along with the feeling of togetherness (Durlach and Slater, 2000; Slater et al., 2000; Schroeder, 2006). From this, Zhao proposes a typology of copresence defining the degree to which actors are physically collocated (i.e., the mode of copresence) and the degree to which users perceive being with another social actor (i.e., sense of copresence).

An important question about copresence is why and how does it occur in virtual

environments? For both presence and copresence to occur, scholars have suggested that users suspend disbelief while engaging in activities mediated by 3D technologies (e.g., Moon and Nass, 1996; Nass, Fogg, and Moon, 1996; Reeves and Nass, 1996; Nass and Moon, 2000). Gilbert (1991) suggests that humans are predisposed to accept a stimulus as true unless there is a strong contravening reason suggesting the contrary, and that it is easier to believe than to reject when presented with realistic or near realistic stimuli. Reeves and Nass (1996) define these behaviors as “The Media Equation” (TME) and suggest that this is the reason people perceive media to be *real*.

In explaining perceptions of presence and copresence, Lee (2004) suggests that folk physics and folk psychology, which are cognitive processes that are used by social actors to infer causation from observed phenomena based on innate or quickly-developed assumptions about the functioning of the system underlying the phenomenon (McCloskey, 1983), are applied by social actors to interpret stimuli from the virtual world. Specifically, folk physics is applied when we automatically accept virtual objects and spaces as real while folk psychology is enacted when we automatically accept the reality of virtual social actors. So, perceptions of copresence exist when folk physics is enacted (i.e., presence) and the user also enacts folk psychology (i.e., he or she perceives the “person behind the mask”). The literature also suggests that perceptions of presence and copresence are affected by various factors, including the embodied form of the user in the virtual environment (Biocca, 1997; Biocca, Harms, and Burgoon, 2003).

2.2.3. Embodiment

Numerous literatures have considered embodiment (Biocca, 1997; Lakoff and Johnson, 1999; Biocca et al., 2003; Baldwin, 2004; Ehrsson, 2007). For example, Merleau-Ponty

observed the following, “I regard my body, which is my point of view upon the world, as one of the objects of that world” (Baldwin, 2004, 83). Similarly, in writing about “the embodied mind,” Lakoff highlights the role of the body in mediating all stimuli and, by extension, cognition and thus emphasizing the importance of embodiment in framing perceptions and understanding (Lakoff and Johnson, 1999). Furthermore, Ehrsson observed that people who had out-of-body experiences had an illusion that “their center of awareness, or ‘self,’ [was] located outside their physical bodies and that they look[ed] at their bodies from the perspective of another person” (2007, 1048). This perspective on *bodies as objects* is useful as a way to understand how people develop a sense of “being there” in media in that it highlights the dialectic between cognition and physicality in virtual spaces (Baldwin, 2004).

While the concept of embodiment has been examined in research examining virtual environments, there is limited literature related to embodiment and presence. Biocca (1997) has dealt with various forms of embodiment in his examination of presence and immersion and his work represents a useful frame for considering the role of embodiment in virtual environments. For Biocca, presence starts with the desire to transcend the body “to move beyond the limits of the body and the sensory channels” (1997, 13) through the extension of the human senses via technology. Biocca suggests that the body fosters a sense of presence in three distinct ways: *being there*, *being with another body*, and having a feeling of *self-presence*. Biocca’s notion of *being there* equates to the general notion of presence while *being there with another body* is comparable to copresence; however, feelings of *self-presence* have been dealt with less directly in the literature. Self-presence addresses the perceptions that a user has of his own representation in a virtual environment. Biocca suggests that this representation, or mental model, takes on two forms. First, “the mental

model of the user's body (body schema or body image) may be influenced by the mapping of the physical to the geometry and topology of the virtual body" (1997, 23). Second, "the virtual body may have a different social meaning (i.e., social role) than the user's body" (1997, 23). Thus, the virtual body influences one's own perceptions of both one's avatar and oneself and the representation of the avatar carries a social meaning for other users who interpret its representation in context.

Biocca also notes that users experience oscillations in their sense of presence because the perception of presence is unstable. Specifically, he suggests that a user's perceptions of presence will straddle three "places"; the physical, the virtual, and the imaginal environment. The imaginal environment is a representation in one's mind that describes how the user perceives space and, by extension, the body, when not cognitively attending to the physical and virtual stimuli or when media filter out stimuli. For example, when using a voice-only channel such as a telephone, most callers will endeavor to *imagine* what a communication partner looks like, how he is positioned, and the space around him. By extension, imaginal embodiment can also occur in other contexts such as in virtual worlds where the user is represented by an avatar.

In summary, Biocca suggests that three bodies can be considered in virtual environments: the physical body, the virtual body, and the imagined body schema. Furthermore, because of the social meaning that an avatar appearance carries, a fourth body, the body schema of the user created in the mind(s) of an observer (or set of observers), is also relevant when using a virtual world. Thus, there is both an objective component to embodiment (i.e., the objective representation of one's body) and a subjective component (i.e., the perception of the body by self and others).

2.2.4. Presence and Activity-Based Interaction

The literature review in the preceding sections illustrates that theories of presence, including copresence and social presence, cannot fully account for the complexity of interactions supported by virtual worlds and other ICTs. Although the presence literature describes a variety of factors influencing the establishment of presence, it fails to demonstrate the richness, depth and multidimensional character of interactions associated with embodied presence and co-presence. This point was made by Biocca and his colleagues when they noted that limitations of the concept of social presence include “defining the limited scope of psychological phenomena that constitute social presence, ...defining the scope of social behavior that elicit social presence, ...[and] setting criteria for measurement” (2003, 471). In other words, what are the antecedents, the psychological phenomena, and the results of presence in its various forms? We propose that activity theory serves as a lens for interpreting the ambiguity noted by Biocca, Harms, and Burgoon (2003).

Activity theory suggests that humans and their actions can be best understood when the observer understands the nature of the context where the interaction occurs and when the social actors engage in shared goal-directed activities. Activity theory understands human existence as involving engagement in collective, outcome-driven, and socially-determined activity mediated through context, tools, and symbols. The theory initially focused on individual mental processes (Vygotsky, 1935) but was expanded to include communities of practice and their complex interaction with their environments (Engeström, 1987). The linkage between the individual and social actors is central to understanding the major premise of this theory: it is only within the context of the community and through participation in mediated activities that individuals understand themselves and others. While

our focus is on individual perceptions of a user in a social setting within a virtual world, Vygotsky and others (e.g., Hollan, Hutchins, and Kirsh, 2000; Hutchins, 2001) have examined concepts related to the social development of meaning and understanding. For example, building on Activity Theory, Hutchins' Distributed Cognition "seeks to understand the organization of cognitive systems" by considering cognition from a perspective beyond that of the perceptions and cognitive processes occurring at the individual level (Hollan et al., 2000, p. 175).

For social actors to achieve an outcome, individuals must work together and utilize tools and symbols that they have invented or adapted. Outcome-driven, human activity is also mediated by the rules and division of work practices embedded in the context (i.e., what is our shared understanding of how we should work together?). Being part of a community where context, tools, and practices are derived from a shared history, individuals perceive reality as both objective (i.e., existing outside of them) and subjective (i.e., residing within them). Human activity is thus directed at others as well as the environment and their activity influences and determines the environment in ways that are comparable to how the environment affects and determines each actor's existence in the environment. Individuals realize their role in a particular shared context through involvement with others via active participation in mediated activity and mastery of tools and symbols. It is through activity-based interaction and acquisition of social knowledge that includes awareness of the functions and pragmatics of shared tools, rules, and labor divisions that individuals become cognizant of reality and begin to exercise their free agency within the context of their community and organization (Engeström, 1987). The meaningful linkage between the individual and social emphasized by activity theory helps to define how individuals perceive

others and that their thinking of others i) revolves around their own contextual understanding of reality and ii) is shaped by both the exercise of their free agency and manipulation of the tools, symbols, rules, and labor divisions entrenched in the shared context.

The connection to the body and lived bodily experiences that ESP explicates makes sense if the body, both virtual and corporeal, is thought of as a tool to mediate communication and to aid participation in social and organizational activities. Humans are intimately familiar with their own physicality and the effects of sensory stimuli on it. They use the body to perform actions and participate in life in a social context and thus rely on their body to become knowledgeable of their environment and their role therein. One's own body then serves as a frame of reference and is heavily used for interpretations of the actions of others (Lakoff and Johnson, 1999) and as an instrument through which learning takes place (Hanna, 1988). In virtual worlds, much like in the real world, the body is used to control the environment and bodily actions are modeled and simulated using an avatar to elicit reactions to virtual stimuli. Further, the body is part of the context, regardless of whether we reference the real or virtual world.

In summary, virtual worlds not only call for the physicality of the human body, but also act as a social context where individuals and communities participate in joined activity, interact with the context, internalize and use tools and symbols embedded in the digital culture, and regard and transform social rules and divisions of labor. During such processing of virtual worlds, users master virtual tools via acts of generalization and systematization and open a gateway to conscious thinking, which appreciates the complex matrix of virtual worlds. Thus, people learn to appropriate avatars, spaces, and objects in context through both generalizing and systematizing acts, which is consistent with how activity theory suggests

that actors learn about their environment.

2.2.5. The Development of Embodied Social Presence

This literature defines an important context that should be considered in examining the specific features of the ESP theory. Specifically, ESP is premised on the notion that certain communication acts and interactions take place in the context of embodied states that create a sense of presence that is derivative of human cognitions associated with physical, real world BtB interactions. To achieve this sense of embodied social presence, the actor must first achieve and perceive sufficient levels of embodied presence and copresence. To summarize the literature, we present a process model in Figure 2.2 that outlines the actions, requirements, and constraints that the presence literature has previously identified and that define a context for the development of perceptions of ESP. This is not a model of ESP, but rather a summary of what the presence literature suggests happens when users enter virtual worlds, experience presence and copresence, and engage in substantive, task-focused interaction.

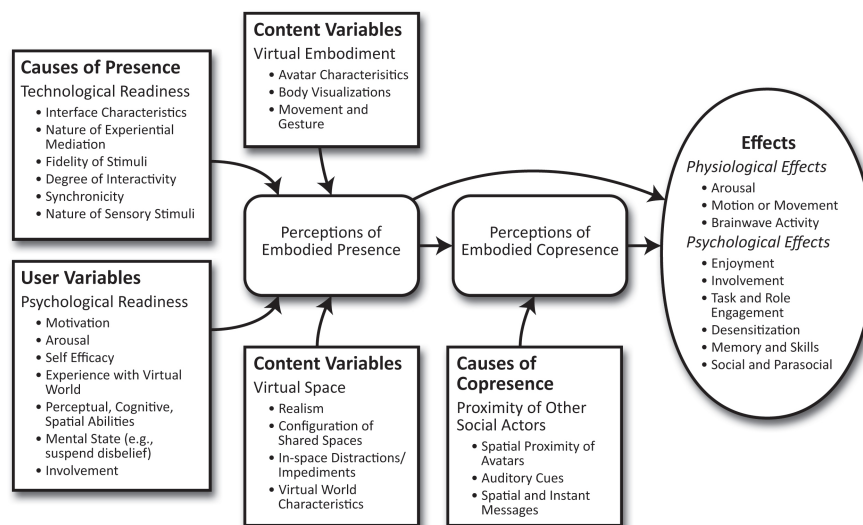


Figure 2.2 The process and context of embodied social presence.

The process begins with the user positioned in the context of a physical space. The user in his or her world is defined by the corporeal existence of that actor, the psychological processes and frames in which the user is operating at the time of interaction, plus other historical and societal contextual elements that create in the user a psychological readiness to engage in presence (i.e., user variables). To enter the virtual world, the user must use physical communication channels (i.e., causes of presence), although it is not necessary for all of these channels to be present for the user to develop perceptions of presence.

Assuming that the user's physical context provides adequate mediation, the user will be presented with the stimuli representing the virtual space (i.e., virtual space content variables). This does not guarantee that the user will experience a sense of presence, but it does afford the user that opportunity. As the literature points out, factors such as realism, spatial characteristics of the environment, and numerous other characteristics will influence whether the user obtains a sense of presence and the degree to which that occurs (Lombard and Ditton, 1997). In a virtual environment the user is presented with stimuli representing the virtual environment, the objects in that environment, and their own avatar's representation (i.e., virtual space variables as well as embodiment content variables). If the user engages with these stimuli he or she will experience, to one degree or another, embodied presence. As Biocca (1997) suggested, when a user of a virtual environment is presented with a body representing himself or herself in the virtual world, that representation will have an influence on perceptions of self, identity, and the user's actions associated with that representation. Thus, embodied presence creates an opportunity for the user to develop and extend his or her identity in the virtual environment in a way that is not present in most other communication

environments.

Once a user develops a sense of presence in a virtual environment, the opportunity exists for that user to share that space with others. When users share a virtual space they have the opportunity to experience perceptions of embodied copresence. At its basic level, embodied copresence is an awareness that another entity is present and, in virtual environments, this is accomplished at a rudimentary level through visual, auditory, and other action-oriented stimuli manifested by the other user's avatar. For embodied copresence to exist, one or more of the social actors whose avatar is in the shared space must experience this perception. It is not necessary for all of the social actors whose avatars are in a shared space to experience perceptions of embodied copresence for this to be perceived by some users. One of the limitations of the current literature on presence and copresence is that the notion of copresence does not take into account the role of interaction in creating a high sense of copresence. The concept of ESP addresses this shortcoming by identifying the factors that are fundamentally associated with rich, BtB interactions in the real world and applying these to interactions in virtual environments. As we will describe below, key to this interactive potential are the shared contexts, spaces, objects, activities, and tools for interaction that exist within the milieu of artifacts that define the context of the development of a sense of ESP.

This review highlights the role and importance of place, presence, embodiment, and shared activities in defining a context where social actors achieve what we have termed embodied social presence. This phenomenon encompasses a set of perceptions that users of virtual worlds experience when they engage in shared activities with other actors. We elaborate on the tenets of the theory and its importance for understanding how virtual worlds influence user perceptions in a later section. In the next section we discuss the qualitative

data that informed our development of ESP theory.

2.3. Qualitative Data Analysis

This section provides a description of a qualitative analysis of factors associated with ESP theory in order to identify the process(es) by which perceptions of ESP are derived and examine the results of this phenomenon on social engagement, collaboration, and interactions. The development of ESP theory followed a traditional grounded theory method that began with research questions, was followed by data collection, theme and code construction, and finally theory development (Glaser and Strauss, 1967; Glaser, 1978, 1992; Charmaz, 2003).

2.3.1. Opening Research Questions

We began with a series of questions to study a phenomenon that the researchers had observed over time through direct observations and interactions within a 3D world. As participants in the Second Life environment, the researchers experienced a depth of immersion which seemed to warrant further investigation. What were the features and affordances of the 3D environment that fostered a sense of presence and co-presence? Did the avatar play any role in the perception of engagement? Did the shared tasks play any role in the immersive experience? And finally, did the combination of the 3D environment, the avatar, and the shared activities affect the experience of the participants?

2.3.2. Data Collection Procedures

Data were collected from two offerings of one graduate course in E-commerce that was taught during the summer of 2007 and spring of 2008. The objective of the course was to help students develop an understanding of the nature of the consumer purchasing process, the characteristics of products and services, and the role of human behavior. The students were

to participate in business activities, socialization, and collaboration, which involved using the virtual environment of Second Life to hold team meetings, engage in social and task-related activities, and participate in class lectures and discourse.

