ABSTRACT

Title of Dissertation:	IT DESIGN FOR SUSTAINING VIRTUAL COMMUNITIES: AN IDENTITY-BASED APPROACH
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A variety of information technology (IT) artifacts, such as those supporting reputation management and digital archives of past interactions, are commonly deployed to support virtual communities. Despite the ubiquity of these artifacts, research on the impact of various IT-based features on virtual community communication is still limited. Without such research, the mechanisms through which information technologies influence community success are not well understood, limiting the design of community infrastructures that can enhance interaction in the community and minimize dysfunction. This dissertation proposes that identity management is a critical imperative in virtual communities and concerns related to communication of identity serve to shape an individual's interactions and perceptions in the community. Sensitivity to this perspective can help in drawing design guidelines for the IT infrastructure supporting the community. Drawing upon the social psychology literature, I propose an identity-based view to understand how the use of IT-based

features in virtual communities can improve community sustainability. Specifically,

identity consonance, defined as the perceived fit between a focal person's belief of his

or her identity and the recognition and verification of this identity by other

community members, is proposed as a core construct that mediates the relationship

between the use of community IT artifacts and member satisfaction and knowledge

contribution. To test the theoretical model, I surveyed two online communities:

Quitnet.com and myIS.com. The former is an online community for people who wish

to quit smoking, and the latter is a site for Lexus IS300 sport sedan enthusiasts. The

results from surveys support the positive effects of community IT artifacts on identity

consonance. The empirical study also finds that a high level of identity consonance is

linked to member satisfaction and knowledge contribution. This dissertation offers a

fresh perspective on virtual communities and suggests important implications for the

design of the supporting IT infrastructure.

IT DESIGN FOR SUSTAINING VIRTUAL COMMUNITIES: AN IDENTITY-
BASED APPROACH

by

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times.

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Chapter 1: Introduction

A virtual community is a group of people who communicate with one another in a technology-supported cyberspace, develop relationships, and see to achieve some goals. Along with the growth of the Internet, considerable attention is being focused on virtual communities and the value they can create for organizations for at least two reasons. First, the more successful e-commerce companies, such as eBay and Amazon, rely on a strong community base. By creating a strong sense of community among their customers, these businesses are able to increase customer loyalty and satisfaction, which thereafter link to growth in market share and firm profit (Anderson and Sullivan 1993; Armstrong and Hagel 1996; Wernerfelt 1991). Second, organizations are investing in community infrastructures with the goal of facilitating communication and learning (Butler 2001). A growing number of companies are building virtual communities of practice to facilitate peer-to-peer help (Constant, Sproull and Kiesler 1996), foster new ideas and innovation (Nambisan 2002; Teigland and Wasko 2003), and build knowledge competencies (Saint-Onge and Wallace 2003). Companies are beginning to recognize that communities can be supported and leveraged to benefit both the member of communities and the organization by facilitating knowledge creation and transfer (For a detailed list of virtual community value creation, see Table 1, adapted from Banks and Daus (2002), and Wenger, McDermott and Snyder (2002)).

Table 1: Value Creation of the Virtual Community

	Customer Communities (e.g., eBay)	Employee Virtual Communities of Practice
Benefits to Organizations	• Decreased cost of customer retention • Higher purchases by community customer than by non-community customers • Lower cost of customer service • Increased customer satisfaction • Lower cost of product development • Decreased cost of customer acquisition • Stronger brands	• Reduced problem solving time and costs • Improved quality of decisions • More prospectives on problems • Coordination, standardization, and synergies across units • Increased retention of talent • Knowledge-based alliances • Capacity to develop new strategic options • Ability to foresee technological development • Ability to take advantage of emerging market opportunities
Benefits to Community Members	• Personalized customer service • Access to information and expertise • Fun of interacting with other customers • Sense of belonging	• Help with work-related problems • Access to expertise • Self-esteem • Sense of belonging • Expanded skills and expertise • Enhance professional reputation and network • Strong sense of professional identity

Adapted from Banks and Daus (2002) and Wenger, McDermott and Snyder (2002)

Virtual communities provide organizations a new way to reach their customers and to coordinate knowledge exchange among employees (Boyd 2003). However, the benefit of virtual communities can only be achieved when ongoing activities and participation are supported (Butler 2001; Finholt and Sproull 1990). Unfortunately, many attempts to build online communities have not been successful despite significant effort expended in their design (e.g., Maloney-Krichmar, Abras and Preece 2002). Few communities can successfully retain their members and motivate member participation and knowledge contribution. For example, it has been reported that the vast majority (91.2%) of communities at MSN (www.msn.com) have less than 25 members and these sites' average number of posts were from one to twenty (Farnham 2002). What factors contribute to the sustainability of a virtual community is a puzzle that continues to intrigue researchers and practitioners.

Much extant research uses a psychological or sociological approach to investigate the success factors of online communities, while the IT artifact supporting computer-mediated communication is often assumed as given and unchangeable. Although, at the end, a psychological and sociological approach may be the only way to understand the sustainability of the social gathering among geographically dispersed people, a major problem with a lot of current research is that the role of technology is not recognized or is kept in a "black-box" (Stolterman 1999). The mechanism through which technology influences online social interaction is still not clear.

Hence, the objective of my dissertation is to develop and empirically test a theoretical framework of the impact of IT-based features on virtual community sustainability, with the goal of informing the design of community IT infrastructures. Technologies create the possibility for communities to emerge and develop, leading to different outcomes in terms of member behavior and community on-going activities (Yates and Orlikowski 1992; Yates, Orlikowski and Okamura 1999). The Human-Computer Interaction (HCI) literature suggests that software built to support sociability and usability, such as real time conversation (e.g., instant messaging) and social feedback (e.g., reputation systems), allows users to create new social relationships (Boyd 2003; Preece 2000). However, much of the work in this area does not yet have a rigorous theoretical underpinning. On the other hand, community infrastructures with increasingly sophisticated IT are being put in place. To bridge this widening gap between virtual community research and practice, the mechanisms through which community features, such as rating systems and user profiles, influence virtual community success are analyzed in my dissertation.

Drawing upon research on social psychology and Human-Computer Interaction (HCI), I present an identity-based approach to explore the sustainability of a virtual community. The concept of identity has been developed in work by Erickson (1968). Despite its wide academic and popular usage, there is no simple and clear definition of the identity construct. In this study, identity is defined with two core components: personal identity and social identity. As argued in the next section, identity management is a critical imperative in virtual communities and the ability to

communicate identity faithfully serves to shape an individual's interactions and perceptions in the community. I define **identity consonance** as the perceived fit between a focal person's belief of his or her identity and the recognition and verification of this identity by other community members. Identity consonance is proposed as a key construct mediating the relationship between those aspects of community design that are enabled by IT and member satisfaction and knowledge contribution.

Community designs or features supporting identity recognition and verification are categorized and examined in this dissertation. These features, also called community artifacts, are investigated in four categories: virtual co-presence, persistent labeling, self-presentation, and deep profiling: (1) Artifacts facilitating "virtual co-presence" that provide a sense of being together with other people in a shared virtual environment (e.g., the 'who is online' feature); (2) "Persistent labeling" that guarantees that a virtual community member has a consistent identification (e.g., user ID) so that other people can build up their perceptions about the focal person overtime; (3) Artifacts supporting "self-presentation" or mechanisms that a person can use to convey her identity (e.g., user profiles or signatures); (4) Artifacts facilitating "deep profiling" that provide mechanisms for other members to identify a particular person and provide feedback (e.g., rating systems). Based on attribution theory and self-verification theory, I propose that the use of these artifacts facilitates identity recognition and verification, which are then linked to member satisfaction and knowledge contribution.

This dissertation analyzing online community satisfaction and knowledge contribution from an identity perspective represents one of the first attempts to bridge the gap between virtual community design research and practice. The proposed framework has two key implications for the information systems community. First, investigation of virtual community design can help us better understand what community technologies can effectively improve the sustainability of a virtual community. The extant community design literature usually proceeds in a pragmatic style that employs guidelines without formal theoretical justification. The mechanisms through which community technologies increase the sustainability of a virtual community have not yet been precisely explained. Drawing upon attribution theory, this dissertation provides a theoretical underpinning for understanding how four categories of virtual community artifacts improve community sustainability. Second, in contrast with prior literature where the importance of identity formation and verification has been mostly overlooked, this study represents one of the first attempts to theoretically integrate the identity construct into virtual community research. Understanding the role of identity in computer-mediated communication can potentially shed light on virtual collaboration in virtual teams or virtual communities of practice.

The present research is also expected to have important managerial implications. First, the empirical results should provide practical guidelines for organizations that expect to create value by supporting customer or employee communities. The

framework proposed in this research is useful for community developers to design

their IT infrastructures to support a sustained virtual community. Further,

geographically distributed organizations can also gain some insight into the

importance of identity consonance in a virtual team.

The remainder of the dissertation proceeds as follows. The next chapter explains why

an identity-based approach is selected in this study. Then, the literature on

community and virtual community, identity and virtual identity, identity

communication, and the IT design for virtual communities is reviewed. This is

followed by the specific research model and hypotheses. I present the research

methodology and empirical results in chapter 5 and chapter 6. The dissertation

concludes with a summary of findings and discussion of the results.

Chapter 2: An Identity-Based Approach of Online Community Study

This dissertation adopts an identity-based approach to examine online communities. In chapter 2, the concept of identity is reviewed and summarized. Then, I present the rationale of adopting an identity-based view emphasizing the three reasons that identity is such an important construct in online community research. The roles of identity in information exchange, relationship building, and knowledge contribution are explored in detail.

2.1 Identity

The concept of *identity* has been developed in work by Erickson (1968). Despite its wide academic and popular use, the concept of identity is still elusive and vague. Although there are numerous definitions of identity in the extant literature, most of them argue that identity comprises two components: personal identity and social identity. A personal identity is "a set of attributes, beliefs, desires, or principles of action that a person thinks distinguish her in socially relevant ways" (Fearon 1999 : 2). Personal identity sometime is also called dispositional identity because it describes individual traits (e.g., brave, optimistic, or intelligent). A social identity is "an individual's self-concept which derives from her knowledge of her membership in a social group together with the value and emotional significance attached to that membership" (Tajfel 1981: 255). In other words, a social identity is formed when people identify themselves as members of a social group.

Despite the popular classification of personal identity and social identity, I do not focus on their difference in this dissertation. As the very first research on identity consonance in an online setting, this study centers on the impact of identity as one single concept rather than on the difference between two types of identity. Future research may look at the influence of various identities. Table 2 provides some frequently cited definitions of identity.

Table 2: Sample Definitions of Identity

Definition	Source
"Identity is one's feelings about oneself, especially with regard to character, goals, and origins"	Adapted from Erickson's concept of "Identity Crisis" (1968)
"Social identity is the individual's knowledge that he belongs to certain social groups together with some emotional and value significance to him of this group membership"	(Tajfel 1981 : 255)
Self is construed in 3 levels: individual level, interpersonal level and group level. Individual level identity is the "differentiated and individuated self-concepts"; interpersonal self is "the self-concept derived from connections and role relationships with significant others"; and collective self " corresponds to the concept of social identity"	(Brewer and Gardner 1996 : 84)
"The individual's self-appraisal of a variety of attributes along the dimensions of physical and cognitive abilities, personal traits and motives, and the multiplicity of social roles including worker, family member, and community citizen."	(Whitbourne and Connolly 1999 : 28)
"Identity refers to either (a) a social category, defined by membership rules and (alleged) characteristic attributes or expected behaviors, or (b) socially distinguishing features that a person takes a special pride in or views as unchangeable but socially consequential, or (a) and (b) at once."	(Fearon 1999 : 1)

2.2 Why an Identity-Based Approach

Purposive behaviorists' suggest that all human behavior is directed by three goals—behavior efficiency, relationship building, and self-image management (Tolman 1932). Based on this argument, I believe that participation in an online community is also motivated by three goals: to obtain useful information guiding efficient behavior, to build and maintain relationships, and to manage online identity. Moreover, among these three goals, identity management is essential for the achievement of the other two goals in a virtual environment for the following reasons.

First, information acquisition is more efficient when the expert is identifiable. In other words, if community members are able to establish their identities as experts in distinct areas, people looking for information in a particular area can accomplish their decision-making tasks more efficiently and effectively by identifying whom they should turn to. Knowing the identity of knowledge contributors helps knowledge seekers recognize source credibility. For example, when a book is sold on Amazon.com, anyone can post a review without revealing their true identity. Recently, multiple cases have been detected where some authors posted fake "5 stars reviews" of their own books. Customers have also become more cautious when reading book reviews and are pressing upon Amazon.com to validate the identity of the reviewers. According to the Elaboration Likelihood Model (ELM), information seekers perceive knowledge more useful and tend to pay attention to it when the source credibility is high (Sussman and Siegal 2003; Zhang and Sussman 2003).

Without knowing the identity of the knowledge contributor, knowledge adoption is difficult, indicating a less efficient knowledge exchange (Nickerson 1999).

Second, from a relationship building perspective, people with similar interests or attitudes, in similar social groups, or with similar experience, are more likely to communicate and build a relationship with each other (Newcomb 1961). Hence, a more accurate online identity should help community members identify similar others to build relationships (Jensen, Davis and Farnham 2002). In this sense, identity formation in a virtual community facilitates the relationship-building goal of virtual community participants.

Finally, besides helping virtual community members achieve their behavior efficiency and relationship-building goals, identity formation also promotes knowledge contribution. Research on pro-social behavior in a virtual environment indicates that people help "strangers" not only because of altruism but also for reputation (Donath 1999; Faraj and Wasko 2003; Lerner and Tirole 2000), future reciprocation (Ackerman 1998), and self-esteem (Faraj and Wasko 2003; Gu and Jarvenpaa 2003; Hertel, Niedner and Herrmann 2003; Kollock 1999). Many studies have provided evidence that recognition and acknowledgment from group members increase a focal person's overall participation (Hertel et al. 2003; Stasser, Steward and Wittenbaum 1995; Thomas-Hunt, Ogden and Neale 2003). Establishing one's online identity provides a great deal of motivation for knowledge contributors, helping them increase their reputation, the possibility of future reciprocation, and self-esteem (Axelrod

1984; Donath 1999). Without appropriate acknowledgement, a participant may perceive her effort unrewarded or non-useful and hence, withdraw from future contribution. Further, based on game theory, Axelrod's (1984) suggested that a system designed with recognition capability, i.e., a system helps users recognize each other and provides information about how others behave, can increase the cooperative interaction between community members. In this sense, identity recognition maintains the sustainability of community activities by motivating cooperation and knowledge contribution.

2.3 Summary

This chapter discussed the concept of identity. In a sense, without a physical body, online identity is the representation of a person's place in an online community. I argued that, as in the context of fact-to-face communication, identity plays the same important role in efficient information exchange and relationship building in mediated communication. The formation of identity also motivates knowledge contribution in an online community. In the next dissertation chapter, the background literature on identity management in the virtual community is reviewed.

Chapter 3: Related Literature

Chapter 2 reviewed the identity construct and its roles in virtual community communication. In this chapter, I summarize research related to the theme of this study (see Table 3). First, the community and virtual community literature is reviewed. This is followed by a brief discussion of studies on identity and virtual identity. Next, I review the literature on identity communication in both physical and virtual spaces. Finally, the literature on virtual community IT design is summarized.

3.1 Community and Virtual Community

The term "community" is mostly used in two ways: place-based communities or communities of interest (Gusfield 1975; McMillan and Chavis 1986). For example, the District of Columbia community is a place-based community where all members are located at the same geographic area; Association of Information Systems is an interest-based community, where members are distributed in various places but have common concerns and interests. One extensively studied type of community of interest is a community of practice, defined as "a group of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger *et al.* 2002 : 4). For example, JAVA programmers who work with similar tasks can

Table 3: Related Literature

		Physical world	Virtual world
Community	**Definition**	A group of people living in a particular geographical area (place-based communities) or sharing interests or skills (relational communities)(Gusfield 1975; McMillan and Chavis 1986)	A technology-supported cyberspace, centered upon communication and interaction of participants, resulting in a relationship being built up (Lee, Vogel and Limayem 2002; Preece 2000; Preece and Maloney-Krichmar 2003)
	Research	Communities of practice (Lave and Wenger 1991; Wenger 1998; Wenger et al. 2002) Sense of community (McMillan 1996; McMillan and Chavis 1986)	Sense of virtual community (Blanchard and Markus 2004; Koh and Kim 2003) Virtual communities of practice or network of practice (Faraj and Wasko 2003)
Identity	**Definition**	What people use to answer the question "who am I"	Same concept in a different setting. What people use to answer the question " who am I in this virtual community"
	Research	Social identity (Tajfel 1978; Turner, Hogg, Oakes, Reicher and Wetherell 1987) Personal identity (Erickson 1968) Multiple identities (Brewer and Gardner 1996; Brickson 2000)	Identity formation and deception (Donath 1999)
Identity communication	**Definition**	The process of controlling how one is perceived by other people (Leary 1996; Schlenker, Forsyth, Leary and Miller 1980) "Methods (e.g., verbal and behavioral) that a person uses to convey his or her identity" (Thatcher, Doucet and Tuncel 2003: 6)	The same as in a physical world.