2.3.3. Data Analysis

A student reflection exercise was collected from 57 students; 29 from the summer 2007 course and 28 from the spring 2008 course. The reflection exercise was a class-related activity that, for pedagogical purposes, asked students to reflect on and describe their experiences in Second Life. Names and other identifiers were removed from the reflections prior to analysis and combined into one document that consisted of 149 pages of text. The students' narratives were analyzed in the tradition of linguistic anthropology (Sapir, 1949; Whorf, 1956; Volosinov, 1973) which asserts that the physical and social environment of a community can be understood through an examination of the vocabulary used by members of that community. Content analysis was used to analyze the text, as it has been described as a multipurpose technique for studying communication artifacts (Berelson, 1952; Holsti, 1969; Krippendorff, 1980; Weber, 1990) and has been used to discover the psychological, attitudinal, and behavioral states of individuals and groups (Krippendorff, 1980; Weber, 1990).

2.3.4. Focused Analysis

Focused analysis began with the development of a start list of codes (Miles and Huberman, 1994) based on *a priori* concepts outlined in Lombard and Ditton (1997). Line by line coding was framed by the causes of presence (e.g. number of senses involved, visual quality, and aural characteristics), effects of presence (e.g. user arousal, enjoyment, and task performance), technology content variables (e.g. conventions and fidelity), and user content

variables (e.g. personality type, mood, age, gender). The initial start list contained eight causes of presence, eleven effects of presence, three content variables, and three user variables. From the start list, a seven-page codebook was developed and used to train two coders. As line-by-line coding progressed, several themes emerged which were not contained in the start list. The student reflection data included additional causes (e.g. place, self, and nonverbal communication) and effects (e.g. the feeling of having and using a digital body). The start list was refined (Table 2.2) to include these new concepts, which are concepts that were not part of the original Lombard and Ditton (1997) list of concepts and represent the important variables relevant to ESP.

Table 2.2 Start list of codes used for text analysis with additional causes and effects.

Causes of Presence (Lombard and Ditton, 1997)								Additional Causes (ESP Theory)		
C-No	C-Vis	C-Aur	C-Othr	C-Intra	C-Obtr	C-Live	C-Ppl	C-Place	C-NV	C-Self
No. of senses involved	Visual quality	Realistic sound	Smell tactile movement	Interactive	Glitches	Real-time	No. of people	Sense of location	Awareness of non-verbal communication	Awareness of self and digital body
Effects of Presence (Lombard and Ditton, 1997)								Additional Effects (ESP Theory)		
Physiological Effects				Psychological Effects				Psychological Effects		
EPy-A	EPy-V	Epy-O	EPs-E	EPs-I	EPs-T	EPs-S	Mediated Body (MB)			
Aroused	Motion or vection	Flinching or ducking	Enjoy-ment	Involved	Task performance	Skills training	An expressed feeling of having and using a digital body			
			EPs-D	EPs-P	EPs-M	EPs-R				
			Desensi-tization	Persua-sion	Memory improvement	Parasocial				
Content Variables (Lombard and Ditton, 1997)				User Variables (Lombard and Ditton, 1997)						
CV-Real	CV-Cnv	CV-Task			UV-Susp	UV-Expr	UV-Other			
Lifelike	Follow conventions	Task match fidelity			Willing to suspend disbelief	Prior experience	Personality, mood, age, gender			

The codebook contained detailed descriptions of the 25 codes used for the text analysis (i.e. eleven causes of presence, twelve effects of presence, three content variables, and three user variables). The codebook also provided a definition of each code, an example from the text, and general researcher notes. The full text was coded and a 29% random sample of 248

statements was re-analyzed to report inter-coder reliability measures for two coders (Table 2.3). Variables with less than 95% agreement were re-examined. Disagreements were resolved by the principal research. The codebook was refined to reduce future miscoding and those data in question were recoded.

Table 2.3 Intercoder reliability report based on a subsample of 25% of the statements in our sample of 248.

Variable	Code	Percent Agreement	Scott's Pi	Cohen's Kappa	Krippendorffs Alpha	N Agreements	N Disagree	N Cases	N Decisions
01	C-No	96%	-0.02	-0	0	24	1	25	50
02	C-Vis	92%	0.702	0.706	0.708	23	2	25	50
03	C-Aur	100%	1	1	1	25	0	25	50
04	C-Othr	100%	1	1	1	25	0	25	50
05	C-Intra	92%	0.802	0.802	0.806	23	2	25	50
06	C-Obtr	100%	1	1	1	25	0	25	50
07	C-Live	92%	0.826	0.826	0.83	23	2	25	50
08	C-Ppl	96%	0.911	0.911	0.913	24	1	25	50
09	C-Plc	96%	0.918	0.918	0.92	24	1	25	50
10	C-NV	100%	1	1	1	25	0	25	50
11	C-Self	100%	1	1	1	25	0	25	50
12	EPy-A	96%	0.905	0.905	0.907	24	1	25	50
13	EPy-V					No instances of this variable reported within the random sample			
14	EPy-O					No instances of this variable reported within the random sample			
15	EPs-E	92%	0.826	0.828	0.83	23	2	25	50
16	EPs-I	88%	0.502	0.516	0.512	22	3	25	50
17	EPs-T	96%	0.883	0.884	0.886	24	1	25	50
18	EPs-S					No instances of this variable reported within the random sample			
19	EPs-D					No instances of this variable reported within the random sample			
20	EPs-P					No instances of this variable reported within the random sample			
21	EPs-M					No instances of this variable reported within the random sample			
22	EPs-R	88%	0.733	0.737	0.738	22	3	25	50
23	MB	92%	0.833	0.834	0.837	23	2	25	50

2.3.5. Theme Development

The coded data were then organized into a clustered matrix (Miles and Huberman, 1994). Each row represented one of the 57 student respondents. Each column detailed the coding associated with the causes and effects of presence, the user and content variables, and

the written text describing the event. The raw data were narrowed to 248 statements (10,058 words) describing the phenomenon we have termed embodied social presence. Statements were one to three sentences that described a complete thought or action.

When reflecting on the virtual communication assignment, most students wrote about their teammates (91%), the visual stimulation they received (77%), the nonverbal body codes they transmitted or received (63%), the interaction within the virtual place (77%), and the feedback that the shared activity provided their real self (77%). The effects of presence most often written about were increased arousal (58%) and improved task performance (53%). Of the 57 students, 39 wrote about a mediated body experience (68%). We define a mediated body experience as a feeling of using a digital body and interacting with others who also possessed a digital body. A frequency table summarizes the causes and effects of presence experienced by the students (Table 2.4).

Table 2.4 Causes and effects of presence experienced by students.

Causes (Lombard and Ditton, 1997)	Number of Students Mentioning Causes (N=57)	Effects (Lombard and Ditton, 1997)	Number of Students Mentioning Effects (N=57)
People	52	Aroused	33
Visual	44	Task Performance	30
Movement	27	Involved	24
Interactive	23	Enjoyment	23
Real-time / Live	20	Motion	4
Aural	8	Memory	3
Causes (ESP Theory)		Effects (ESP Theory)	
Place	44	Digital Self	39
Real Self	44	Digital Other	39
Nonverbal	36		

2.3.6. Operationalizing ESP

The next stage of content analysis was the development of a step process model (Meyer and Conrad, 1957; Smelser, 1962; Lofland and Stark, 1965). In addition to coding the data

for the causes and effects of presence, the step process model examined the conditions necessary in order to progress through the process of embodied social presence. Lofland, Snow, Anderson, and Lofland (2006, 161) wrote that a step process model is, “akin, analogically, to the assembly line production process in which each stage shapes further the character of the product, such that there is a progressive narrowing of the range of possible outcomes.” The student reflection data were used to identify the possible steps or conditions associated with achieving the state of ESP.

Three categories were operationalized to measure the possibility and range of ESP, which were based on the distinction between the narrative mode of first-person, and third-person. Drawing from cognitive linguistics, a first-person perspective has been defined as one “experienced either as physical forces or as emotional or social pressures that make you move in a particular direction” and a third-person perspective is one which “sees forces acting upon an object from the outside” (Gärdenfors, 2007, 188). Thus, Gärdenfors (2007, 189) concluded that “from the first-person perspective, powers act directly on you, while from the third-person perspective forces act at a distance.” Grammatically, the English language utilizes a set of categories to express first- and third-person perspectives. Using the distinction between the grammatical modes of first-person and third-person, the embodied social presence (ESP) process was operationalized as:

- ESP Achieved:** Author writes of the avatar in the first person. Author uses possessive form to refer to digital self and digital others (e.g. *my* avatar, *our* avatars, or *her* avatar). The author describes the feeling of using a digital body to interact with digital others (i.e., *actions* in the context of *activity*).
- ESP Neutral:** Author switches between using first person and possessive forms to using articles and adjectives to refer to digital self, digital others, and avatars.
- ESP Not Achieved:** Author uses an article (e.g. *an* avatar or *the* avatar) or an adjective (e.g. *that* avatar) to refer to the Second Life experience. The author also describes psychological and/or technological barriers that prevented them from moving into the next stages of presence, co-presence and then to embodied social presence.

Based on these definitions, we found that 68% of the students experienced ESP at some point during the exercise (Table 2.5) (while these students experienced ESP at some point and reflected upon this experience, we are not arguing that this is a persistent perception; rather, much like “Flow,” ESP is achieved when the conditions support its development). In this sample, males and females were approximately equally divided in experiencing ESP.

Table 2.5 Distribution of students experiencing embodied social presence (ESP).

	ESP Achieved	ESP Neutral	ESP Not Achieved	Total
Male	16	9	4	29
Female	20	7	1	28
Total	36	16	5	57

Besides determining the perception of ESP, the step process model also focused on the conditions needed to achieve ESP. Students who experienced ESP did so by expressing visual, emotional, and nonverbal stimulation when engaging in a shared activity with their teammates in the virtual environment. It is important to note that the students writing these reflection pieces had only used Second Life for several months. Even so, these novice users

experienced a complex feedback loop. For example, one of the students made the following statement; “Others around me can see my expressions and mood much easier than in two dimensional chat.” On the surface, this statement seems quite simple. However, a closer analysis uncovers its density. The word “others” refers to digital others who are “around me”—the author’s digital self in the virtual place. The phrase “can see” refers to the real others and “my expressions” refers to the actions of the author’s avatar. Lastly, the word “mood” refers to the emotional state of the author’s real self. The realization of embodied social presence experienced by this individual went from *digital others*, to *digital self*, to *real others*, back to *digital self*, and finally ended with the *real self*. The students who did not achieve embodied social presence clearly indicated that there were motivational, technological, and psychological barriers preventing them from taking the next steps into presence, co-presence and then to embodied social presence. Students also identified the affordances of having and using a digital body. An affordance has been described as the properties allowed by an object (Gibson, 1979; Norman, 1998; Gärdenfors, 2007). A classic example (Gibson, 1979) is that a chair affords sitting. Those experiencing ESP reported that the affordances of virtual communication included such things as emotional and realistic communication that enabled improved interaction with their teammates.

2.3.7. Analysis Summary

In summary, graduate students compared and contrasted the communicative experience of using Second Life versus traditional two-dimensional chat for the purpose of discussing a team project. Fifty-seven students from two different courses produced nearly 150 pages of data describing this activity. Our qualitative analysis was a mix of inductive theory building and focused *a priori* coding. The analysis showed support for previously identified causes

and effects of presence and identified new causes and effects proposed by ESP theory. An in-depth content analysis operationalized the linguistic choices that could measure the possibility and range of embodied social presence.

This analysis provides a context for the ESP theory. The next section details the components and tenets that we propose in this theory. The theory is derivative of the researchers' own experience in virtual worlds and this content analysis of these data.

2.3.8. Theory of Embodied Social Presence

We suggest that ESP is experienced through participation in shared collaborative activities occurring in virtual worlds and mediated via embodied representations of social actors. Or in other words, ESP Theory posits that the body is the nexus of communication, and that an embodied representation – whether virtual, physical, imaginal, or some combination, combined with goal-directed shared activity – including body-mediated gestures and verbalizations that are used as tools and symbols, in a shared virtual or real space, affects the perceptions of users by drawing them into a higher level of cognitive engagement in their shared activities and communication acts. As noted, the user reflection data linguistically suggests that third-person inanimate pronouns describing the use of an avatar (e.g., it, its) are replaced by personal and possessive pronouns (e.g., I, me, my, his, hers), which suggests that at some point the user's embodied perceptions mesh with their avatar so that as they flow through these stages of ESP they experience a higher sense of engagement and immersion in not only the space and activity but also in the actions and persona of their virtual embodied representation.

In this light, the virtual body is a tool for communication through action embedded in a symbolic context, which is how we use physical bodies in physical spaces. Like activity

theory, ESP recognizes the social and contextual nature of activity, but shifts attention from activity as the unit for analysis to an individual, or rather his or her embodied representation that in the context of the virtual environment becomes a recipient of and actor in a social activity-based and shared structure. In contrast to most of the presence literature, ESP does not rely on the objective content of communication with the goal of accurate transmission of information by means of particular technology. Rather, ESP emphasizes the processes by which the users of a virtual environment jointly strive to accomplish a purpose that is unattainable individually, to achieve a consensus, and a mutual commitment to a shared meaning that drives their activity within a context. Such a commitment is not dormant; it is constantly modified by further interactions that bear on objective, subjective and mutually agreed upon content.

Ultimately, one important goal associated with social presence is to understand what the reality is “behind the mask.” The theory of the mind addresses this and is at the core of ESP theory. However, activity theory argues that we can only develop our understanding of others through subjective lenses that are influenced both by objective stimuli and subjective interpretation. A conclusion one might errantly draw from activity theory is that there is no point in trying to decipher the intent of the communicator since one cannot read his mind. Of course, this is not the purpose of activity theory; rather, it is to highlight that understanding one’s environment is, in part, a subjective process and that understanding it is internalized through the stimuli available to the observer. The important stimuli when communicating are the actions taken by other social actors along with contextual factors (media, objects and symbols). Activities consist of verbal and non-verbal actions that involve tools, such as the body and language, which are symbols in a context. In the context of communication, all

actions are initiated by the mind but carried out through the quintessential medium, the actor's body. While actors have intent and goals, intentions are instantiated through actions that are manifest through the body. In virtual worlds the avatar is used as a tool for impression management, communication, and symbolic interactions just as one's real body is used in the real world.

Our inquiry into ESP began with the observation that the use of virtual worlds created in us and our students greater engagement with the environment and others in the environment. This caused us to ask, what causes these perceptions? We observed that even though we knew that the avatars being used by other social actors were not real bodies, the perception remained that interactions with the avatar were engaging, dynamic, and satisfying and this begged the question, why? The answer lays in the space the avatars share and the interactions the users engage in through their virtual bodies. Sharing of space provides context and the interaction of virtual bodies used as tools creates richness. But the question might be posed, isn't this just copresence? While copresence addresses the perception of the presence of another social actor, it does not capture the deeper interaction that occurs when the users of avatars are engaged in substantive activity-based, body-centered interactions. It is at this rich level of interaction that deeper meanings can be encoded and conveyed through actions. So, while virtual bodies cannot replace real-world bodies, a virtual body can be used as a tool for conveying concepts, meaning, and symbolism in a way that mirrors how social actors use their physical bodies in real world social activities.

We conjecture that for ESP to occur, social actors must participate in goal-directed, shared activity mediated through embodied representations in a context (e.g., a shared space, a place with meaning, on a task with purpose, etc.). This occurs as a multi-stage process that

begins with the antecedents of the phenomenon (e.g., the process of attaining presence and the context in which that occurs) and culminates with the manifestation of the phenomenon (i.e., development of perceptions of ESP).