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	Research	Physical world	Virtual world
	Research	Self-presentation Theory (Goffman 1959; Goffman 1967; Jones, Berglas, Rhodewalt and Skelton 1981; Jones and Pittman 1982; Leary 1996) Self-verification theory (De La Ronde and Swann 1998; McNulty and Swann 1994; Swann 1983; Swann, Milton and Polzer 2000; Swann, Stein-Seroussi and Giesler 1992) Interpersonal congruence (Polzer, Milton and Swann 2002) Identity comprehension (Thatcher 2004; Thatcher and Zhu 2004)	Presentation of self online using personal home pages (Miller and Mather 1998; Papacharissi 2002) Self-disclosure in computer-mediated communication (Tidwell and Walther 2002) Self-presentation in computer-mediated groups (Connolly, Jessup and Valacich 1990; DeSanctis and Gallupe 1987; Jessup, Connolly and Galegher 1990)
IT design for virtual communities	Research	*NA*	Usability and sociability (Preece 2000) Social software (Boyd 2003) Social translucence (Erickson, Halverson, Kellogg, Laff and Wolf 2002; Erickson and Kellogg 2000) Electronic group communication technologies (Subramani and Hahn 2004)

organize a community of practice and interact frequently. They may not work together but can find value in their interaction by exchanging knowledge and helping each other with programming problems.

As summarized in Table 3, one central concept of community psychology is *Sense of Community (SOC),* defined as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' need will be met through their commitment to be together" (McMillan and Chavis 1986). McMillan and Chavis (1986) proposed that a sense of community is composed of four dimensions: membership, influence, fulfillment of needs, and shared emotional connection. Several empirical studies have emerged around the concept of sense of community and provided evidence for its impact on individual behavior and identity (Chavis and Pretty 1999). Based on previous argument that a sense of community is positive for community experience (e.g., McMillan et al., 1986), I discuss the impact of group identification (membership) and fulfillment of needs on community satisfaction and knowledge contribution later in this dissertation.

The academic research on virtual communities up till now has been largely exploratory in nature. There is no agreed upon and established definition of virtual communities. Preece (2000; 2003) proposed that an online community has four key components: people, a shared purpose, policies, and computer systems. Similarly, in this study, a **virtual community** is defined as a group of people (virtual community members) who communicate with one another in a technology-supported cyberspace,

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develop relationships, and seek to achieve some goals (adapted from Lee et al. 2002). By definition, both technical and social factors will influence the development of a virtual community. The interaction environment supported by information technologies determines how social information can be presented and communicated, while the social factors impact social norms and interpersonal dynamics.

Virtual communities are formed in the process when people wish to fulfill specific needs online. Based on these needs, Armstrong and Hagel (1996) and Carver (1999) classified online communities into four types: communities of relationship, communities of interest, communities of fantasy, and communities of transaction. A community of relationship is a group of people who come together because of certain life experiences. QuitNet.com, an online community for people who want quit smoking and other addictions, is an example of a community of relationship. People provide social support to each other and the emotional connection between community members in such communities is usually deep. Communities of interest are places where people gather together to discuss specific topics, such as photography, software, or traveling. One successful online community of interest is Digital Photography Review (dpreview.com), an online forum where digital photography professionals and amateurs come together to review digital cameras and share and commend on each other's works. People also get together in communities of fantasy for role-playing, where they can pretend to be somebody else and temporally escape reality. Finally, communities of transaction facilitate business transactions and delivery such as Amazon.com and eBay.com. Compared to the other

three types of communities, a community of transaction may have less social interactions. However, increasing the social connection between buyers and sellers might be beneficial to both by promoting a sense of trust between them.

While virtual communities are different in goals and focus, all of them are built upon communication and relationships (Armstrong and Hagel 1996). By definition, sustained interaction and relationships are necessary conditions that differentiate a virtual community from simply a collection of people. As shown in Table 3, two exploratory works using a case study approach and a survey suggest that people can achieve a sense of community online (Blanchard and Markus 2002; Koh and Kim 2003). Other studies have also revealed that members of a virtual community are able to establish social relationship as they do in a face-to-face setting (Faraj and Wasko 2003).

While identity may be a component of all types of communities, I believe that its impact on community experience is stronger in communities of relationship and communities of common interests. Therefore, in my dissertation, I will focuses on the investigation of these two types of communities. In a community of transaction, business transactions are the core activities and individual identity could be less important than other factors such as reputation. In a community of fantasy, people gather together to play totally different roles from who they are and their virtual identity could be very different from their real identity. I will focus only on

communities of relationship and communities of interests in this dissertation because the influence of identity in the other two types of communities may be weaker.

3.2 Identity and Virtual Identity

The concept of identity has been discussed in the previous section (also summarized in Table 2). Identity is essentially what people use to answer the question "who am I" (Thatcher 2004). There is a large amount of research on identity formation and its impact on individual behavior and attitude. However, research on online identity formation and its impact is lacking. Virtual identity has the same concept as identity but in a different setting—the virtual world. Similar to identity in a physical world, virtual identity is what people use to answer the question "who am I in this virtual space" and it could also be composed of personal identity and social identity. Individuals may bring their personal identity and social identity in a physical world to a virtual world, or, they may learn and build new identity when interacting with others online (Berman and Bruckman 2001; Donath 1999; Turkle 1995). Virtual identity is enabled by technology and communicated through technology. Community members can build and express their identities by participating in online activities, providing information about themselves, and offering expertise and knowledge (Zhang and Sussman 2002). Through these identity communication activities, which will be discussed next, others can form an understanding of the focal person's personal identity—her attributes, beliefs, desires, and principles of action, and learn

her social identity—which social groups she belongs to and what social roles she undertakes.

3.3 Identity Communication

3.3.1 Identity Communication In the Physical World

The research literature suggests two motivations for identity communication: epistemic concerns and pragmatic concerns (Goffman 1959; Jones and Pittman 1982; Swann et al. 1992). For epistemic concerns, Goffman (1967) argued that people want to explain themselves to others regarding their identities before concentrating on the work or other goals that bring them together. By reaching this consensus regarding identities, people will feel understood and obtain a sense of continuity and coherence (Swann et al. 2000). For pragmatic concerns, individuals are motivated to present their identities to predict and achieve smooth interactions in everyday social life (Jones et al. 1981; Jones and Pittman 1982). Leary (1996) later summarized the three functions of identity communication as a mean of interpersonal influence, self-esteem maintenance, and positive emotions promotion.

Self-verification theory proposes that individuals prefer being known as who they are. As summarized in Table 3, previous studies have provided significant empirical evidence that people were more satisfied and were more inclined to continue the relationship if others could confirm their identities, even when those identities were

negative (De La Ronde and Swann 1998; McNulty and Swann 1994; Swann 1983; Swann et al. 2000; Swann et al. 1992).

Individuals can use a variety of tactics to communicate their identities. In his seminal work *the Presentation of Self in Everyday Life,* Goffman *(1959)*, focusing on face-to-face communication, suggested that the presentation of identity is through social interaction. He also speculated that *physical co-presence* is essential to identity expression. The process of establishing social identity is allied to the concept of "front", which is described as "that part of the individual's performance which regularly functions in a general and fixed fashion to define the situation for those who observe the performance" (Goffman 1959: 22). An individual needs to both fill the duties of the social role and communicate the activities and characteristics of the role to other people in a consistent manner (Goffman, 1967). Leary (1996) examined multiple identity expression tactics, including self-description (i.e., telling others about oneself), attitude statements, public attribution, nonverbal behavior (e.g., emotional expression, physical appearance, and body language), social associations, conformity and compliance, the physical environment (e.g., the setting of the offices or homes), and other behavioral tactics (e.g., helping behavior).

3.3.2 Identity Communication Online

Computer-mediated communication has provided new avenues allowing people to express themselves. Although the research on identity communication online is sparse, I believe that, similar to being in the physical world, participants in a virtual

community also need a sense of certainty and continuity by obtaining identity

confirmation from other people they interact with. For example, a virtual community

member who believes that she is knowledgeable in JAVA programming will feel less

uncertainty about the outcome of cooperating with others and contributing JAVA

knowledge if she feels that other community members hold the same belief about her.

Due to a relative lack of identity cues in computer-mediated communication,

individuals may be even more motivated to express their identities in a virtual world

to obtain identity affirmation from others. Recent experiments in Computer-

Mediated Communication support this notion and show that individuals demonstrate

more self-disclosure using computer-mediated communication than face-to-face

communication (Tidwell and Walther 2002).