We have already outlined in general terms the process by which perceptions of presence and co-presence are achieved in Figure 2.2. The presence literature has identified many variables that influence this process; however, to provide a richer framework for defining the factors that influence this process, we reference the contextual elements suggested by activity theory. Specifically, activity theory suggests that understanding and meaning are developed in a context mediated by tools and symbols (Table 2.6 contains a list of some of these contextual factors). Each of these factors represents elements that define and influence whether, when, and how social actors derive meaning and understanding from their environment and ultimately makes interpretations about interactions with other social actors. As such, each represents a broader frame for a category of variables that can be examined to identify the role of context, tools, and symbols in shaping a social actor's development and perception of ESP. Further, this also suggests the research framework presented in Figure 2.3, which summarizes and categorizes these antecedents within the context of the presence literature and the factors suggested by ESP theory.

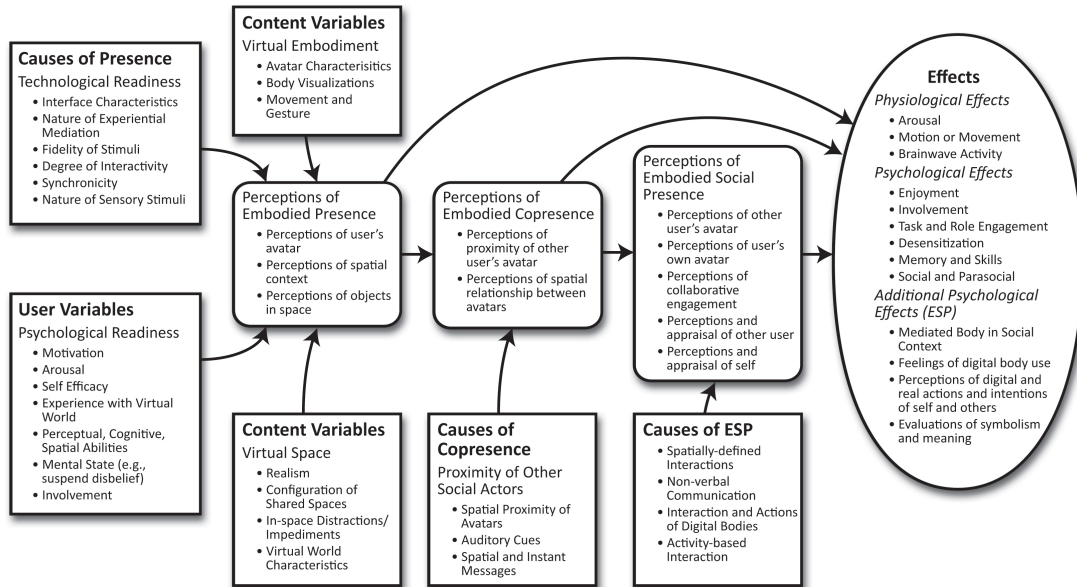


Figure 2.3 The ESP research framework: factors influencing presence, co-presence, and embodied social presence.

Table 2.6 Social presence antecedents.

Context	Tools	Symbols (Semiotics)
Culture	Body	Bodies
Experience	Objects	Objects
Goals and Tasks	Space	Semantics, Pragmatics, and
History	Technology and	Syntactics
Needs and Wants	Medium	Space
Space		
Technology and Medium		

Note: Several antecedent factors are present in multiple columns, which is purposeful.

The second stage in the development of ESP occurs when the phenomenon itself is manifest. Our analysis of the student reflection data suggest that perceptions of ESP are achieved through a complex process that begins with a perception of embodied presence and

co-presence and culminates with a perception of embodied self and others engaged in interactive, task-focused activity. ESP is manifest in a process that is multi-stepped and cyclical and involves multiple levels of cognitive engagement in the virtual space and its context (Figure 2.4). This process starts with recognition of the other social actor as manifest by his avatar, which is engaged in activities in the shared space. Recognition of one's own digital self follows as the observer develops a perception of his embodied representation as an avatar. Collaborative engagement in the shared task activity follows when the social actor's cognitive attention becomes focused on interactions with the social actors, his or her avatar, and the avatar's embodied actions. The social actor will appraise the other social actor (i.e., the person behind the avatar) by assessing and perceiving that individual through his actions and appearance. As this process evolves, the social actor will reflect on and appraise himself as he observes his own avatar interacting with the other actor's digital body. The result is a reflection on and consideration of his or her real self, including motivations, additional actions, and attitudes in the context of action and interaction. This represents a loop of shifting attentional focus on the virtual and real self, on the other social actor's virtual and real self, and on the context of interactions. It is this loop of attentional focus, which ultimately results in the user perceiving himself as a component of the environment manifest in his avatar (i.e., I rather than it) that defines the core of the ESP phenomenon.

Stage	Perceptual Focus	Context	Instrumental Tools	Understanding or Outcome
Recognition of the Other	The other social actor's avatar	Other social actor's virtual body (i.e., avatar) engaged in goal-oriented activities in a virtual space	<ul style="list-style-type: none"> Avatar Body Virtual Space Virtual Objects Verbal Communication Non-Verbal Communication 	<ul style="list-style-type: none"> Perception of other avatar Perception of Space
Recognition of Digital Self	Digital self embodied in one's own avatar	Actor's avatar present in the virtual space in proximity to the other social actor's avatar	<ul style="list-style-type: none"> Avatar Body Virtual Space 	<ul style="list-style-type: none"> Perception of one's own avatar Perception of Space
Collaborative Engagement	Joint activities	Actor's avatar engaged in goal-directed collaborative activities with the other social actor's avatar	<ul style="list-style-type: none"> Avatar Body Virtual Space Virtual Objects Verbal Communication Non-Verbal Communication 	<ul style="list-style-type: none"> Perception of other avatar in action Perception of one's own avatar in action
Appraisal of the "Real" Other	Actions (verbal and non-verbal) of virtual other	Actor's avatar engaged in goal-directed collaborative activities with the other social actor's avatar	<ul style="list-style-type: none"> Avatar Body Virtual Space Virtual Objects Verbal Communication Non-Verbal Communication 	<ul style="list-style-type: none"> Perception of the social actor "behind" the other avatar
Reflection on and Appraisal of Self	Digital self embodied in one's own avatar	Actor's avatar engaged in goal-directed collaborative activities with the other social actor's avatar	<ul style="list-style-type: none"> Avatar Body Virtual Space Virtual Objects Verbal Communication Non-Verbal Communication 	<ul style="list-style-type: none"> Perception of one's own actions as manifest in avatar-based social interaction

Figure 2.4 The component steps involved in embodied social presence.

It should be noted that ESP theory is a process theory that describes and frames the

context in which ESP occurs. Nevertheless, as has been the case with activity theory, we expect that as the model is developed and the factors further investigated, we will be able to develop a predictive frame for examining this phenomenon. While outside of the scope of this paper, perceptions of ESP will follow and be dependent on both a sense of presence and copresence, which are constructs that others have addressed previously (e.g., Witmer and Singer, 1998; IJsselsteijn, de Ridder, Freeman and Avons, 2000; Biocca et al., 2003). Furthermore, perceptions of ESP will occur when the social actor engages in shared activities performed in a context (e.g., involving specific tasks, in a particular place, etc.), using tools (e.g., objects, the avatar, etc.), within a symbolic frame (e.g., a location with meaning, clothing with symbolism, etc.). These factors can be measured and manipulated to understand the development of ESP. Finally, ESP is associated with high levels of cognitive engagement, a focus on shared activities and spaces, on the actions exhibited by the virtual and real bodies of self and others, and on perceptions and interpretations of intent and content from verbal and non-verbal communication. Thus, a measurement scale for ESP will focus on these constructs and phenomena; that is, the other social actor's virtual body and self, shared actions and communiqués, and the social actors own body and self.

2.4. Discussion

We have reviewed various theories and literature that converge in our model of ESP. First, in reviewing the literature we noted that a sense of place identity has been demonstrated to be closely tied to how people understand space and the ways in which these perceptions are interpreted and acted upon (Relph, 1976). Then, we reviewed the extensive literature on presence paying special attention to Biocca and colleagues' proposals as well as those of other researchers who have dealt with different aspects of the construct of presence

(e.g., Lombard and Ditton, 1997). As we have discussed, our model for ESP responds to the need for filling a gap in the literature on presence which has obviated such central concerns in the analysis of communication acts as space, place, and the mediation of both the real and the virtual body. Our model seeks to provide an account for such meaningful elements in communication. We are interested in the explanation of presence in virtual worlds, but with an eye on the implications for communications across a variety of media in a number of communication contexts. Our model is holistic in that it accounts for multiple factors and is central to an understanding of the process of communication that takes place through interactions mediated by virtual bodies.

Embodiment's role in framing an observer's interpretation of reality has received considerable attention in the literature in disciplines such as feminism (De Beauvoir, 1953; Irigaray, 1981; Haraway, 1985; Butler, 1988; Braidotti, 1990); however, ESP examines how the language of the body will influence the perceptions that users of virtual environments develop and how this influences their understanding of and the meaning ascribed to their interactions with other social actors. When social actors are engaged in interaction the sense of presence they develop is derivative of and is manifest as a re-enactment of real-world social conventions and experiences. In essence, the user draws on their experiences from other contexts in real life where their body functions as the mediator of all interaction. As a tool for projecting information, a virtual body functions as a materialization of the social actor's self online and that body is used as a tool to operate in a spatial context where virtual objects and space represent context and tools and the virtual representations of other social actors are recognized as manifestations of observers. Activity theory is useful in framing this thinking about the projection and interpretation of meaning by providing a framework for

understanding the communication process when the virtual body becomes part of the mix of tools and symbols that are used and interpreted by social actors. In this context, we apply activity theory as a framework to ground our theory of communication in embodied contexts, which is a unique application of Activity Theory.

Our data suggests that users experience a greater sense of engagement, arousal and task performance when they experience ESP. This engagement is similar to the concept of flow as described by Csikszentmihalyi (1990, 1998), although ESP focuses not only on an individual's development of cognitive engagement but also on how social interaction influences the development of cognitive engagement and one's perception of embodiment. We see flow as one manifestation of ESP but there will be other components to this cognitive engagement that will focus on these other contextual elements, on embodied perceptions, and on the process that leads to these cognitions. Therefore, what ESP adds to this perspective is a mechanism by which this higher level of engagement is achieved in virtual environments and, by drawing on activity theory, embodiment, and the presence literature, ESP offers a broader framework for understanding the antecedents to the development of this phenomenon. Specifically, the focus of this activity, at least in relation to the experiences of the students involved in our research, is on the shared task and the digital bodies involved in enacting the activities associated with completing tasks. This embodied perspective on flow is particularly relevant to virtual environments because virtual worlds are relatively accurate simulations of real life contexts (i.e. the context in which our minds are adapted to operate). Because our physical bodies are all we know in our real world experiences, in the virtual environment we can more readily recognize our digital body and that of the other social actors as we learn about them (and ourselves) by engaging in collaborative activities. Thus,

we argue that ESP theory offers a richer, more comprehensive framework for examining the role of embodiment in social communications.

People are inherently social and the social nature encoded in our primeval survival instincts drives us to define ourselves by relating to others. The self does not occur in isolation or a vacuum (Goffman 1959 p. 195) and the digital body the user wears for online *performances* has the power to influence the perceptions developed by other social actors in a manner similar to the way a stage actor's physical body is used in a stage performance. Research demonstrates that the presence of another sentient being is sufficient to impress change on an individual's performance (Bailenson, Beall, and Blascovich, 2002, Zambaka, 2007). So, just as boyd has suggested that online social network profiles are digital bodies (public displays of identity where people can explore impression management) (boyd, 2007. 13), the mediated body of the avatar is a more wholesome representation of the self that is complete with affordances that allow users to re-enact existing social scripts while interacting with others. In virtual worlds the social conventions associated with FtF (i.e., BtB) interactions prevail in that embodied presence drives a re-enactment of real life social conventions.

The ESP model explicates the elements in a process of communication occurring throughout this spatially defined and embodied context. Central elements of the process, some of which have been previously brushed over, are accounted for in this model. Our data indicates that a user's embodied representation of self interacting with others in a meaningful virtual space has the potential to generate in users greater arousal and a sense of satisfaction with task completion. Ultimately, ESP provides a comprehensive framework for understanding the role of the body in interactive social and organizational communications.

The most important contribution to the IS literature and to other literatures examining presence is framing the discussion of communication in collaborative contexts in light of the user's actions as presented by the body and as understood and interpreted by a social actor in the context of his or her own experiences, intentions, and motivations thereby adhering to a user-centric paradigm.

2.5. Implications and Conclusions

In the *Academy of Management Review*, Whetten outlined the “building blocks” of theory development (Whetten, 1989). He emphasized that it is important that the scholar addresses the what, how, and why questions associated with the phenomenon when proposing or extending a theoretical model. Specifically, Whetten suggests that the *what* question addresses the constructs and variables that make up the framework of the theory, the *how* question addresses the way these factors are related, and the *why* question addresses the logical justification for the construction of the model as presented (Whetten, 1989). ESP theory, as presented, addresses the question of what (i.e., multi-stepped and cyclical focus of cognitive attention resulting in psychological and physiological arousal), the question of how (i.e., embodied representations invoking perceptions and cognitive responses based on real-body experiences in the context of shared activity), and the question of why (i.e., higher levels of attention to the shared context, shared activities, and embodied representations). As such, ESP is a useful theory and represents a valuable perspective for framing scholarly work in this domain.

In this context, we conclude that this theory will be relevant to research in the IS field and sister disciplines. The most obvious application for this theory will be to continued research on collaboration in virtual environments and the 3-D Internet. The popularity of

online 3-D environments among pre-teens (i.e. Webkinz™, Habbo Hotel™) and teens and adults (i.e. the Sims™, Nintendo's Wii™, Microsoft's Xbox™ and Kinect™, and MMORPGs like World of Warcraft™) all suggest that virtual worlds will continue to be important and will likely increase in popularity. Understanding how users interact and react to embodied forms is important for this industry; this research offers game designers a framework for developing richer and more engaging platforms and applications for social interaction. Furthermore, while there have been several false starts with business ventures in virtual worlds, it is likely that business applications such as marketing, customer support, modeling, and product development will also grow at a fast pace (e.g., Ganis et al., 2008; Morrison, 2009).

As with the development of the Internet and ecommerce during the 1990s, we will likely see an increase in 3D collaboration. Just as it was important for IS researchers to examine issues related to designing, building, and using e-commerce applications, so too will it be important for researchers to apply theories from the IS field when studying collaboration in virtual environments as these environments are applied to address business and organizational tasks. The avatar, space, objects, context, and related issues are fundamental features of virtual worlds and therefore understanding how the user reacts to and perceives other actors in virtual environments will be important for identifying how to build effective platforms for collaboration, commerce, and education. ESP suggests a robust set of factors and variables that can be examined to better understand how users will react to these environments.

Similarly, ESP could be helpful in designing better spaces and affordances for collaboration. For example, our results show that when ESP is achieved, collaborators are

more engaged in the conversation and the team's shared activities. Using ESP theory to design spaces for collaboration that provide, for example, adequate room for activity-based interactions is key in developing effective tools for collaboration. Prior research in CAVE™ environments where collaborators engage in interactive collaborative virtual design of, for example, vehicles demonstrates that these platforms offer advantages in terms of productivity and accuracy (e.g., Loftin, 2001; Ragusa and Bochenek, 2001). As such interactive applications are moved into the mainstream of business, it is important to identify how these applications can be used effectively lest they fail to “cross the chasm” (Moore, 1999). For example, decision room technology, an offshoot of group support systems technology, struggled to achieve widespread acceptance in the business boardroom. A framework like ESP theory offers developers an opportunity to focus on those features and affordances that generate positive outcomes for users and will likely improve the adoption of this type of technology for business applications. Conversely, research on how affordances in virtual spaces can be applied to real world collaboration and interaction would be helpful. For example, CAVEs™ and other virtual reality technologies have been used to develop and test new product designs as simulators. In a similar way, virtual environments can be useful as simulators in which collaboration can take place and be applied to real-world phenomena (e.g., Reeves et al., 2008). Thus, applying ESP to examine collaboration in online simulators could be useful in identifying useful interventions and environmental designs for collaboration and interaction in organizational contexts where it is otherwise impractical to design real spaces or bring people together in physical proximity.

Furthermore, compared to networks of connected profiles like the popular social networking site Facebook, 3D environments go a step further in allowing a sense of

embodiment through a moving avatar. Interactions in 3D worlds occur in real time and have a spatial dimension which can approximate real world FtF interaction better than networks of linked social network profiles (Stutzman 2006). Arguably, the sense of presence given by the profile page is a means to “type oneself into being” (Sundén cited in boyd and Ellison, 2007, 2), which is complemented by the “looking glass self” (Cooley, 1964) represented by the friends liaisons and subsequent interactions. Virtual worlds go a step further because by manipulating an avatar rather than typing, the user models himself into being. With the rise of the net generation and its entrance into the corporate world, we must be aware of the need for technologies that enable the level of expertise and worldview this generation has grown accustomed to (Tapscott, 1998).

This analysis and discussion should be considered in light of the limitations associated with this research. First, the reflection data represent reflections made by novice users of Second Life who used this tool in the context of classroom activities. While all students were graduate students and are therefore representative of a working population of adults (most worked in full-time professional positions while enrolled in this course), the context in which they interacted was artificial in that their use of Second Life was imposed by the course requirements, interactions were made to fulfill course assignments, and exposure to Second Life lasted for several months with no requirement to continue use after the course. As such, their interactions might have been different had they used Second Life in a different context. Nevertheless, the students had considerable exposure to Second Life through course activities, assignments, and interaction events in the environment. Further, these students (MBAs who are working professionals) would likely approach this task with an eye toward identifying organizational applications for the tool and would likely be cynical in their

critique of the experience. For example, one might expect that MBA students would frown upon the use of Second Life, with its game-like atmosphere, for use as a tool for organizational collaboration and interactions. In contrast to this expectation, many students reported that they found their interactions in Second Life to be productive, professional, and comparable to working in a corporate context. For example, consider the following:

Second Life with voice chat is much more practical to complete project work. A meeting feels more like a meeting. [Female]

Having a physical distance while being virtually close can allow high-level people to get out of the box and shake more hands in the crowd. With a click, they are back at their desks and can opt in or out of any conversation, as they wish there are no hard feelings. [Male]

As a technologist I've been using chat as a customer support tool and communication method for several years. I've also been able to use of variety of different chat systems. For this class project I preferred the Second Life chat experience. [Male]

Therefore, these students' comments suggest that Second Life is suitable for organizational applications such as meetings, training, professional development, and socialization.

A second limitation that should be considered is the nature of the data itself. While reflection data can be very useful for exposing respondent attitudes and feelings, they are based on memory and may include responses that are influenced by expectations about what the instructor in the course wants them to say (i.e., demand bias) or discussions with other students about experiences and attitudes. Furthermore, our model is based on reflections rather than direct observations; therefore, causes and effects we report in our model may not be as influential or important as we assert. For example, a subject might attribute a perception or feeling to an event that did not actually cause that perception or feeling to

develop. While these represent potential sources of bias, the richness and personal nature of the commentary suggest that these feelings and attitudes were salient and personal to the respondents and influenced more by their personal experience rather than other external stimuli. Further, we received consistent reports of these experiences across multiple responses, which lead us to conclude that the causes and effects of the phenomena of ESP are accurate. Of course, further testing in controlled settings would help to clarify the exact nature of the development of ESP. Finally, while these data were coded using a commonly used and accepted methodology for content analysis, the fact that these data were coded by two experienced Second Life users should be considered when interpreting these results.

Future research should focus on examining the research model to determine its validity, particularly for organizational applications such as product sales, organizational meetings, or informational briefings (e.g., Ganis, Hall, and McNeill, 2008). An important next step would include identifying a set of measures for quantifying perceptions of ESP. Further, additional research should examine this theory in other contexts using subjects from other populations.

In closing, we return to the issue of generalizing this theory. Specifically, it is important to know whether ESP can be used in other contexts to examine communication behaviors, perceptions of social actors, and the role of context, tools, and semiotics. We expect that ESP is relevant for examining and explaining interactions in other contexts because, as noted above, the body is the nexus of communicative actions and it is the focus of activity during interactions. As such, bodies are one of several artifacts that can be used to mediate communication regardless of the medium used to communicate (Nardi, 1995). Research shows that gestures, body language, and other non-verbal communication along with verbalizations represent activities that take place during FtF communication, which is

consistent with our perspective of ESP. We suggest that communication should be conceptualized as the theory of the body in action, the implication being that we can't read minds, but we can attempt to infer meaning through actions. Furthermore, activity theory represents a component of the ESP framework and the application of ESP to explain communication in other than virtual contexts is useful as our theory views understanding as arising from human participation in social activity that occurs through the mediation of context, tools, and symbols. The body, although not particularly visible in activity theory, comes to the forefront because the focus in virtual worlds is on the avatar as a bodily form used as a tool. As people come to realize themselves within their social contexts, and master tools and symbols embedded in such contexts, the body is what they know and how they position themselves with regards to others, place, and tools. People use their bodies, movements, and perceptual affordances to engage in activity. The body as a tool (i.e., a mediating artifact) is not merely a platform for engagement in activity, whether it happens in real world or virtual settings. Thus, ESP is relevant to communication and observing and making sense of interactions in real-world settings.

But the question remains, what about other computer-mediated environments? At first it might seem unlikely that ESP would be relevant to contexts where embodied representations are not possible due to, for example, the lack of a visual channel. Tools like the telephone would appear to have little in common with virtual environments when we try to compare them using embodiment as the criterion. In fact, we argue that ESP is relevant to these environments because, in spite of the lack of a visual channel, activity is a component of communication mediated by the body, therefore the ESP factors are relevant for understanding how communication takes place in these environments and, most importantly,

how bodily affordances are used to participate in social activity and are perceived by other social actors.

Biocca and colleagues (2003) pointed out that the imaginal body is relevant to user experiences in VR systems. When, for example, you call a relative you know well, you might imagine what the person is doing, where he is located, what is around him, and other features of his environment. In such circumstances it is possible to develop a sense of ESP even though no visual channel is present as the social actor shifts his or her attention from the self, to the task, to the other in both the imaginal and real-world contexts. Of course, not everyone who is talking on the phone will experience perceptions of ESP nor is it always needed or relevant to accomplish a given task. Comments from our subjects indicated that they would select and use virtual worlds for some tasks and not others, depending on the complexity of the task they are engaged in. Thus, we suggest that while ESP occurs in a variety of contexts, it is shared activity and participation in the task that draws participants into the higher levels of engagement that describes this phenomenon. As such, we suggest that this theory is useful in understanding a variety of team and organizational communication acts and functions, understanding how communication effectiveness and efficiency can be improved, and how this will influence the outcomes of team task and decision making activities.

2.6. Acknowledgments

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CHAPTER 3. A FRAMEWORK FOR DETECTING NETWORK STRUCTURES IN VIRTUAL COMMUNITIES

A paper to be submitted to *Computers and Human Behavior*

Janea L. Triplett

Abstract

This paper introduces a semi-automatic approach for the examination and the organization of unstructured text. It presents and describes a framework that was able to infer relevant relationships within social network structures. The use of social network analysis in this study was strengthened when it was merged with principles from discourse analysis. When combined, these methods offered an efficient process for data organization and an effective framework for research inquiry. The paper describes a study where the two methods were used. The findings, from a double-blind experiment, were able to detect three information networks as well as their cliques within an online gaming community.

3.1. Introduction

At an October 2012 technology symposium attended by chief information officers and senior IT executives, Gartner Inc. identified their Top 10 strategic technologies. The consulting group forecasted that organizations able to mine untapped data sources for “insights” could gain an advantage by strategically using their discoveries as a point of differentiation (Claunch 2012).

Similarly, information system researchers explore the structures of our field in order to make meaningful connections between people, technology and the organization. The digital revolution has created an industry driven by knowledge workers dependent on information technology. The archive produced by these information-intensive organizations is bursting with email exchanges, text messages, customer feedback, and team wikis. To understand the network structure is to gain insight into the health or dysfunction of the system. A challenge for information systems researchers and business analysts will be to manage the vast archive of unstructured text to mine it for meaning.

3.2. Literature Review

As noted, information sources are found in the form of employee emails and text, corporate blogs and wikis, or industry press releases and customer feedback. Admittedly, the thought of analyzing a large dataset of unstructured text without a team of computer scientists trained in natural language processing might seem daunting and time intensive. This research study demonstrates that language pattern recognition is possible with the assistance of a spreadsheet, open-source social network analysis, a semi-automatic Excel function, and an understanding of a few principles of human language.

Information networks organize around the exchange of communication. A rich body of knowledge exists for both network analysis and linguistic analysis. Social network analysis has interdisciplinary roots with a continuing multi-disciplinary focus. The understanding of complex systems has benefited from fields such as social psychology, anthropology, sociology, physics, computer science, mathematics, and statistics. The study of language (i.e. sounds, structure, and meaning) has been a point of inquiry since early Greek philosophers began thinking about linguistics (Taylor and Harris 1997).

3.2.1. Social Network Analysis

Social network analysis gained attention with theories such as the strength of weak ties (Granovetter, 1973), social capital (Putnam, 1993), and small worlds (Milgram, 1967). Computing power advanced network diagramming from simple, hand-drawn sociograms (Moreno, 1943) to million-node, mobile phone networks (Hildaldo and Rodriguez-Sickert, 2008). In addition to contributions from theory and technology, social network analysis also developed in part from the creation of algorithms that handle complex calculations, data processing, and machine learning (Robins et al. 2005; Newman et al. 2006; Doreian, 2002; Goyal et al. 2006; Hummon, 2000; Wasserman and Pattison, 1996).

3.2.2. Discourse Analysis

In the 1950s an American linguist, Zellig Harris, introduced the idea of discourse analysis as method of connecting language features to the context of their speakers (Paltridge 2006). The theoretical background of discourse analysis was derived from concepts such as communicative competence (Hymes 1972), textual competence (Bhatia 2004), and discourse communities (Labov 1972; Milroy 1987; Swales 1990). Individuals demonstrate communicative or textual competence by knowing the rules of language and then appropriately using that knowledge to communicate within and across differing social contexts (Paltridge 2006). Discourse communities are groups of people who are linked by common goals, language, and values (Swales 1990). Within discourse communities there may be a ‘threshold’ of communicative competence before one is considered a member of that group (Swales 1990). In summary, discourse analysis is concerned with understanding the relationship between language use and its context. Johnstone (2002, p. 3) notes that discourse analysis is the discovery of “what happens when people draw on the knowledge

they have about language ... to do things in the world.”

3.3. Framework for Detecting Network Structures in Virtual Communities

For this research, the platform for data collection and study was a worldwide, massively multiplayer online role-playing game (MMORPG). The online game provided a vibrant and culturally rich environment where much of the content and context was created and maintained by the community of gamers. For example, once players created an account, they had the option to align themselves with one of five major organizations. When a player matured in skill and tenure, they could join specialized alliances with which they could collaborate on tasks to achieve group and organizational goals.

In addition to the embedded social structure, this particular MMORPG contained an extensive archive of discussion threads, forums, and community pages. The game ‘universe’ encompassed character profiles, wikis and a detailed encyclopedia of gaming jargon (i.e. words, phrases, acronyms and emoticons knew and used by this discourse community). The history of the game was chronicled in player created backstories, art and video. Demonstrating the global involvement of this MMORPG, the player guide was available in English, German, and Russian.

The activities occurring within the MMORPG met all of the dimensions of a virtual community as formalized by Herring (2004). The online game was shown to exhibit 1) active and regular participation; 2) emergent roles, rituals, and hierarchies; 3) documented evidence of a shared history, culture, norms and values; 4) self-awareness of the group as an entity that was distinct from other groups; 5) solidarity and support, as evidenced in examples of humor, politeness, and reciprocity; and 6) criticism, conflict, and the emergence of means of conflict resolution.

When approaching a social network analysis problem, Marsden (1990, p. 437) advised, “sound conceptualization must precede measurement.” DeChoudhury and colleagues cautioned that the availability of data has created a frenzy “overshadowing” sound research practices.

“The excitement generated by this explosion of available data has overshadowed two distinct but related problems: first, the inference problem, that ‘real’ social ties are not directly observable and hence must be inferred from observations of events, like physical interactions or communication records; and second the relevance problem, that there is not one ‘true’ social network, but rather many such networks, each corresponding to a different definition of a tie, and each relevant to different social processes.” (DeChoudhury, 2010, p. 301)

Researchers increasingly use electronic communication data to construct and study large social networks, effectively inferring unobserved ties (e.g. i is connected to j) from observed communication events (e.g. i emails j). Often overlooked; however, is the impact of tie definition on the corresponding network, and in turn the relevance of the inferred network to the research question of interest. Software programs and algorithms are able to measure nodes that display influence (i.e. betweenness centrality) and popularity (i.e. degree centrality); however, the programs cannot capture the context of those interactions. Before beginning data analysis, the researcher considers how theory frames and informs the study.

In this study, discourse analysis preceded the social network analysis. The ties between nodes were not connected by intuition or algorithms, but were grounded by examining the discourse exchanges between individuals. Hence, the inference/relevance problem was addressed. Discourse analysis principles such as communicative competence and discourse communities addressed the inference problem (e.g. i asked a question and j responded because of obligation and/or knowledge). The tie connecting the MMORPG network was linked by relevant social interdependencies.

With this foundation in mind, a framework (Figure 3.1) is suggested to facilitate the process of managing large datasets of unstructured text. A semi-automatic formula reduced coding error and reduced the time needed to create an edge-list from a large dataset for social network analysis. The social network analysis visualized a relevant pattern of communication activities (i.e. information gathering and providing) that were directly observable in the virtual community under examination in this study.

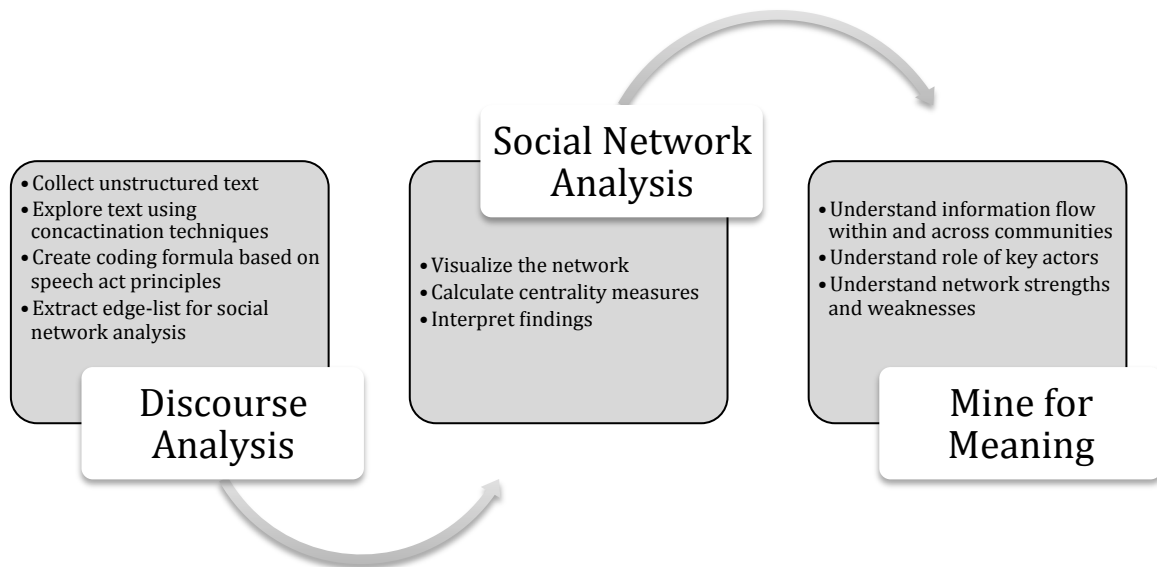


Figure 3.1 Framework to create relevant social networks from discourse analysis.