Some self-presentation tactics discussed above are applicable to the non-face-to-face

communication mediated by a computer network. For instance, a new form of

identity communication is using a personal web page (Miller and Mather 1998)—

people can describe themselves and make attitudinal or social association statements

on their homepage. However, as Goffman emphasized, *social interaction* and *co-

presence* are necessary for identity communication. Successful and efficient identity

communication requires two-way social interaction. Limited interaction and a lack of

co-presence in a personal web page may make it a less efficient way to communicate

identity.

Along with the development of interactive technologies and the popularity of virtual communities, more and more social interactions have been taking place in chat rooms, online forums, distribution lists, etc. While physical co-presence is usually impossible, various design features can facilitate a feeling of the *virtual co-presence* of others. For example, some online communities will explicitly show whether a particular member is currently connected online. Some are even designed to provide information about what a particular user is doing—reading a message or typing a reply. Some other communities will show how many registered members and how many anonymous (unregistered) members are online. These new features made available in online communities can enhance and motivate identity communication. Thus, the many "taken for granted" limitations of CMC (i.e., lack of social and identity cues) may be relieved by improved community design.

Most important, however, is the question of whether the limitations of CMC are really constraints for identity communication online. The emphasis placed on physical proximity may be less of a theoretical necessity than a consequence of the fact that most theories of identity communication were developed before the explosion of computer-mediated communication and interactive technologies. Some conditions may be helpful for self-presentation, but they do not necessarily predict whether one can present himself in a virtual space, how others perceive this focal person, and how congruent are their beliefs. Prior studies have shown that, given enough time, profound social relationship building and mutual understanding are possible in computer-mediated communication (Walther 1992; Walther 1997;

Walther and Burgoon 1992). In addition, the experiments reviewed earlier showing

that individuals demonstrate more self-disclosure using CMC than face-to-face

communication (Tidwell and Walther 2002) imply that not only does physical

distance not inhibit self-presentation, but it also may promote it. In summary, it is not

clear whether some assumptions inherent in identity communication theories are still

applicable in computer-mediated communication.

In addition, because extant theories in identity communication were established

before the ubiquitous adoption of CMC, some necessities of identity maintenance

may be overlooked. For example, in a physical world, it is almost impossible for a

person to change her name or face and present herself as a different individual. In a

virtual world, the chance is increased. In an online community, other members'

perception about a focal person is linked to her user ID. Keeping a single and

permanent user ID is important to maintain other people's identity perception. Once

a person discards her ID, all identity communication efforts invested before are gone

as well. Therefore, in the virtual world, a permanent user ID is a necessity for the

focal person to be recognized by other people. To summarize, some necessities for

effective identity formation may be overlooked in current identity communication

theories.

3.4 IT Design For Virtual Communities

One central concern of virtual community research is how technology helps support

community development. Community artifacts can impact social activities and

determine what people CAN do. Whether or not a user knows the personality of other people online, whether she knows that other users are present and engaged in some activities, whether she can find if those around have the same interests or habits, and how easy it is to get this information— all these depend on the design of the interaction environment (Donath 1999). Different online communities provide a variety of interaction environments, though the evidence is sparse regarding whether differences in the quality of online communication can be explained, in part, by the differences in the environmental design.

Researchers in Human-computer Interaction (HCI) propose that community technologies should be designed from a social perspective. Such conceptualizations in HCI include social software (Boyd 2003; Hattori, Ohguro and Yokoo 1999) and social translucence approach of system design (Erickson et al. 2002; Erickson and Kellogg 2000) (see Table 3). The *Social software* literature suggests that systems built to support real time conversation (e.g., instant messaging), social feedback (e.g., reputation systems), and social networks (e.g., Fridendster.com) allow users to create new social relationships. They also provide organizations a new way to coordinate knowledge exchange among employees and to reach their customers (Boyd 2003). However, the scattered literature in this field does not have a rigorous definition of social software. Moreover, the mechanism through which social software increases the sociability among a group of people is not well-understood.

Social translucent system research is interested in designing systems that make social cues more visible to their users (Erickson and Kellogg 2000). A number of systems that illustrate social translucence have been developed, where cues about the presence and activity of online members are visualized. This stream of research proposes that when individuals in a virtual community perceive the presence of others, they tend to be more responsible and cooperative. The rationale is based on the social psychology theory of accountability, which specifies that people who feel more accountable for their behavior are engaged in more impression management and behave in a more socially favorable way.

Although many of the virtual communities have similar design features, individual members may use them differently. When I observed various communities, I have found that some people disclose large amount information about themselves, use reputation systems actively, change their signature frequently according to their mood, etc., while other people like to hide their online status and seldom express their opinions, even though the features are available and extensively used by other members. Hence, like some other studies (e.g., Khalifa and Shen 2004), this dissertation focuses on the individual use and perception of community design features instead of the availability of those features.

3.5 Summary

This chapter reviewed the literature on community and virtual community, identity and virtual identity, identity communication in physical and virtual worlds, and the IT

design for virtual communities. The reviewed literature was summarized in Table 3.

It was argued that the many "taken for granted" limitations of Computer-Mediated

Communication need to be revisited and a better IT design of virtual communities

may promote healthy social interactions among community members. While

community infrastructures with increasingly sophisticated IT are being used, the

limited studies on IT design for sustaining virtual communities are still exploratory in

nature and lack theoretical underpinnings. The research model and hypotheses

presented next examining the IT design for successful virtual communities from an

identity-based view bridge this widening gap between virtual community research

and practice.

Chapter 4: Theoretical Model and Research Hypotheses

In this Chapter, I introduce the key construct of my dissertation—Identity Consonance—a concept adapted from previous literature on identity verification. According to the self-verification literature reviewed in chapter 3, identity verification from others influences an individual's satisfaction, productivity, and relationship building. Hence, in this chapter, I propose that the perceived identity confirmation (i.e., identity consonance) predicts individual community members' level of satisfaction and knowledge contribution. I also argue that the use of those community IT artifacts that support identity communication (such as user profiles) will help increase identity consonance. The theoretical model and research hypotheses are discussed in detail in this chapter.

4.1 The Identity Consonance Construct

Identity consonance, the key concept of this dissertation, is defined as the *perceived fit between a focal person's belief about his or her identity and the recognition and verification of this identity by other community members*. Two similar constructs can be found in the recent literature: interpersonal congruence (Polzer et al. 2002) and identity comprehension (Thatcher 2004; Thatcher and Zhu 2004). In the group diversity literature, interpersonal congruence is a group-level construct defined as "the degree to which group members see others in the group as others see themselves" (Polzer et al. 2002:298). Polzer et al. (2002)'s field study showed that interpersonal congruence fostered harmonious interaction and creative performance in work groups. Similarly, identity comprehension is defined as "the degree to which

important others understand a focal person's identities and the relative importance of their identities to the focal person" (Thatcher 2004 : 2). A survey study with 220 respondents from a single organization found that identity comprehension was positively linked to individual performance, attendance, group commitment, and open communication (Thatcher 2004).

The identity consonance construct defined in this dissertation is different from interpersonal congruence and identity comprehension in three ways. First, identity consonance is a perceptual construct. The psychology literature has provided abundant evidence that people may perceive more self-confirmation than actually exists (Swann, Polzer, Seyle and Ko 2004). Hence, the perception of consonance may be biased. However, it is an individual's perception that ultimately determines her interpretation of community experience and behavior. Hence, the perceived rather than the objective fit between an individual's self-view and others' appraisal is adopted in this study to predict community member behavior. Second, identity consonance is an individual level construct, which differentiates it from interpersonal congruence. Finally, the identity consonance construct focuses on both identity recognition and verification, while identity comprehension simply evaluates the recognition of important identities by significant others. For instance, group members may understand that the identity as a programming expert is important to an individual (identity comprehension is high) but do not verify or acknowledge the "expert" identity (identity consonance is relatively low).

Based on the extant literature on identity and self-verification theory, the identity consonance construct can be conceptualized along two dimensions: identity orientation and the level of identity verification. According to classifications of the identification process in social psychology, self-concept is multifaceted, consisting of two fundamental loci: the self as an individual and the self as a group member (Brickson 2000). The two loci of self-definition represent distinct identity orientations (Brewer and Gardner 1996). When the personal identity consonance is high, an individual perceives her personal traits and characteristics are recognized and verified by others. For example, Mary may think of herself as a good engineer. She may be motivated to interact with other people if she believes that they also think of her as a good engineer. When the group identity (social identity) consonance is high, an individual perceives that other group members know her group membership and treat her like a group member. For instance, Mary may identify herself with a virtual group of programmers. If she perceives that other members in the group accept her as a member and treat her as a member of the group, she may be motivated to participate more and benefit the group.

The second dimension of identity consonance is the level of identity verification. Based on self-verification theory, identity recognition and identity verification are two steps of self-verification (Swann 1983; Thatcher 2004). The first step is identity recognition, emphasizing that before others can verify an individual's identity, they must first recognize the importance of various identities to the focal individual (Thatcher 2004). For example, group members may recognize that the identity as a

"good" engineer or the membership of a programmer group is important for Mary, but may not verify or agree to it. The second step of self-verification is identity verification (Swann et al. 2004), where the personal and/or group identities are accepted and verified by group members. The two conceptual dimensions of the identity consonance construct are shown in Figure 1. An individual has the highest identity consonance when both personal and social identities are confirmed and verified by other community members.

Level of Identity verification

Highest consonance

Verified by others	Verified by others
Recognized by others	Recognized by others
Not recognized by others	Not recognized by others

Personal Identity   Social Identity

Identity orientation
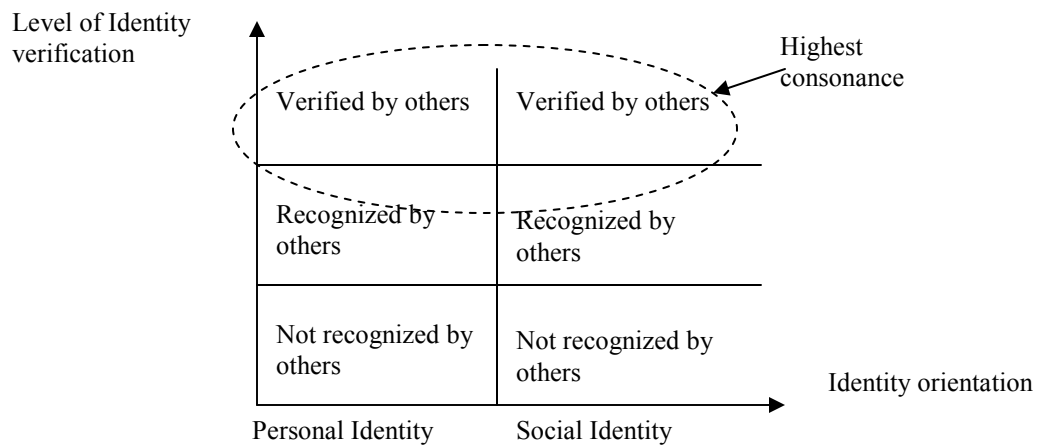
Figure 1: The Two Dimensions of the Identity Consonance Construct

The remainder of this section presents the antecedents and consequences of identity consonance in a virtual community. As shown in the theoretical model in Figure 2, the use of four categories of community IT artifacts--virtual co-presence, persistent labeling, self-presentation, and deep profiling-- is proposed to link to higher identity consonance, which in turn, relates to higher satisfaction and knowledge contribution. Attribution theory and self-verification theory are adopted as the primary theoretical explanations for the proposed hypotheses. As presented in Figure 2, the control

31
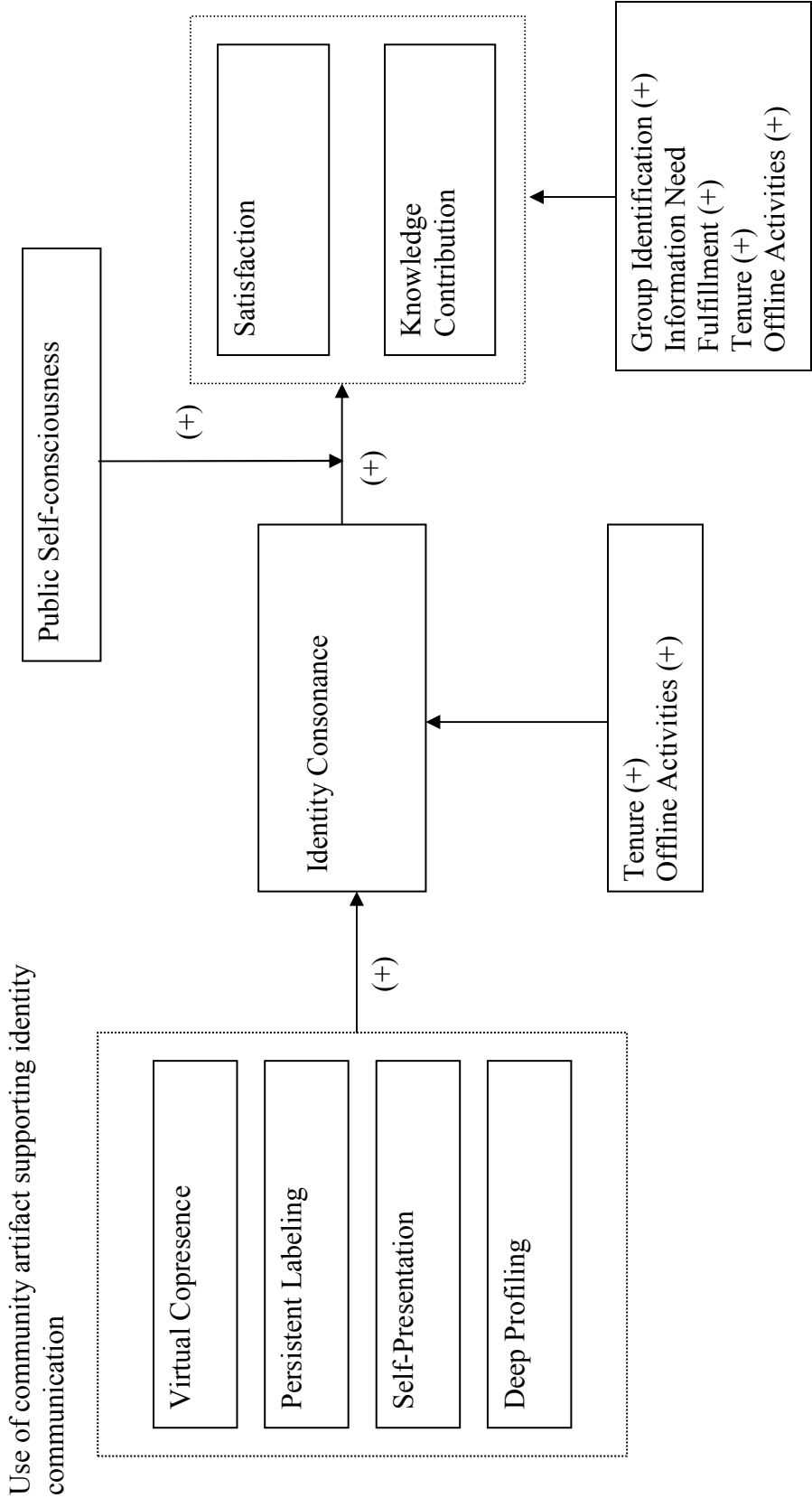
Figure 2: Theoretical Model

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variables (community tenures, offline activities, and community size) and a moderating variable (public self-consciousness) may also influence the level of identity consonance or the relationship between identity consonance and satisfaction and knowledge contribution. Below in section 4.2, I explain the four categories of community IT artifacts supporting identity communication in details.

4.2 Community Artifacts Facilitating Identity Consonance

In spite of the ubiquitous use of many community artifacts such as reputation systems and interaction archives, no theoretical underpinning has been provided to explain how these technologies can promote the success of a virtual community. Next, drawing upon a synthesis of empirical research and theories, including attribution theory and self-presentation theory, I propose that the use of four types of community artifacts (virtual co-presence, persistent labeling, self-presentation, and deep profiling) will lead to identity consonance, which in turn influences an individual's satisfaction and knowledge contribution in a virtual community.

Attribution Theory

Attribution theory explains how people use available information to develop social perceptions about others (Heider 1958; Jones and Davis 1965; Kelley 1972). One key arena in attribution research is actor-observer difference, defined as the different attributions made by behavior actors and observers (Ross 1977). Researchers have suggested that the observer may not be aware of the behavioral contexts or constraints

faced by the actor, therefore is likely to use stereotypes or over-attribute dispositional factors about the actor. In contrast, actors may use self-serving attribution to make inference of their behavior in favor of their own self-images. This attribution difference leads to different understanding of a focal person's identity. For instance, if a person fails a test, is it because s/he is not smart, or is it because the test is difficult? Experiments have showed that the subjects who took the test emphasized situational factors (i.e., the test is difficult), while the subjects who were observers were more likely to infer that the actor was unintelligent (Ross 1977).