3.4. Data Analysis

The study enlisted an informant for data collection. Ethnographers use informants to gain access to field sites with barriers of entry to outsiders (Lofland et al 2006). In this case, access to the MMORPG was limited because the researcher did not have the skill or game character development to allow access to the virtual community. A double-blind data collection approach was used to avoid convoluting the natural evolution of game events and

to reduce researcher bias in the discourse analysis and network diagram process. The informant was unaware of the study's research questions or methods of analysis. The researcher was uninformed as to the organizational structure of the MMORPG or the purpose of the communication events.

The informant recorded chat activities from Internet Relay Chat (IRC) channels for three different virtual communities. IRC is an open communication system designed for real-time text messaging over the Internet. The system is primarily used for group communication through discussion forums called 'channels'. The chat logs were text files that were imported into Excel. Three columns of data were collected and used for analysis. The first column contained the date and time of the communication event. The second column tagged the participant's gaming name and the third column included the text written by the participant.

3.4.1. Discourse Analysis

Language is a structured system by which individuals learn the values and norms of their culture (Holsti, 1969; Lindkvist, 1981; Weber, 1990). The analysis of discourse created by MMORPG players employed speech act principles such as 1) turn-taking (Sacks 1974), 2) conversational contribution (Grice 1975), 3) directives (Gordon and Lakoff 1971), and 4) requests (Labov and Fanshel 1977). Communicative interactions examined under the lens of discourse analysis offered insight into status, socialization, rights, obligations, needs, and abilities of the virtual community.

3.4.2. Social Network Analysis

For the social network analysis, the researcher examined communication events produced by three groups. The first group (i.e. Small Group) was comprised of 10

participants who wrote 798 lines of text (4,149 words) over the course of 14 days. The second group (i.e. Medium Group) was represented by 325 participants who wrote 1,319 lines of text (4,644 words) over the course of 14 days. The third group (i.e. Large Group) was made up of 683 participants who produced 4,178 lines of text (21,090 words) over the course of 14 days.

An open source software application, NodelXL (Smith et al. 2010), was used for the social network analysis. The application made use of a two-column edge list to explore the relationships (i.e. edges) between actors (i.e. nodes). The Fruchterman-Reingold layout algorithm visualized the network. Graph metrics were calculated for vertex degree, betweenness centrality, eigenvector centrality, closeness centrality, and clustering coefficient. In addition to the graph metrics calculations, sub-graph images were generated for each of the nodes for an added level of granularity.

3.5. Findings and Discussion

3.5.1. Small Group Discourse Analysis.

An IRC communication channel was recorded for 14 days. Ten participants produced 798 communication exchanges. Three individuals contributed 77 percent of the conversation. The conversation switched between Russian (57 percent) and English (40 percent). The group also exchanged non-verbal communication codes (3 percent) through various emoticons [:) , :p , :(, o/] and internet acronyms [lol, kk, afk, gn, TS, noob].

The content of the online chat included conversations about game tasks, internal politics, character assessments, relationship building, advice, complaining, and humor. No chat message was over 10 words long. Longer messages were split into shorter phrases and entered consecutively by a player who had more to say. The group used abbreviations,

acronyms, and game lingo. Personal information was shared.

To explore the structure of communication, concordance techniques were used (i.e. word frequency, key-word-in-context). A theme of information “seeking and providing” emerged from this process. The text chat occurred in sequential order. Every chat line was tagged with a date and time stamp. When a player asked a question, other gamers interested in the question or obliged to respond to that player would quickly respond to the question. The pattern was observed in both English and Russian chat. The players used punctuation (i.e. a question mark) to signify the end of questions for both English and Russian chat.

This communication pattern was the inspiration for a semi-automatic, Excel function. The function searched the text for question marks, selected that row (i.e. ego) and the next three rows (i.e. possible alters), and moved those rows to a separate worksheet. The routine continued until the function reached the end of the chat file. Extracted from the unstructured text was an observed network relationship built on the pattern of information seeking and providing. The function reduced error and improved efficiency. Computer-aided coding quickly and reliably found all instances of the question mark. Human interpretation of the text for meaning was unnecessary because the function was built on the larger act of asking a question and not on specific words.

3.5.2. Small Group Network Analysis.

The first step in analyzing the social network was the creation of a two column, edge-list. The discourse analysis informed the structure of the edge-list based on the theme of information seeking and providing. Recall that language requests reveal obligations, needs, and abilities. Thus, the relationship between ego and agent could be inferred from an observed communication pattern. The pattern of information exchange was particularly

relevant to this virtual community because the membership existed and assembled to perform tasks and accomplish goals.

A network diagram created from the discourse pattern indicated that that P_S01 was the center hub of information exchange. This member was directly linked to all but one of the group members. Three of the remaining nine in the group only spoke directly to P_S01. The second connector in the group was P_S07 who was directly linked to four other players. P_S07 had the most input of lines of chat, but was the number two connector in the group. Two group members did not connect directly to P_S01 or P_S01. Group member P_S06 connected the one outlier (P_S08) to the rest of the network.

The network diagram illustrated (Figure 3.2) that there were two subgroups or cliques within this network. P_S01 was the hub of the group by connecting three outliers (participants S02, S03, and S06) to the other four within the group. The connection between P_S01 and P_S06 was a link that could possibly span a boundary and make connections to another group represented by P_S08.

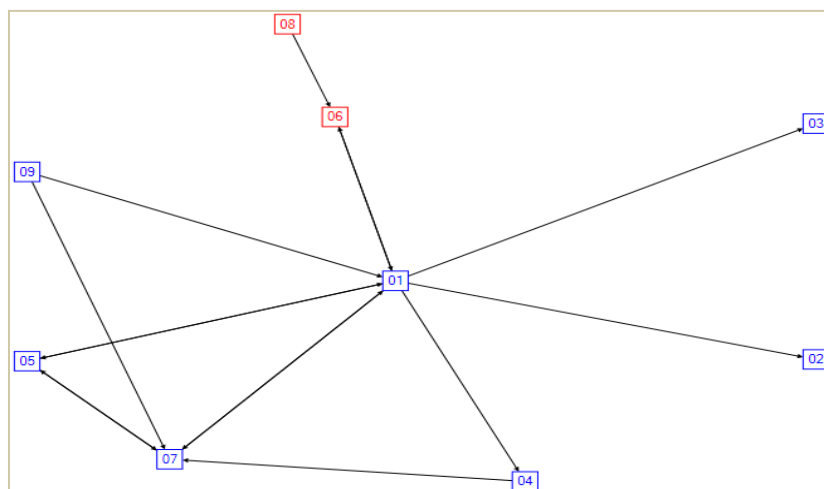


Figure 3.2 Network diagram of Small Group interaction.

3.5.3. Medium Group Discourse Analysis

Fourteen days of communication was recorded for the Medium Group. There were 1,319 chat exchanges between 325 participants consisting of 4,644 words. One individual contributed 264 lines of chat text and 135 individuals contributed one line of text chat each. Similar to the Small Group communication pattern, the Medium Group was depicted by a power-law distribution. The power-law distribution in social networking depicts the voluntary nature of the environment (Shirky 2008). When participation is voluntary, the long-tail does not indicate a deficiency in the group. Instead, the long-tail indicates that participants are free to join the group and contribute what they can, when they can.

3.5.4. Medium Group Social Network Analysis

A network diagram was created representing type of communication exchanges produced by the medium size group (n=325). After running the information answering-seeking formula, a sample of 149 communication exchanges was used to construct the edge list for the purposes of social network analysis. What was determined from the directional graph was that there were three types of communication roles within the group. Participants were information seekers, information providers, or a mix of the two. The role of information seeker was represented 55 percent (n=82) of the communication exchange. The role of information provider represented 29 (n=43) percent of the communication exchange. Participants whose text chat was a mix of both information provider and seeker represented 16 percent (n=24) of the total communication exchange (n=149).

Within the Medium Group (Figure 3.3), Participant_M01 was the top contributor of text by producing 20 percent (n=264) of the total communication exchanges (n=1,319).

Participant_M01 was also the top information provider of the group. Participant_M158 was the group's top information seeker. Participants M02, M08 and M09 produced communication that was a mix between information provider and seeker.

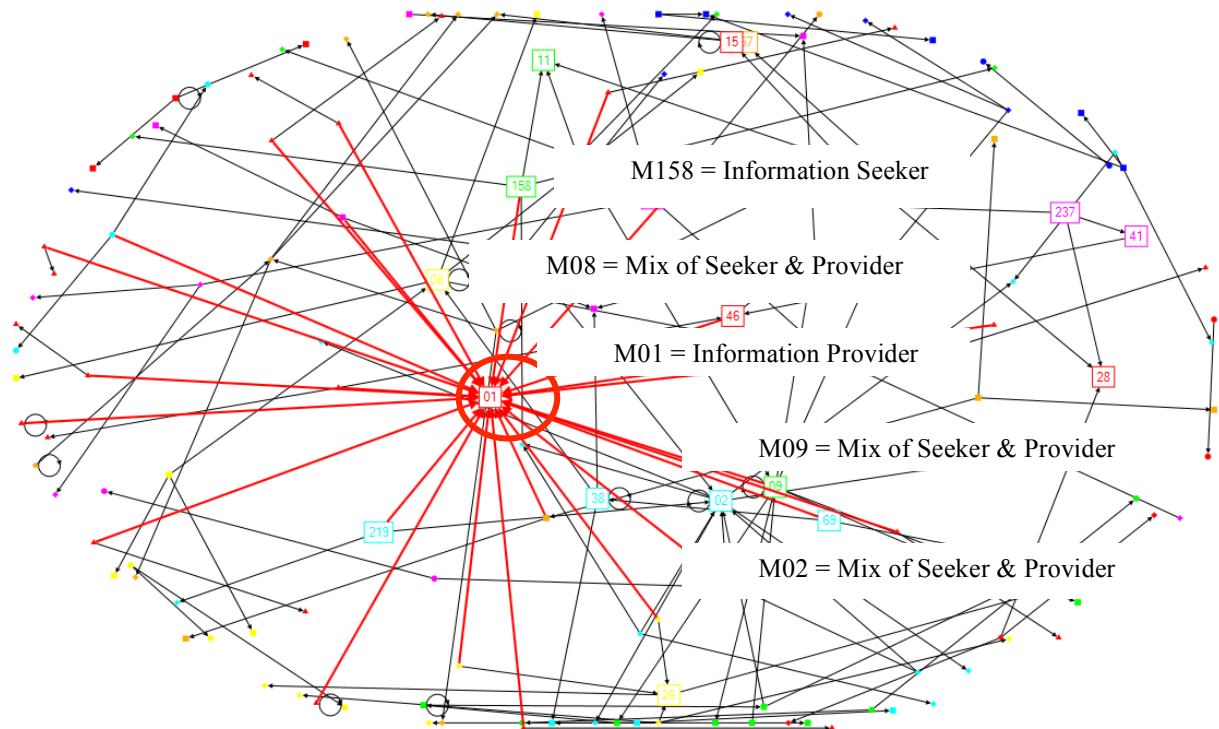




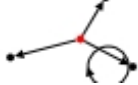
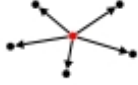
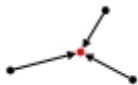
Figure 3.3 Type of communication produced by participants within the Medium Group.

3.5.5. Medium Group Information Flow

In social network analysis, betweenness centrality measures the shortest distance of one actor to others within the network (Brandes, 2001). Nodes with higher betweenness centrality measures indicate important locations within the group by showing the individuals who have influence over the information flow within the group. The network table was sorted by betweenness centrality calculations. A communication pattern emerged possibly indicating that the quality of information was as important as the quantity of text being produced (Table 3.1). P_M01 was the most frequent communicator who produced 264 lines

of text and who also received the highest measure of betweenness centrality. The individual with the second highest betweenness centrality ranking; however, was P_M09 who was the ninth most frequent communicator producing 16 lines of text. And, P_M158 received the fourth highest betweenness centrality ranking and yet produced only two lines of text. As the sub-graph for P_M158, indicated a well formed, star pattern of information exchanges suggesting many linkages to others within the group.

Table 3.1 Comparison of betweenness centrality ranking versus lines of text produced.

Medium Group Participant ID No.	Lines of Text Produced	Subgraph	In-Degree	Out-Degree	Betweenness Centrality
M01	264		25	0	1.000
M09	16		3	8	0.316
M39	6		0	3	0.302
M158	2		0	5	0.278
M11	13		3	0	0.274

3.5.6. Large Group Discourse Analysis

Another 14 day recording captured the communication exchanges of a Large Group. There were 4,178 communication exchanges between 683 participants consisting of 21,090 words. Twelve individuals contributed 624 lines of chat text and 175 participants contributed one line of text each. As with the Small and Medium groups, the Large Group was also depicted by a power-law distribution. An in-depth analysis was conducted to examine the

Large Group's network and communication flow as well as player centrality and clustering.

3.5.7. Large Group Centrality Measures

Five measures were used to explore the communication network 1) eigenvector centrality, 2) betweenness centrality, 3) out-degree, 4) in-degree, and 5) cluster coefficient (Table 3.2). Eigenvector centrality measured the importance, prestige, prominence, and power of an actor in a network (Bonacich, 1972; Freeman, 1978/79). Eigenvector centrality was calculated using the accelerated power method outlined by Borgatti (1995). Betweenness centrality measures the shortest distance of one actor to others in the network (Brandes, 2001). In the directed graph, the out-degree reports the number of outgoing edges (i.e. the number of questions asked by a gamer). The in-degree reports the number of incoming edges (i.e. the number of actors responding to questions). The cluster measures how close the actor and its neighbors are to forming a clique or sub-group.

Table 3.2 Social network analysis summary for Large Group.

Eigenvector Centrality [Importance]	Large Group Participant ID No.	Betweenness Centrality [Distance]	Large Group Participant ID No.	OutDegree [Question]	Large Group Participant ID No.	InDegree [Answer]	Large Group Participant ID No.	Cluster	Large Group Participant ID No.
0.236	L09	1.000	L04	25	L09	27	L04	1080	L09
0.219	L06	0.878	L06	22	L06	26	L02	1080	L14
0.201	L05	0.700	L05	18	L05	20	L14	1080	L17
0.191	L02	0.631	L02	16	L08	20	L10	1077	L02
0.188	L15	0.594	L15	15	L27	18	L01	1077	L10
0.171	L27	0.557	L08	15	L15	17	L05	1077	L06
0.159	L17	0.523	L14	14	L24	14	L20	1077	L12
0.158	L08	0.504	L09	13	L23	14	L17	1077	L21
0.157	L01	0.430	L10	12	L26	13	L06	1070	L01
0.152	L04	0.382	L21	11	L25	12	L12	1070	L22
0.145	L14	0.339	L01	11	L21	11	L15	1070	L08
0.145	L21	0.300	L27	8	L01	10	L22	1070	L23
0.144	L20	0.265	L17	6	L17	9	L25	1069	L04
0.135	L25	0.261	L26	3	L02	9	L08	1049	L05
0.131	L23	0.237	L24	3	L22	8	L24	1049	L24
0.129	L10	0.237	L23	3	L04	8	L26	1049	L25
0.126	L12	0.192	L25	2	L12	6	L09	1049	L26
0.123	L26	0.150	L20	0	L14	6	L27	1014	L27
0.115	L24	0.109	L12	0	L20	6	L21	960	L20
0.111	L22	0.100	L22	0	L10	3	L23	960	L15

3.5.8. Large Group Betweenness Centrality

Betweenness centrality measures the shortest distance of one actor to the others in a network (Brandes, 2001). In social groups, actors with high degrees of betweenness centrality are said to play powerful roles in the network and often have control over the flow of information (Newman, 2004).

While it appeared that the number of communication events produced by a “talkative” player (e.g. shown in red) could be related to that player’s betweenness centrality ranking, the summary table also indicated there were players who were not top communication contributors who were also high on the betweenness centrality ranking. This could indicate that other factors such as the context and quality of information were involved in determining a player’s power in the group and their control over information. For example, player “P_L22” was the 10th most talkative gamer by producing 28 lines of text and was ranked 27th on the betweenness centrality measure. Conversely, player “P_L27” was the 15th most talkative player by producing 19 lines of text and was ranked 6th on the betweenness centrality measure.

3.5.9. Large Group Clustering Coefficient

The clustering coefficient of a vertex in a graph is determined with a formula that quantifies how close the vertex and its neighbors are to being a clique. In this network, 190 gamers were assigned to 17 cliques (Table 3.3). Recall, the top contributors represented seven of the 17 cliques. This could indicate that power roles within the game were distributed. In the case where two top contributors belonged to the same clique (e.g. 347), it the type of communication produced was different and thus did not overlap. For example, players “P_L09” and “P_L20” were members of clique 347. Player “P_L09” contributed 25

questions and 6 answers while player “P_L20” contributed 16 answers and zero questions. These two were very talkative players from the same clique, however “P_L09” served a role of information seeker and “P_L20” served a role of information provider.

Table 3.3 Distribution of players assigned to cliques based on the clustering coefficient measure.

Clique	266	282	310	315	322	338	341	347	350	355	356	357	358	359	361	362	363	
Players within each Clique	L54	L46	L33	L60	L45	L65	L47	L09	L27	L48	L49	L94	L50	L55	L56	L61	L32	
	L40	L51	L57	L69	L43	L78	L66	L52	L14	L92	L58	L53	L59	L62	L63	L64	L67	
	L109	L77	L70	L76	L110	L81	L82	L68	L71	L129	L73	L74	L79	L103	L75	L72	L80	
	L41	L136	L95	L02	L44	L25	L11	L83	L30	L132	L84	L85	L88	L89	L86	L87	L01	
			L96	L03		L113	L116	L20	L97	L142	L102	L39	L93	L126	L90	L91	L104	
			L112	L111		L138	L118	L98	L114	L180	L105	L130	L106	L140	L101	L05	L127	
			L128	L117		L151	L119	L99	L124	L184	L115	L133	L134	L148	L107	L108	L132	
			L137	L123		L156	L120	L100	L133		L22	L147	L159	L190	L31	L135	L141	
			L04	L126		L158	L10	L121	L146		L08	L34	L182	L188	L149	L36	L144	
			L19	L142		L177	L139	L15	L23		L125	L153	L186	L37	L155	L150	L187	
			L42	L152			L06	L122	L18		L16	L181			L169	L154		
			L145	L157			L161	L131	L162		L163	L183			L170	L160		
				L38			L173	L165	L172		L175	L185			L12	L164		
							L174	L166	L178		L176					L171		
							L21	L167	L17		L189					L07		
								L168	L179							L191		
																L35		
																		L192

3.5.10. Large Group Closeness Centrality

While determining a sub-groups or cliques was important, so too was finding the individuals who frequently connected their clique to other sub-groups through communication exchanges. Table 9 was organized based on the ranking of closeness centrality. These players could be considered the communication connectors or the boundary spanners within the network. Player “P_09” was assigned as the top boundary spanner with the lowest closeness centrality measure. This player’s communication reach extended to 31 other gamers and to 10 other cliques.

Boundary spanners often serve a powerful role of as a network connector and yet this measure could also indicate possible weaknesses within the group’s communication flow. If a connector was absent from the group, then the information flow between certain cliques may fail. Players “P_20” and “P_19” were strongly connected within their own cliques, however, the remaining communication exchanges with outside cliques was usually limited

to one or two other individuals (Table 3.4).

Table 3.4 Connections to other players and to other cliques.

Boundary Spanners			Clique Assignment with Number of Connections to Other Cliques														Total Reach			
Own Clique	Large Group ID No.	Closeness Centrality	282	310	315	322	338	341	347	350	355	356	357	358	359	361	362	363	Other Players	Other Cliques
347	L09	2.370			3	1		2	13	3		2		1	1	1	2	2	31	10
315	L02	2.429			6		2		2	2	3	1	1	1	1	1	2	1	20	9
350	L17	2.471	1	1		1	2		1	5		1	1	2		2	3		20	10
350	L27	2.503		2	1		1	3	1	7		2	1				1	2	21	9
347	L15	2.519		1	1		1	1	5	1		2	3		1	1		1	18	10
341	L06	2.519				1	2	7	3	2	1	1	2			1			20	8
361	L12	2.556		1	1			2	1	2	1		2	1		3			14	8
350	L23	2.571			1			1		8		2	1		2	1			16	6
347	L20	2.640		2			2	2	4	1		1	1				1	1	14	7
310	L19	2.720		6		1	1		2			1		1		1	1		14	7

Figure 3.4 also illustrated that some cliques were better connected than others and that some cliques were more fragile than others. For example, clique No. 266 consisted of four members. Two of the members were connected only to each other. The other two were connected to their own clique and were separated from the top 10 boundary spanners by two degrees (e.g. P_L40—P_L38—P_L02 and P_L41—P_L42—P_L19). The information flow to and from clique No. 266 might be considered fragile.

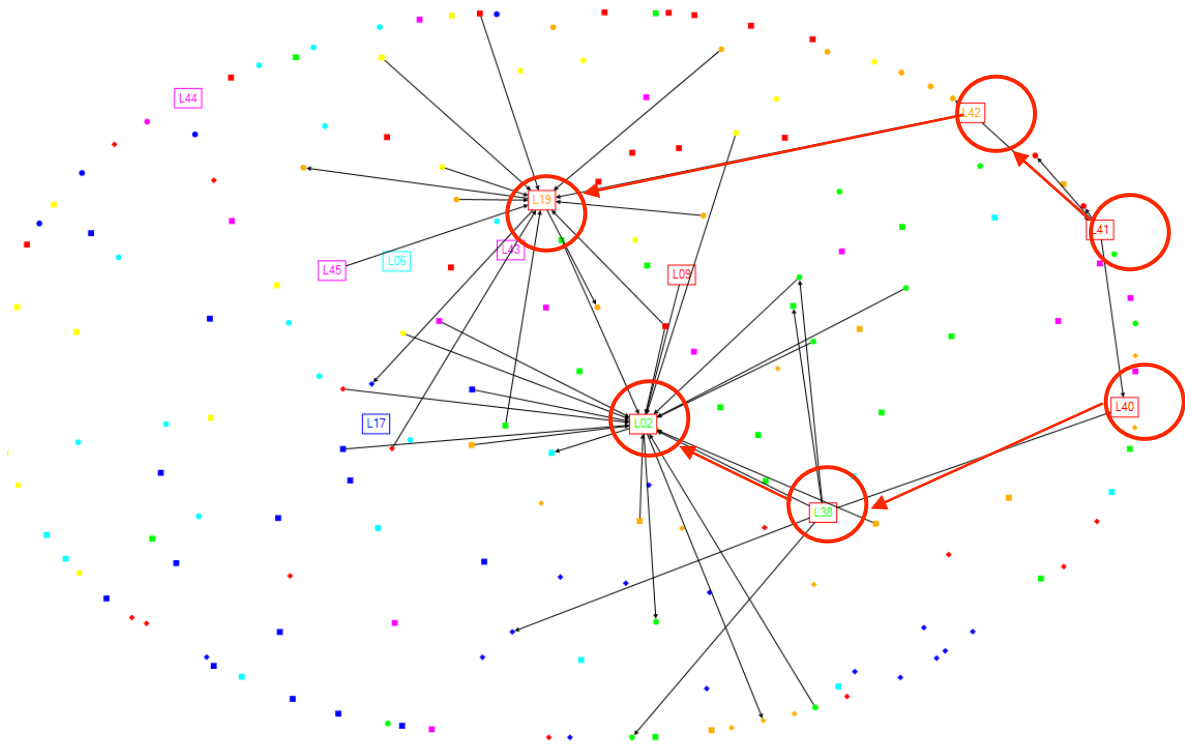


Figure 3.4 Clique No. 266 illustrated two-degrees of communication separation.

The size of the clique; however, did not always seem to determine its vulnerability to being cut off from the communication flow. Clique No. 322 (Figure 3.5) also consisted of four members. Three of the four were directly connected to the top 10 boundary spanners (e.g. P_L43—P_L09 + P_L17; P_L44—P_L06; and P_L45—P_L19). These communication lines illustrated that this sub-group had direct access to the top boundary spanners in the large network

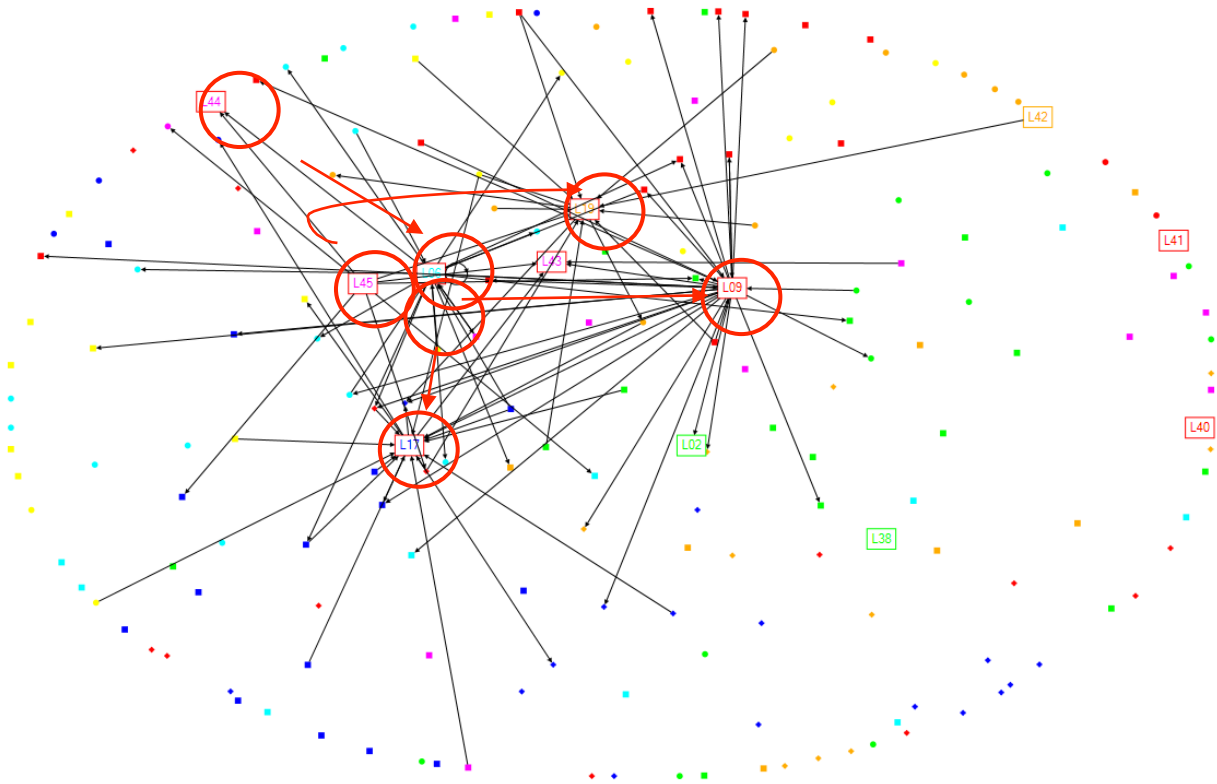


Figure 3.5 Clique No. 322 illustrated direct lines of communication.

3.6. Conclusions

To summarize, actors with high degrees of betweenness centrality played powerful roles in the network and exhibited control over the flow of information. A player's betweenness centrality ranking was influenced by the quantity and quality of communication produced by the actor. Quantity influenced information flow, but the quality and specific type of information also influenced a player's power in the group and their control over information flow.

In addition to the quantity and quality of communication produced by individual actors, players who also exhibited frequent communication exchanges with other sub-groups were found to be boundary spanners within the network as indicated by the closeness centrality

measure. The closeness centrality ranking indicated the shortest communication path to others in the network. By examining the betweenness and closeness centrality measures, key actors were identified. Players who ranked high on the betweenness centrality measures also ranked high on closeness centrality measures. These players held powerful influence over the flow of information within their own groups and throughout the network.

A limitation of this analysis was that it not measure the question-mark formula on other forms of sequential communication. Future work will need to examine the development of coding formulas based on other discourse analysis principles. The scaling-up of the framework will also need to be tested. At present the framework was able to visualize a relevant network of nearly 900 nodes. In order to benefit business and research endeavors, this framework and other discourse analysis formulas will need to handle thousand and million node networks.

The purpose of the study was to explore online chat to determine if meaningful and accurate communication patterns could be detected. To that purpose, the study was successful. At this stage of exploration, it is sufficient that the double-blind study reached an agreement between researcher and informant. The informant confirmed that the study detected network connections and sub-cliques as experienced by this MMORPG. Not only was the social network detected, but the information seeking-providing framework was also able to recreate a relevant visualization that inferred group leadership. It would be expected that information networks, such as the virtual community examined in this study, would also relevant in business settings.

The result of this exploration is a framework to manage unstructured text based on discourse analysis theory and principles. The methods used in this study were able to address

issues related to the challenge of inferring relationships based on observations that in the end recreated relevant network diagrams. Meaning was found in an untapped data source.

CHAPTER 4. THE ROLE OF MEANING IN TECHNOLOGY ACCEPTANCE

A paper to be submitted to *Computers in Human Behavior*

Janea L. Triplett, Anthony M. Townsend, and Brian E. Mennecke

Abstract

In an effort to understand the role of meaning in technology acceptance, we embarked on a multi-method study. We were guided by the collection and analysis of data using qualitative and quantitative approaches. The data for our research took the form of language and images. Content analysis guided the interpretation of textual data. Visual narrative analysis framed the deconstruction of photographic data. Cluster analysis and computational linguistics assisted in finding patterns of similarities within the text and images. We found that cell phones, music devices, and laptops exuded symbols such as social, educational, professional and aesthetic status. We also found embedded within cell phones, music devices, and laptops different meanings associated with their intended use.

4.1. Introduction

For decades, information system researchers have explored the motivating factors of technology use and adoption. A number of theories of technology acceptance have been proffered to explain how a potential user's intentions might be used to forecast behavior. For example, Fishbein and Ajzen (1975) suggest in their theory of planned behavior (TPB) that an individual's evaluative affect plays an important role in predicting future actions. Similarly, information systems (IS) theories such as the technology acceptance model (TAM)

demonstrate how perceptions of usefulness and ease of use influence behavior (Davis 1989; Venkatesh and Davis 2000). In addition, research also supports the involvement of intrinsic and extrinsic motivation (Davis et al. 1989), performance expectations (Compeau and Higgins 1995), and a user's awareness of social influences (Venkatesh et al. 2003) as significant constructs in predicting behavior.