Attribution differences can result in low identity consonance because the focal person makes different identity inferences from those made by others. Attribution difference is expected to be particularly strong in computer-mediated contexts because identity cues are less available compared to face-to-face communication (Gu and Jarvenpaa 2003; Lea and Spears 1992). Information related to behavioral contexts and constraints is also masked because of the unsynchronized and distant interaction between virtual community members. In such settings, actor-observer difference is likely to be more significant.

Several interventions have been proposed to reduce actor-observer difference. First, increasing individual *accountability* may reduces attribution difference (Tetlock 1985; Wells, Petty, Harkins, Kagehiro and Harvey 1977). Accountability is defined as the expectation that one is responsible to justify his/her feeling and behavior to others (Lerner and Tetlock 1999). It can attenuate bias because people pay greater

attention to social cues and engage in more effortful search for relevant evidence in the attribution process when they perceive more responsibility. A feeling of accountability can be achieved by inducing a sense of the co-presence of others or by increasing the identifiability of individuals (Lerner and Tetlock 1999). In other words, individuals feel more accountable for their behaviors when they feel the presence of others or when they know that others can identify them. Second, mechanisms that aid in the exchange of perspectives of actors and observers help reduce attribution difference. For example, in a lab experiment, when the actors saw a videotape showing their own behavior as seen by the observers, attribution difference was reduced (Storms 1973). In some other studies, the contexts or environment under which a behavior was conducted was brought to the observers' attention, which augmented their comprehension of the actors (e.g., Regan and Totten 1975).

Self-Presentation Theory

Goffman (1967)'s self-presentation theory argues that people want to explain themselves to others regarding their identities before concentrating on the work or other goals that bring them together. By reaching this consensus regarding identities, people will feel understood and obtain a sense of continuity and coherence (Swann et al. 2000). Individuals are motivated to present their identities to predict and achieve smooth interactions in everyday social life (Jones et al. 1981; Jones and Pittman 1982). He suggested that *co-presence* is essential to identity expression. An individual needs to both fill the duties of the social role and communicate the

activities and characteristics of the role to other people in a consistent manner (Goffman, 1967).

Based on an extensive theoretical and practical literature review and a close observation of a large number of online communities, Table 4 summarizes the community artifacts that may reduce attribution difference and promote self-presentation. I propose that four categories of community artifacts will increase identity consonance: *virtual co-presence, persistent labeling, self-presentation, and deep profiling*. Though there is no established framework investigating the factors facilitating identity consonance, these four categories are rooted in the current literature on why and how people present and communicate their identities, both online and offline. First, Goffman discussed that for people to engage in self-presentation, they must feel the co-presence of others. According to the research on accountability reviewed earlier, copresence enhances a sense of accountability and therefore reduces attribution difference. In a virtual community, this is supported by system features facilitating virtual-copresence. Second, different from face-to-face communication where people identify others by their "face", in online communities, each individual need be identified by a unique and persistent user ID. A unique and persistent user ID guarantees that other community members can build up their attribution about the focal person overtime (persistent labeling). Third, Leary (1996) summarize all tactics that individuals use to present themselves: verbal and non-verbal behavior, identity and social connection statement, etc. In a virtual community, this is supported by system features facilitating self-presentation.

Finally, attribution theory and research on mental models also discuss how people make their attribution about others based on the social information available. In a virtual community, this is supported by system features facilitating social information recording and exchange, i.e., deep profiling. Together, these four categories of IT features contribute to WHY individuals want to present themselves (virtual co-presence), WHO is presenting (persistent labeling), HOW to present oneself (self-presentation), and WHAT identity information is available (deep profiling). In addition to the support for the artifacts found in the research literature, I have reviewed popular virtual community (forum) software (e.g., phpBB, Invision Power Board, vBulletin, etc.) and summarized their features. I also observed the communities developed by individual companies, such as DELL, HP, etc. to make sure no technology currently widely available in online environments is missing. Below, I discuss these four categories of community artifacts in detail.

Table 4: Community Artifacts Reducing Attribution Difference and Increasing Identity Consonance

	Virtual co-presence	Persistent labeling	Self-presentation	Deep Profiling
Intervention	• Accountability (induce a sense of co-presence)	• Accountability (increase identifiability)	• Perspective Exchange	• Perspective Exchange
Definition	• A subjective feeling of being together with others in a virtual environment	• The use of a single label to present (identify) oneself	• The means by which the focal person presents herself online	• The digital organization of social information with which community members can identify the focal person
Sample Community Artifacts	• Instant Messenger • Chat room • "Who is online" feature • "Who is doing what" feature • Interactive tools (e.g., real time posting)	• UserID • UserID across different communities (e.g., MS Passport)	• User Name • Signature • Avatar or nickname • Profile • Personal page • Interactive tools	• Member directories • Reputation or rankings • Feedback • "Who did what" feature • Interaction archive and searching tools

4.2.1 Virtual Co-presence

Goffman defined co-presence as "a form of physical co-location in which individuals become accessible, available, and subject to one another" (Goffman 1963:22). He also suggested that a sense of co-presence is a requirement for both the perceiver and the perceived to engage in identity communication. Without co-presence, individuals may feel their identity expression cannot be observed and perceived. If we adopt a broader definition of co-presence, electronic proximity can also bring a sense of co-presence. Slater (2000) and other researchers (e.g., Biocca et al. (2003)) define virtual co-presence as a subjective feeling of being together with others in a virtual environment.

Nash et al. (Nash, Edwards, Thompson and Barfield 2000) and Lombard and Ditton (Lombard and Ditton 1997) review the factors that will promote a sense of presence or co-presence in a virtual environment. First, interactivity and the speed of interaction can affect presence (Khalifa and Shen 2004). For instance, using synchronized communication tools such as chat room and instant messenger may bring a sense of being together. Second, medium vividness, or whether the users can sense the presence of each other like in a real world, influences a sense of co-presence too. For example, some online communities show explicitly which members are currently connected online, or provide information about what an online user is doing, e.g., reading a message or typing a reply. The use of these features may improve an individual's sense of co-presence with other community members.

As reviewed earlier, a sense of accountability can be manipulated by the presence of others. Individuals who perceive higher co-presence should engage in a more effortful search of social information that helps them understand their own identities seen by others (Erickson et al. 2002; Erickson and Kellogg 2000; Gerhard, Moore and Hobbs 2002; Lerner and Tetlock 1999), which in turn may attenuate the attribution difference between members and lead to a high identity consonance. Furthermore, a feeling of co-presence also motives an individual to engage in more identity management and expression, facilitating the elimination of others' ignorance and bias toward the focal person. Hence, I propose,

> *Hypothesis 1: A virtual community member's use of community artifacts*
> *facilitating virtual co-presence is positively related to his/her identity*
> *consonance.*

4.2.2 Persistent Labeling

Anonymous communication online is double-edged, having both positive and negative impacts on virtual group communication (Davenport 2002). On the one hand, anonymity, promoting free speech and a sense of privacy, may be beneficial to the online community by encouraging participation and the expression of ideas (Connolly et al. 1990; DeSanctis and Gallupe 1987; Jessup et al. 1990). For example, Connolly et al. proved that anonymity produced more solutions and comments in a group decision system. On the other hand, research on deindividuation suggests that people would be less concerned about their image and behave socially undesirably when communicating anonymously due to reduced accountability, i.e., they no longer

feel that they can be identified and evaluated (Siegel, Dubrovsky, Kiesler and McGuire 1986) in the absence of the body as a source of social legibility.

Even though the revelation of real-world identity (i.e., name) is not required for most online communities, users maintaining a permanent ID (label) online may perceive more accountability than those without a persistent label. Members who keep a label for a relatively longer time have usually gained more identity capital and are more identifiable. According to attribution theory, increased accountability due to identifiability will lead to a higher identity consonance. Moreover, intuitively, individuals who change their ID frequently are less likely to be recognized and understood by others, hence,

> *Hypothesis 2: A virtual community member's use of community artifacts*
> *supporting persistent labeling is positively related to his/her identity*
> *consonance.*

4.2.3 Self-presentation

People often use stereotypes to infer other community members' dispositions. However, an individual's actual identity can be very different from the stereotyped one. Self-presentation is a process to communicate one's identity, helping others form a more sophisticated and accurate understanding of individual identity.