While constructs related to expectations about performance and effort have received much of the attention in technology acceptance studies (Fishbein and Ajzen 1975; Davis 1989; Thompson et al. 1991; Davis et al. 1992; Compeau and Higgins 1995), the relationship between human attitudes and technology adoption is complex, multi-faceted and is a research space with opportunities for additional contributions.

The dual-nature of technology is part of its complexity (Feenberg, 1999). Design, as we know understand it, involves the principles function and form. Even though function is said to precede form (Sullivan, 1896); it is form that delights and excites our relationship with objects. Function might award a few dates, but form will lead us to fall in love with our objects. In order to develop an enduring connection with a technology, it should attend to a multitude of needs, wants, and demands beyond improvements in job performance.

The implication of this inquiry is that numerous issues remain uninvestigated concerning why individuals adopt, use, and display technologies. The objective of this study is to examine a text gathered from open-ended questions and images collected during a photographic session. Our research questions are related to the adoption of technologies that are routinely carried; specifically, the mobile devices that occupy a permanent space in our pockets and on our pillows. Our research draws on social and cultural theories about identity and postmodern bodies as well as consumer research about the connections between the

purchasers and their possessions. We employ a mixed-method examination to explore the meanings that our subjects attribute to the mobile devices they carry.

4.2. Literature Review

4.2.1. The Meaning of Technology-Objects

Our exploration begins with a philosophy of technology presented by the communication scholar, Andrew Feenberg (2001). In his work, *Questioning Technology*, Feenberg states:

“...the essence of technology is abstracted from a larger social context within which functionality plays a specific limited role. Technologies do of course have a causal aspect, but they also have a symbolic aspect that is determining for their use... (Feenberg, 2001: p. 84).”

From Feenberg’s definition we recognize that technology fulfills a dual role of function and symbol and further understand that technology values are socially constructed. With that understanding, the discussion moves to the writings of cultural theorist, Jean Baudrillard. As suggested by Baudrillard (2005), technology-objects are embedded with four fundamental values: exchange value, functional value, sign value, and symbol value.

The first two values of technology-objects (i.e. exchange and function) are captured in traditional theories of technology acceptance. The exchange value is categorized as cost and specifically cost-to-performance evaluations. The functional value is categorized as utility or more commonly referred to in the IS field as usefulness and ease of use. Venkatesh, et al. (2003) acknowledges elements of social influence. The construct definition; however, is more about the outcome behavior (i.e. the social pressure or assistance given in order to adopt the technology) and less about the social or symbolic meanings attributed to the technology.

The remaining two technology-object values (i.e. sign and symbol) invite an exploration

into the social construction of their meanings with a particular focus on why these values influence decisions to adopt technology. Due to the nature of our research questions, it is appropriate to study technology acceptance with a social constructivist approach (Orlikowski 1992). The outcome of our research study is to present a socially constructed model of technology acceptance and adoption.

4.2.2. The Role of Meaning in Technology Acceptance

Meaning describes the nature or intent of something. Acceptance, as defined in any dictionary, is an internal assent to the reality of a situation and then the coming to terms with that situation in order to achieve harmony. A precursor to understanding technology acceptance behavior is to delve into the initial symbolic and psychological meanings attributed to technologies. In an effort to appreciate the role of meaning in technology acceptance our research seeks to answer the following research questions: (1) Why do we accept technologies into our lives and onto our bodies? (2) What does it mean to extend oneself through technology? (3) How does a technology such as a mobile device or laptop become linked with the identity of its user?

4.2.2.1. Bionic Acceptance

The notion of bodies accentuated by technology is embedded into western culture. Early authors and philosophers consider humans as machines (La Mettrie, 1996) or frankensteins (Shelley, 1818) that were aided or created by tools or technological know-how. A classic statement by Maurice Merleau-Ponty (1962 p. 165) observes "... the blind man's stick has ceased to be an object for him, and is no longer perceived for itself; its point has become an area of sensitivity, extending the scope and active radius of touch and providing a parallel to sight."

At the forefront of the personal computer era, cultural theorist Michel Foucault (1988), presents the notion of ‘technologies of the self.’ Foucault argues that the body is a social construction and that humans have the power to alter themselves through technology in order to achieve a desired state. To quote,

“technologies of the self, which permit individuals to effect by their own means ... a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection, or immortality.” (Foucault 1988, p. 18)

Cultural critic and feminist scholar, Donna Haraway, states that relationship between human and technology is one ‘biotic system’ and that “ ... the difference between machine and organism is thoroughly blurred; mind, body, and tool are on very intimate terms” (Haraway 1990, p. 165). *A Cyborg’s Manifesto* declares:

“High-tech culture challenges these dualisms in intriguing ways. It is not clear who makes and who is made in the relations between human and machine. It is not clear what is mind and what body ... we find ourselves to be cyborgs, hybrids, mosaics, chimeras.” (Haraway 1990, p. 177)

Cultural theory attests to the notion of technology’s ability to increase human powers. The devices we choose to carry expand the range of our voice through mobile phones and the capability of our brains through laptops and the Internet. Our memories are documented with text messages and photographs. As Anne Balsamo (1996) suggests, “techno-bodies are healthy, enhanced, and fully functional – more real than real.” (p. 5).

4.2.2.2. *Techno-Identity Acceptance*

Besides accepting technologies onto our body, we also accept technologies into our identity. One of the processes by which this identity formation occurs is found in impression management literature. Goffman (1959) suggests that individuals take great effort to manage impressions while crafting a favorable presentation of selves. Part of the presentation is the

observable material culture adorned by individuals. Although the symbolic display is indeed carried on the body, it acts as more than a physical enhancement. In this situation, technology can be viewed as a tool to influence mental impressions. It is through a display of objects that others gather the information necessary to make proper inferences about another (Goffman, 1959). The technology functions as a heuristic to interpret and predict present and future behavior (Goffman, 1959).

“...many sources of information become accessible and many carriers (or ‘sign-vehicles’) become available for conveying this information...but it is only in the world of social interaction that the objects about which they make inferences will purposely facilitate and hinder this inferential process.” (Goffman, 1959, p.1-3)

In addition to impression management literature, the field of consumer behavior also presents the notion of extending the self through possessions (Belk 1988; Belk and Watson 1988, 2003; Tian and Belk, 2005). Belk (1988, p. 139) writes that, “we regard our possessions as parts of ourselves” and reiterates by stating, “we are what we have” (Belk 1988, p. 160). The objects we carry offer external and internal signals as to the persona of its possessor.

Nearly 75 years of research suggests that items like clothing (Harms 1938; Solomon 1983; Thompson and Haytko 1997), handbags (Ahuvia 2005), and shoes (Belk 2003) act as signals of our identity. Technology-objects also signal identity through the display of brand names and logos; through the personalization of technologies; and through the music, entertainment, and applications that populate these technologies (Townsend, et al. 2010).

4.3. Data Collection

In an effort to understand the meanings that our subjects attributed to their technologies, we embarked on a multi-method study. We were guided by the collection and analysis of

data using qualitative and quantitative approaches. The data for our research took the form of language and images. Content analysis guided the interpretation of textual data. Visual narrative analysis framed the deconstruction of photographic data. Cluster analysis and computational linguistics assisted in finding patterns of similarities within the text and images. The following sections describe in detail the collection and analysis of the textual and visual narrative as conveyed by our subject group.

4.3.1. Mobile Device Questionnaire

An extra-credit opportunity was offered to students enrolled in a management information systems course. We administered a questionnaire collecting demographic and mobile data as well as first-person narrative from 140 subjects (82 males and 52 females). The average age of our subject pool was 21 years. On the day of the study, 95% were carrying a mobile phone (i.e. basic phone=76% or smartphone=19%). In addition to their mobile phones, 34% were carrying a music device (e.g. iPod, iPodTouch, Mp3), 16% were carrying laptops, and 12% were carrying productivity devices (e.g. calculators, electronic dictionaries, or flash drives).

Participants took approximately 30 minutes to answer five demographic questions, seven general questions describing their technologies and six open-ended questions and about the mobile technologies they were carrying. The result was a collection of first-person narrative (i.e. unstructured text) and a matrix with 33 variables (Table 4.1) describing mobile device and demographic data.

Table 4.1 Variables collected to describe mobile devices and demographic data.

Variables		
CarryUsually_BasicCell	CarryUsually_Smartphone	UsuallyCarry_Music
UsuallyCarry_Laptop	UsuallyCarry_ProductivityTools	UsuallyCarry_Personal
UsuallyCarry_Medical	Now_BasicCell	Now_Smartphone
Now_Music	Now_Laptop	Now_Productivity
Now_Personal	Now_Medical	ChooseOnlyOneDeviceCarry
Which_ReflectsSelf	WhyReflectSelf_Function_1	WhyReflectSelf_Value_2
WhyReflectSelf_Sign_3	WhyReflectsSelf_Symbol_4	Symbol_Access
Symbol_Education	Symbol_Equalizer	Symbol_Personalize
Symbol_Simplify	Symbol_Social	Symbol_Status
Symbol_Taste	Sex_F=0, M=1	USCitizen_Y=1,N=0
Age	Major	Ethnicity

4.3.2. Photographic Session

Using photographs as a cultural text has been used the fields of anthropology (Collier and Collier 1986; Schwartz 1989; Pink 1999) as well as marketing (Holbrook, 1987; Rabikowska, 2010). A visual technique introduced in the *Consumer Behavior Odyssey*, Belk (1991) used photography to record a visual inventory of the possessions within homes in an attempt to understand their deeper meanings. We echoed this technique and saw it as a compliment to textual data. The visuals were used for cataloging and less for photographic interpretation.

After subjects completed their mobile device questionnaire, researchers guided the subjects to another room for a photographic session. We collected images of 140 subjects who displayed their mobile devices in a manner that they saw fit. We used the images to record the visual representation of personal identity as they were extended through

technology-objects. Recall that the participants were not instructed by the researchers how they should pose for their photography. The majority (87%) of participants displayed their technologies while smiling. The remaining posed in an action shot reenacting how they might use their technology in a natural environment (e.g. making a call, sending a text, listening to music with ear buds, or opening a laptop).

4.4. Analysis and Discussion

4.4.1. Textual Narrative

Subjects produced a corpus of 12,160 words describing their personal experiences with their mobile technologies. To analyze the first-person narrative we used methods from computational linguistics and content analysis. With the concordance software we explored the text by running frequency counts, key-words-in-context, and collocates.

4.4.1.1. Context Analysis

We build from previous work (Townsend et al., 2010) that analyzed the text using an *a priori* codelist (Miles and Huberman, 1994) framed by Baudrillard's (2005) four characteristics of objects: (1) exchange value, (2) functional value, (3) sign value, and (4) symbolic value. The unit of analysis was a complete phrase that described the meaning of a technology-object as expressed in value characteristics. One statement could receive up to four value characteristics depending on the meaning identified.

For example, a 19-year-old female pre-business major wrote: "When I'm on my iPhone I can multi-task. I like talking to others while at the same time checking my recent emails." This statement was coded with three characteristic values. In this statement, the subject described the device's (1) functional value by identifying its multi-tasking utility, (2) sign value by naming the iPhone brand, and (3) the symbolic value by noting the enjoyment the

technology facilitated through social connection.

At the conclusion of coding, we had a list of four technologies (i.e. basic phone, smartphone, music device, and laptop) with its value characteristics. A technology could receive a total of four characteristics, if a subject mentioned a technology's function, exchange, sign and symbol values when describing why they chose to carry that particular technology. When calculating the average of the characteristic values, laptop ranked first (2.625), then smart phone (2.456), followed by basic cell (2.085), and music device (1.934).

4.4.1.2. *Computational Linguistics*

A second examination of the first-person narrative about mobile devices was aided by computational linguistics. With this analysis we wanted to delve into the meanings attributed to specific technology-objects. From our previous analysis we discovered that technologies were prized for their symbolic values. The second step was to use concordance software to examine the text in an effort to decipher specific themes within our text that were represented by frequencies and as well as context.

When running frequency counts, subjects mentioned technologies such as cell phones, iPods, laptops, and iPhones with the most regularity (Table 4.2). Cell phones were the most written about technology and were also the technology carried by nearly all (95%) of our subjects.

Table 4.2 Frequency summary of technologies most written about by participants.

Technology	Frequency	Percentage	Technology	Frequency	Percentage
Cell(s)	463	3.81	MP3	34	.28
iPod(s)	189	1.55	Blackberry	27	.22
Laptop	64	.53	Computer(s)	26	.21
iPhone(s)	51	.42	Smartphone	8	.07
iPodTouch(s)	44	.36	usbDrive	8	.07
Calculator(s)	44	.36	Netbook	7	.06

For the next exploration into the text, we studied keywords in their context. We sought to gain a deeper understanding of the meanings that subjects attributed to their mobile devices. To do this, we aggregated the text used to describe devices such as cell phones, iPods, laptops, and iPhones. We then looked at word usage trends (Table 4.3) that were used to describe general themes.

Nouns most frequency associated with the word *cell* (i.e. the five most frequent words collocated either to the left or right of the key word) were words referring to friends, people and family. The verbs most frequently collocated with the word *cell* were words denoting actions such as transporting, existing/being, texting, or contacting. Quite simply, the purpose of a cell phone was to contact others. For our participant group a cell phone means a people device. It is a technology that is needed to stay in-touch with friends, family and everyone.

Table 4.3 Word usage trends most frequently associated with mobile device key word.

Key Word	Noun (frequency)	Verb (frequency)
Cell	Friends (78)	Carry (95)
	People (21)	Is (86)
	Everyone (21)	Choose (55)
	Time (19)	Can (45)
	Internet (18)	Use (23)
	Emergency (18)	Need (20)
	Communication (16)	Text (19)
	Family (9)	Contact (15)
	Games (8)	Feel (10)
	Class (8)	Touch (10)

Another concordance technique was the examination of clusters or n-grams. This technique used computer-aided processing to locate words with the highest probability of occurring next to each other in a sentence. The words that *cell* most frequently clusters with were *because* (41 times), *with* (20 times), *to* (19 times), *is* (18 times) and *reflects* (9 times).

Our subjects used a cell *because* of emergencies, *because* it was a part of life and *because* it connected them to others. Our subjects carried a cell *with* them at all times for communication, texting, and reminders. Similarly, our subjects stated that they used cell phones *to* stay in touch, *to* text and *to* communicate with others. The aggregate understanding of what a “cell phone is” was expressed by qualifiers such as a cell *is* the most important device, a cell *is* my main source of communication, a cell *is* crucial, and a cell *is* a necessity.

“iphone because it pretty much has whole life on it.” [Female, age 21, accounting major]

“cell has been with me everyday for about five years.” [Female, age 20, management major]

“because cell can save my life in emergency. It is necessary to someone who is living in an information society.” [Female, 21, accounting major]

“cell because it enables me to stay connected with job, social/family life at all times.” [Male, age 19, finance/marketing major]

“having cell is crucial in day to day life. It allows me to keep contact with people.” [Male, age 19, management/finance major]

When examining the nouns most frequently collocated with devices such as iPods or Mp3 players were *music* (16), *me* (15), *kinds* (8) and *entertainment* (6). Verbs most frequently collocated with music devices were *carry* (30), *listen* (12), *reflects* (11), *use* (8), and *like* (7). The words associated with music technologies illustrated that they fulfilled a different need than cell phones. Music devices were carried to entertain the individual user. The kinds of music found in the device reflected the personal style and likes of its possessor.