Community artifacts for self-presentation are listed in Table 4. I have observed multiple virtual communities to find how these artifacts are used to express individual

identity. For example, a community member explained in a post why he chose his screen name "tgskeeve":

> *"My personality was reminiscent to the bungling wizard 'The Great Skeeve' in Robert*
>
> *Asprin's 'Myth' series…It's frightening how much Skeeve and I thought alike (ethic,*
>
> *philosophies, etc). I decided on the handle…This way I have been identifiable by others."*

A signature file can be appended to a post. It is usually a statement of personal style and value. Here is a sample signature that expresses an individual's identity as a knowledgeable sport fan:

> *"Qiaqia's top 5 saddest sports moments in 2003:*
>
> *1. Yankees lost in the world series…2. Steelers lost in OT in the playoff…*
>
> *3. Fitzgerald did not win Heisman….4. Steelers couldn't win 2 games in a row….*
>
> *5. Pitt football didn't win Big East and go to a BCS Bowl… "*

Similarly, an avatar is a visual symbol that usually presents some personality. The selection of avatars expresses one's personality or social attitude, helping other members understand the social or personal identity of the focal person (Golder and Donath 2004; Smith, Farnham and Drucker 2000). Sample popular avatars include the Simpsons avatar, pop stars avatar, or customized avatars designed by the user. Some people use their own photos, which present more physical appearance cues. User profiles may include any identity information about a user, such as photos, background, experience, interests, and habits. Some virtual communities add statistics or log files into individual profiles regarding a user's activities, such as the total number of posts and the total amount of time of site visiting. Some other

communities allow users to create or link personal webpage, offering even more space for self-presentation.

The asymmetric attributions by actors and observers are partially due to information asymmetry, i.e., the observer's lack of information of the actor's environmental and personal characteristics. Experiments have found that providing the same information to both parties eliminated the attribution differences (Hansen and Lowe 1976). A focal person actively using the community artifacts described above makes available his/her behavioral contexts, social associations, dispositional traits and value systems to other community members, which, according to prior studies, may reduce the actor-observer attribution differences and lead to a high identity consonance.

> *Hypothesis 3: A virtual community member's use of community artifacts facilitating self-presentation is positively related to his/her identity consonance.*

4.2.4 Deep Profiling

For efficient identity communication, personal and social identity information needs to be available to community users to construct a mental representation about others. Even though many identity cues available in the physical world are missing, computer-mediated communication could also have some advantages over face-to-face communication. Knapp and Vangelisti (2000) suggested five stages in relationship formation: initiating, experimenting, intensifying, integrating, and

bonding. In an online community with a ranking system (i.e., a user can be rated by others based on her expertise, willingness to help, contribution, or other criteria) and/or an interaction archive (where previous social interactions among members are recorded and available to all members), a great deal of social and identity information has already been provided to the new users, hence, the pace of relationship building and interpersonal recognition may be accelerated in communities offering such features. Ranking systems and archives serve as an extended memory of social information, helping users, especially new members of a community, to understand a focal person's identity.

According to attribution theory, community artifacts in this category help reduce attribution differences and promote identity consonance. First, community archives record more accurate context information of previous social interactions than traditional mechanisms such as word-of-mouth. As explained earlier, a lack of awareness of an actor's behavioral contexts may result in attribution difference. Therefore, interaction archives with context information help observers understand the identity of the focal person. Additionally, user directories and efficient archive search tools help users find others' identity information more easily. For example, HP's customer forum lets users to search all the posts by a particular user. This feature helps other members find rich identity information about the focal person such as what her expertise is (i.e., where does she always post an answer) and who she likes to interact with frequently. Second, ranking (or reputation) systems, archives and feedback help an actor reflect on her own behavior and hence take the perspective

of an observer. Examining oneself from a third person's perspective can help reduce self-serving attribution errors, which in turn minimizes the gap between the self-view of an actor and the appraisal of others (Bem 1972). Albright and Molloy (1999) empirically demonstrated that an opportunity to observe one's own behavior in social interaction increased the accuracy of a person's social judgments of herself. This leads to the following hypotheses:

Hypothesis 4: Other virtual community members' use of community artifacts supporting deep profiling is positively related to the focal person's identity consonance.

4.3 Consequences of Identity Consonance

A social structure is sustainable only when it can provide continuing emotional or informational benefits or resources to its members (Butler 2001). Without such benefits, it is difficult for a virtual community to attract new members and retain older ones. In the limited amount of literature currently available, the sustainability (continuance) of an online community is investigated in two levels: community level and individual level. In the community level, the number of active community members and community activities are two of the most frequently used indicators of social structure continuance. Butler (2001) adopted a resource-based view to study the relationship between communication activities and membership size. He suggested that knowledge creating and transferring between community members would ultimately impact the community sustainability. In the individual level, the

community sustainability variables that have been examined include individual commitment (Hertel et al. 2003; Koh, Kim and Bock 2004), knowledge contribution and pro-social behavior (Constant et al. 1996; Faraj and Wasko 2003; Subramani and Peddibhotla 2003), and sense of community (Blanchard and Markus 2004; Koh and Kim 2003).

In this study, two individual level variables are investigated as surrogates for community sustainability. First, satisfaction indicates whether a member is satisfied with her access to the community resources and continues the membership. Communities with a large number of unsatisfied participants are less likely to survive in the long term. Second, member participation provides resources to the community and the contribution of members pooled together helps the continued existence of the community. An online community will not be able to develop in a healthy fashion unless it has ongoing activities and discussions that provide knowledge or emotional support for its members. It worth noting that I acknowledge the importance of lurkers, which make up over 90% of many online group (Nonnecke and Preece 2000). Nonnecke and Preece (2000) argue that posting is only one way of social engagement and lurking is normal, acceptable and maybe even beneficial to the community. However, lurkers were found to be more neutral or negative about their experience in an online community and less likely to stay compared to posters (Nonnecke, Preece and Andrews 2004). How lurkers really affect online community sustainability needs further investigation, which is beyond the research topic of this dissertation.

4.3.1 Satisfaction

Self-verification theory indicates that people seek confirmation of their identity (Swann, 1983). The majority of studies on self-verification have investigated and found a strong relationship between identity verification and satisfaction (De La Ronde and Swann 1998; McNulty and Swann 1994; Swann 1983; Swann et al. 2004). For example, in a longitudinal study, Swann et al. (2000) found that personal identity (academic ability, skill at sports, social competence, and creative ability) verification heightened participants' feeling of connection to their group and reduced interpersonal conflict. Chen et al. (2004) found a similar relationship for social identity verification.

Individuals in a virtual community whose identities are recognized and verified by others will feel better understood and are more likely to believe they will be treated in ways desired. They interact with other more easily with less misunderstandings and conflict, because the interaction partners' expectation matches the focal person's self-view. In other words, individuals think that they can better predict and control the proceeding of the social interaction when their identities are verified (Chen *et al.* 2004). Hence, I propose:

> *Hypothesis 5: A virtual community member's identity consonance is positively related to their satisfaction with the community.*

4.3.2 Knowledge Contribution

What motivates knowledge contribution among strangers in computer-mediated contexts has been explored by several studies recently. Constant, Sproull and Kiesler (1996) examined the use of email for help seeking and giving within an organization and suggested that citizenship behavior and the desire to benefit the organization were the major motivations for helping behavior. Other work by Constant et al. (1994) showed that people were more willing to share information that expressed their identities (i.e. personal expertise) than share information not identity-related. Wasko and Faraj (2000) noted that altruism, generalized reciprocity, and community interest were important motives. Further, Subramani and Peddibhotla (2003) examining individual contribution to product reviews of an Internet store noted that social affiliation, professional self expression, reputation benefits, and social capital help explain the motivations underlying contribution.

According to the research discussed above, two core expectations motivate a community member to contribute knowledge: individual interests and group interests. For individual interests, community members contribute knowledge to gain reputation, future reciprocity, self-expression, and social capital. In this sense, a high level of identity consonance fulfills such expectations and promotes further contributions. For group interests, community members contribute knowledge because they want to benefit a group and its members. However, they must first engender a feeling of being part of that group before contributing (Chen et al. 2004). In other words, the social identity as a group member and other related identities must

be first recognized. By reaching this consensus regarding identities, people will feel confident to interact with a sense of continuity and coherence (Swann et al. 2000).

Hence, no matter what motivates individuals to contribute, individual or group interests, identity consonance represents a prerequisite and an important motivation for knowledge contribution and activity participation. Numerous studies have provided evidence that acknowledgment from group members increases a focal person's contribution (Hertel *et al.* 2003; Stasser *et al.* 1995; Thomas-Hunt *et al.* 2003). Evidence from the self-verification literature has also showed that people prefer interacting with partners who verify their personal and social identities than those who do not (e.g., Swann, Pelham and Krull 1989). For example, Chen, Chen and Shaw (2004) designed two experiments and found that people preferred to interact more with (personal identity or social identity) verifying partners instead of non-verifying partners. Hence, I propose:

> *Hypothesis 6: A virtual community member's identity consonance is positively related to his/her knowledge contribution.*

The causal relationship between identity consonance and knowledge contribution could be bidirectional. Intuitively, community members who contribute more knowledge will reveal more about their expertise in a particular area and therefore, are more likely to be recognized as experts by other people. However, contributing knowledge does not necessarily express other aspects of a person, i.e., other salient identities not directly related to the theme of the community. For example, a

community member at dpreview.com (a digital photography forum) may help answer many questions regarding photography but does not express any other important aspects of her identity. Hence, the link from knowledge contribution to overall identity consonance is not proposed.