“I listen to music on my walk to class everyday because it helps cheer me up and keep me in a good mood.” [Female, age 20, marketing major]

“iPod entertains me. It makes me happy and relaxes me. It kills the boring time when taking the bus or waiting in queue.” [Male, age 20, pre-business major]

“I would say iPod because it has on it the kind of music I am into. Which shows

the kind of person I am.” [Male, age 20, marketing major]

“The iPod I carry with me because I like to walk on campus listening to music it makes me don't notice that I'm walking or make me sometimes just get away from the noise I have around me in the computer labs and cafes on campus.” [Female, age 19, business major]

The collocates frequently associated with the word *laptop* were *research*, *education*, *college*, *work*, and *Internet*. When examining clusters associated with the word *laptop*, our subjects stated that a laptop *is heavy* and *is* used for *work* and *study*. The meanings attributed with *laptop* were its ability to function as a work object and an Internet object.

“I carry laptop with me because usually I have break from classes from so I work on homework and other stuff in that break period.” [Male, age 22, pre-business]

“Laptop is a little heavy I therefore don't carry it around with me as much but it does tend to follow me around quite bit especially when I go over to someone else's place to hang out (I always bring laptop with me to work on things).” [Female, age 21, biology major]

“Laptop is very useful for me as mobile user any place with internet access I could just simply sit down, go online surfing the net whether for work purposes or just simply personal pleasures.” [Male, age 20, supply chain management major]

4.4.2. Visual Narrative

To analyze the photographic data we adopted a visual narrative approach. Similar to text, images can portray a story. The approach traditionally used for film interpretation (Mantgomerie and Reck, 2011; Melgosa 2010; Khouri 2010), recently has been adopted by researchers in consumer behavior to interpret brand strategies (Woodside et al., 2012) and fashion marketing (Ko and Megehee 2012).

In our study, we use a visual narrative approach to create a coding scheme of *body-symbol* rankings. Recall that identity was evident in the display of material objects (Goffman, 1959). The body-symbol coding scheme categorized signs of identity as presented on the male and female form. For categorization purposes, just as a sentence can

be broken into its parts (i.e. subject, predicate, clause), so were the photographs. The subject of the body-sentence was divided into six parts (i.e. face, hair, upper-body, hands, legs, and feet). The predicate of our visual narrative involved the actions required (i.e. time and care) to apply symbols to the body (i.e. grooming, dressing, shopping). The action of our visual narrative was also expressed by the pose of the body in the photograph. The clause of our visual narrative was the context that was provided by the first-person narrative collected by the open-ended questionnaire and then linked to the photographs.

Based on the visual narrative approach, a 40-item coding scheme (Table 4.4) categorized the representations of body-symbols exhibited on a subject's face, hair, upper-body, hands, legs, and feet (Figure 4.1). For coding purposes, the definition of the word *trendy* was operationalized to mean an ensemble, clothing item or accessory that was unique (e.g. hipster, urban, hippy), fashionable (e.g. classic, business casual, contemporary), or radical (e.g. grunge, metal, political). The photographs were taken during a spring semester of a day course attended by full-time students. Participants were photographed in clothing and styling that most likely represented their usual manner of dress and self-presentation for an educational environment.

Table 4.4 Coding scheme to categorize representations of body-symbols.

Female (n=58 of 140)					
Face	Hair	Upper-body	Hands	Legs	Feet
natural make-up	ponytail or barrette	athletic t-shirt	clear polished nails	sweatpants	tennis shoes
stud earrings	athletic hat	university wear	brightly polished nails	faded blue jeans	winter boots for function
drop earrings	curled or straightened	casual jacket	rings	twill pants	loafers
heavy or noticeable make-up	colored or highlighted	necklace	bracelets	leggings	casual brand name boots
trendy scarf	trendy up-do	button-up shirt		slim cut jeans	dress leather boots with heel
trendy eyewear	trendy flower, scarf, hat	sorority gear		designer jeans ripped jeans	

upper ear lobe piercings		trendy sweater or top		black or white jeans	
face piercings		business casual blouse		wool trousers	
		trendy outerwear			
Male (n=82 of 140)					
Face	Hair	Upper-body	Hands	Legs	Feet
unshaved	wash and go	athletic t-shirt	manicured nails	sweatpants	tennis shoes
clean shaved	athletic hat	university wear	rings	faded blue jeans	hiking shoes
facial hair goatee mustache	university hat	casual jacket	bracelets	dark blue jeans	tennis shoes with bright laces
beard	buzz cut	button-up shirt	watch	twill pants	high-top tennis shoes
trendy eyewear	trendy hat	fraternity gear		designer jeans or ripped jeans	loafers
trendy scarf	gel styled	necklace		slim cut jeans	leather boots
ear pierce	spiked	trendy sweater		wool trousers	
face pierce	colored	trendy outerwear			

The body-symbol totals of our participant group represented a simple bell curve. The majority (53%) of our participants fell within the average body-symbol ranking: (1) eXtreme body-symbol ranging from 31-40 represented 8% (n=9) of the participants; (2) High body-symbol ranging from 21-30 represented 21% (n=30) of the participants; (3) Average body-symbol ranging from 11-20 represented 53% (n=73) of the participants; and (4) Low body-symbol ranging 1-10 represented 19% (n=28) of the participants.

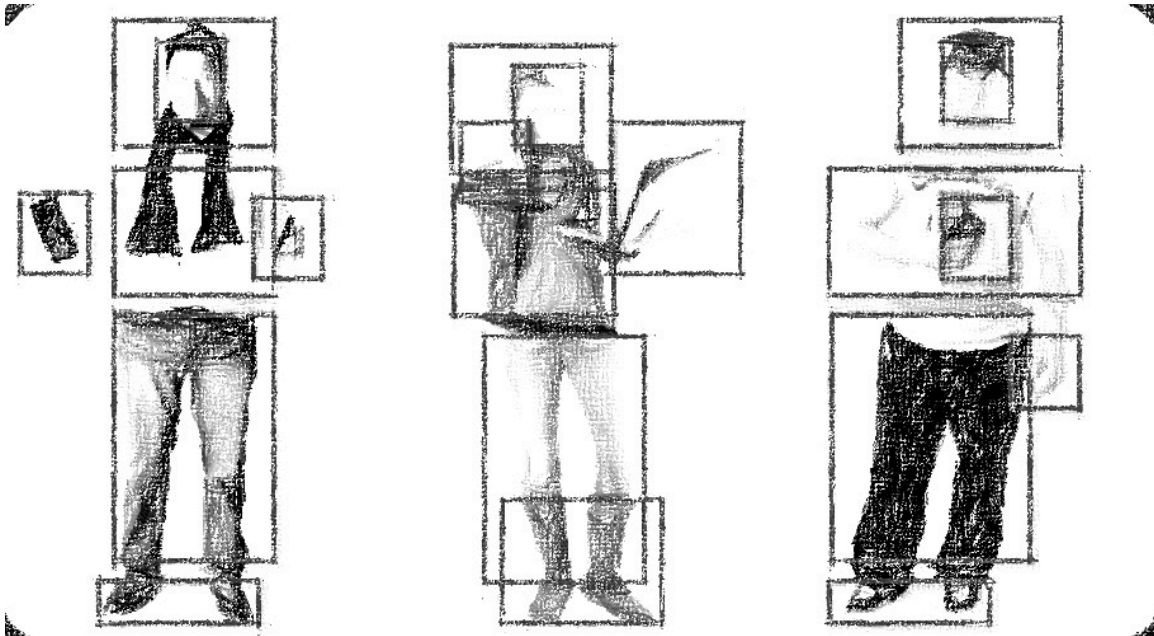


Figure 4.1 Categorization of the representations of body-symbols exhibited on a subject's face, hair, upper-body, hands, legs, and feet.

4.4.3. Correlations and P-values

The 40-item, body-symbol scheme was merged with the questionnaire data to create a 140x49 matrix. The total score of the body-symbol categorization was correlated with variables collected from demographic data and the mobile device survey. We used R (i.e. an open-source, statistical software package) to calculate correlations and p-values. We hypothesized that individuals with higher body-symbol totals would adopt technology-objects with higher symbolic values.

When examining p-values and correlations, we saw that females had higher body-symbol totals than males (Table 4.5). Females with high body-symbol totals were more likely to desire technologies containing all technology-object values (i.e. function, exchange, sign, and symbol). Music devices were less likely to be carried by females and males with high body-symbol totals. The symbols valued by females with high body-symbol totals were

simplicity and access. Males with high body-symbol totals were more likely to carry laptops.

Table 4.5 Correlations and p-values of body-symbol totals.

Class	Variable	p-value	Correlation with <i>BodySymbolTotal</i>	Description
All	Sex_F.0..M.1	0.00013	-0.318546684	More females had higher <i>BodySymbolTotals (BST)</i> than males
All	UsuallyCarry_Music	0.00391	-0.242360503	Higher BST were less likely to carry additional music devices
All	Now_Laptop	0.00526	0.234649276	Higher BST were more likely to be now carrying a laptop
All	Symbol_Simplify	0.03751	0.176005823	Higher BST were more likely to value technologies that symbolized simplicity
All	WhyReflect_Tech_F1V2S3 S4 Totals	0.04715	-0.168068154	Higher BST were more likely to value technologies with all four values
Class	Variable	p-value	Correlation with <i>BodySymbolTotal</i>	Females with higher <i>BodySymbolTotals (BST)</i> were
Female	UsuallyCarry_Music	0.00949	-0.337871371	Less likely to carry music devices
Female	Symbol_Simplify	0.02657	0.291211026	More likely to state that simplicity was a symbolic reason for why a technology reflected them
Female	Symbol_Access	0.04106	0.269142094	More likely to state that access was a symbolic reason for why a technology reflected them
Female	Tech_Symbol4_Total	0.04112	0.269062032	More likely to value technologies with all four values
class	Variable	p-value	Correlation with <i>BodySymbolTotal</i>	Males with higher <i>BodySymbolTotals (BST)</i> were
Male	UsuallyCarry_Music	0.01533	-0.266957228	Less likely to usually be carrying additional music devices
Male	Now_Laptop	0.01834	0.259970949	More likely to be now carrying laptops
Male	Symbol_Taste	0.03449	-0.233829701	Less likely to state that taste was a symbolic reason for why a technology reflected them

We employed descriptive statistics to condense a question related to identity (i.e. Which mobile device most reflects you?). From this summary (Table 4.6), we concluded that a majority (52%) of our participants wrote that a cell phone (e.g. either basic or smart) reflected them. The next device reported to most reflect the self was music device (33%) and then laptop (6%). Four percent of the participants said that a technology such as a calculator or medical device represented them and the remaining 5% of participants wrote that no technology reflected them.

Table 4.6 Summary of mobile devices described as reflecting self.

Which mobile device most reflects you?						
	Male		Female		All	All
Cell	n=23	BodySymbol%	n=28	BodySymbol%	n=	%
eXtreme	1	4%	2	7%		

High	4	17%	10	36%		
Average	11	48%	13	46%		
Low	7	30%	3	11%		
	23		28		51	36%
SmartPhone	n=16	BodySymbol%	n=7	BodySymbol%		
eXtreme	0	0%	3	43%		
High	5	31%	1	14%		
Average	10	63%	2	29%		
Low	1	6%	1	14%		
	16		7		23	16%
Music Device	n=32	BodySymbol%	n=14	BodySymbol%		
eXtreme	0	0%	1	7%		
High	2	6%	2	14%		
Average	17	53%	10	71%		
Low	13	41%	1	7%		
	32		14		46	33%
Laptop	n=3	BodySymbol%	n=5	BodySymbol%		
eXtreme	0	0%	0	0%		
High	0	0%	2	40%		
Average	3	100%	3	60%		
Low	0	0%	0	0%		
	3		5		8	6%
Other	n=4	BodySymbol%	n=1	BodySymbol%		
eXtreme	0	0%	0	0%		
High	2	50%	0	0%		
Average	1	25%	0	0%		
Low	1	25%	1	100%		
	4		1		5	4%
No Technology	N=4	BodySymbol%	N=3	BodySymbol%		
eXtreme	1	25%	1	33%		
High	1	25%	1	33%		
Average	2	50%	1	33%		
Low	0	0%	0	0%		
	4		3		7	5%
					n=140	

4.4.4. Implications and Conclusion

From a previous examination (Townsend et al. 2010), we found that technology-objects possessed symbolic values. In this current study we examined the meaning of mobile devices as it was conveyed through language and image.

We found the meaning of a cell phone to be a lifeline to others. The linguistic connotations of *cell phone* inferred that it was a people device. It represented connections, communication, and security. A cell phone was accepted as an extension of one's voice (i.e. bionic-acceptance). The object provided opportunities to stay "in-touch" with others despite being physically separated. A cell phone, however, was also viewed as an everyday object;

something normal; something everyone else had. There was a meaning distinction between basic cells and smartphones. Smartphones were attributed with more value characteristics than basic phones. Females with higher body-symbol totals were more likely to carry smartphones than basic phones.

The linguistic connotations of a music device were that it was a personal entertainment object. It was used for relaxation and to at times create a mood or a private space. A music device was accepted into one's life to influence psychological states. It also served to extend the self through the music contained on the device representing the listener's personal style and likes.

A laptop was associated with work and the Internet. Participants reported that they carried cell phones and music devices more than laptops. Even so, the laptop was the technology-object that was attributed with the most value characteristics. It was accepted for its power and versatility for the mobile user. Males with higher body-symbol totals were more likely to carry laptops.

We used a textual and visual narrative to tell a story of technology acceptance. The purpose of this research was to explore the meanings associated with objects as they are accepted into our lives and identity and onto our bodies. We found that cell phones, music devices, and laptops exuded symbols such as social, educational, professional and aesthetic status. We found different meanings embedded within cell phones, music devices, and laptops. This study is offered as an extension to technology acceptance literature by concluding the meanings conveyed by technology-objects plays a role in their acceptance.

CHAPTER 5. GENERAL CONCLUSIONS

Chapter 2 introduced the Embodied Social Presence (ESP) theory to explain perceptual engagement that users of virtual environments may experience as they engage in activity-based social interactions. The theory discussed and empirically examined the importance of embodiment, context, and spatial proximity as they pertained to collaborative interaction and task completion in virtual environments. The ESP theory was grounded in an analysis of reflection data from Second Life users that explained the process by which perceptions of embodied social presence were realized. Discourse analysis (i.e. virtual world context) and grammar (i.e. first- and third-person perspectives) defined the ESP experience.

A semi-automatic approach for the examination and the organization of unstructured text was presented in Chapter 3. The framework described a process able to infer relevant relationships from social network structures. Principles from discourse analysis strengthened the development of network analysis. The chapter described a study where the two methods were used. The findings, from a double-blind experiment, were able to detect three information networks as well as their cliques within an online gaming community.

In Chapter 4 a multi-method study examined the role of meaning in technology acceptance. The study was guided by the collection and analysis of data using qualitative and quantitative approaches. The data took the form of language and images. Content analysis guided the interpretation of textual data. Visual narrative analysis framed the deconstruction of photographic data. Cluster analysis and computational linguistics assisted in finding patterns of similarities within the text and images.

A challenge for information systems researchers and business analysts will be to manage

the vast archive of unstructured text to mine it for meaning. This dissertation explored first-person narrative as a data source while using methodological treatments such as linguistic anthropology, discourse analysis, and content analysis. The objectives of this research were to demonstrate how text was used in (1) developing a theory to examine collaborative interaction in virtual worlds, (2) creating a framework for improving the efficiency and effectiveness of dealing with text datasets for social network analysis, and (3) structuring an understanding of the role of meaning individuals attribute to their mobile devices. The implications of this research effort benefit information systems research by demonstrating that unstructured text offer vast opportunities for inquiry.

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