4.4 Moderating Effects

People try to present and confirm their identities or self-image to both internal (oneself) and external audiences (others). However, they may not weigh the two types of audiences equally (Markus and Wurf 1987; Thatcher and Zhu 2004). Depending on an individual member's dispositional traits, he or she may rely more on others' appraisal, or, place more emphasis on verification from oneself to obtain a sense of satisfaction (Thatcher and Zhu 2004). Because the identity consonance construct describes the perceived fit between an individual's belief of her identity and the recognition from external audiences, the relationship between identity consonance and satisfaction and knowledge contribution will be stronger for virtual community members with a stronger focus on external audiences. For individuals who emphasize the inner audiences more, confirmation from others has relatively less impact for their sense of achievement and satisfaction.

From the personality psychology literature, there are three personal traits that illustrate this individual difference. Public self-consciousness describes a person's tendency to focus on self as perceived by others (Buss 1980; Fenigstein, Scheier and Buss 1975; Trapnell and Campbell 1999). Individuals high in public self-

consciousness are more sensitive to their publicly displayed aspects of the self that can be evaluated by others, while those low in public self-consciousness focus more on their inner feelings. Another relevant trait is need for approval, defined as the extent to which an individual would give socially desirable responses to get approval from others (Crowne and Marlowe 1960). Similarly, self-monitoring describes the extent to which people monitor and change their behavior in social situations (Snyder 1974). Both need for approval and self-monitoring focus on the individual tendency to change the behavior in a socially favorable way, which could be more applicable to study work groups where the ability to move from one occupation or group to another is relatively low (low mobility). In a virtual community, people may be less willing to change their behavior according to others' expectation because they can leave the community easily. Therefore, in this study, public self-consciousness is proposed as a moderator, even though all three traits are indicators of a need for social acceptance.

Hypothesis 7a: The relationship between identity consonance and member satisfaction will be stronger for a virtual community member with a high public self-consciousness.

Hypothesis 7b: The relationship between identity consonance and knowledge contribution will be stronger for a virtual community member with a high public self-consciousness.

4.5.1 Control Variables for Identity Consonance

Besides using community artifacts to form one's online identity two other variables may influence the level of identity consonance. First, individual tenure in a virtual community can have a positive link to identity consonance. Members who have been with a virtual community for a longer time are shaping and communicating their identities in day-to-day interactions with other members, and therefore may perceive a higher fit between their own self-views and those of others. Second, offline activities can be positively related to identity consonance. Identity communication online can be broadened and reinforced during face-to-face communication. Through offline activities, virtual community members will be able to express and obtain more identity cues (Fulk, Steinfield, Schmitz and Power 1987).

4.5.2 Control Variables for Satisfaction and Knowledge Contribution

The first variable that could affect satisfaction and knowledge contribution is group identity, a construct builds on the theory of social identity (Tajfel 1978; Tajfel and Turner 1986). The key point of this theory is that when an individual identifies herself with a group, she tends to think of in-group members as better than out-group. The explanation for such preference is that individuals are motivated to maintain a positive self-image, which is composed of personal identity and social identity. Group membership forms individuals' social identity, so they appear automatically to

elevate their social identity to improve their self-image. Therefore, people tend to be more satisfied with the group with which they identify (i.e., favoring in-group members over out-group). In addition, individuals may engage in more pro-social behavior (i.e., knowledge contribution) in order to benefit the group and be perceived positively by group members (e.g., Constant et al. 1996; Ellemers, De Gilder and Haslam 2004; Simon, Stürmer and Steffens 2000).

Another variable that can potentially influence the dependent variables is information need fulfillment. As reviewed earlier, human behavior is goal oriented and people tend to be satisfied and pleased when their information acquisition goal is realized in an online community. In addition, when individuals fulfilled their information need, they are more likely to reciprocate others' favor by engaging in pro-social behavior and contribute their own knowledge.

Finally, the two control variables for identity consonance may also influence the dependent variables. Individuals who stay longer in a community are more likely to be satisfied and contribute knowledge. In addition, offline activities may also increase satisfaction and knowledge contribution. To summarize, four variables—group identification, information need fulfillment, tenure, and offline activities — are included as controls of satisfaction and knowledge contribution.

4.6 Non-fully Mediated Model

This study focuses on investigating the role of identity formation in virtual community satisfaction and participation. The proposed model in Figure 2 is primarily based on extant social psychological research on identity verification, much of which addresses the importance of identity management in everyday interaction. Nevertheless, there are alternative theoretical perspectives in the sociology and linguistic literature that tackle the same problem from different angles. Hence I consider a non-fully mediated model to recognize these other perspectives.

The non-fully mediated model proposes a direct relationship between community artifacts usage and member satisfaction and knowledge contribution based on symbolic interactionism and common ground theory. Symbolic interactionism is one of the major theoretical perspectives in sociology. Interactionists argue that individuals adjust their reaction and attitude according to their interpretation of others' behavior. Therefore, to interact smoothly, an accurate interpretation based on mutual understanding and shared social norms is necessary. Using the community artifacts facilitating communication promotes a sense of familiarity, understanding, and interpersonal attraction, which may lead to satisfaction and pro-social behavior (e.g., Clark, Oullette, Powell and Milberg 1987). In addition, the common ground theory in the linguistic literature can also be applied to explain how different media characteristics and functions influence communication. It is argued that people interacting with each other need to develop shared understanding in a conversation, i.e. common ground. The establishment of common ground facilitates constructive

and satisfactory social interaction. And media features, such as co-presence, simultaneity, reviewability, and visibility, may affect the ease with which common ground is established.

4.7 Summary

In chapter 4, the key construct of my dissertation—identity consonance—was discussed. Defined as the perceived fit between a focal person's belief about her identity and the recognition and verification of this identity by other community members, identity consonance was argued to relate to individual satisfaction and knowledge contribution in an online community. I propose that the use of four types of community IT artifacts, including virtual co-presence, persistent labeling, self-presentation, and deep profiling, will promote identity consonance. In addition, public self-consciousness is suggested to moderate the relationship between identity consonance and satisfaction and knowledge contribution. Finally, I also acknowledged the possible existence of an alternative model and presented it in this chapter. The next chapter discusses the research setting and method for this dissertation and some preliminary results from the interviews.

Chapter 5: Methodology

This chapter discusses the research methodology. The research model and hypotheses proposed in Chapter 4 are tested using a survey method. Due to the lack of existing research on online identity management and community IT infrastructure, semi-structured interviews were first conducted to provide preliminary support for the proposed identity consonance construct and theoretical framework. Then, I conducted a pilot study by recruiting graduate students from the University of Maryland. The pilot study served to validate the reliability of the scales that are used in the final survey. Finally, this chapter presents the final research setting, together with the refined measurement developed from the pilot study.

5.1 Preliminary Interviews

The preliminary interviews used semi-structured questions and were conducted either face-to-face or via instant messenger with online community members. Their purpose was to discover important constructs that may have been overlooked, to obtain some preliminary support for the research model, and to provide insights into questionnaire design. Randomly selected community members from five virtual communities were invited for the interview. Two interviewees were from the Dell customer forum (a technical support online community), two from QuitNet.com (an emotional support forum for people who want quit smoking), two from information bulletin boards (local information forum), and finally, one from an event-planning forum (the purpose of the forum is to plan a big event). These communities represent

different type of online social gatherings as suggested by Armstrong and Hagel (1996). Appendix 1 presents the interview questions and response summary. The respondents were asked questions about their use of community IT artifacts, their experience and activities in the community, and their feeling of being recognized and understood by others. The interviews provided preliminary support for the presence of the proposed constructs and the relationships between them (see Appendix 1). Overall, interviewees with a higher identity consonance were more satisfied with their experiences in the community and usually participated more. They also used more community artifacts to present themselves and manage their identities.

5.2 Pilot Study

An online survey was designed with instruments adapted from existing scales or developed for this study. Section 5.4 discusses the development of survey instruments in detail. In the pilot study, the link to the online survey was sent to PhD students in the Information Systems department and graduate students in the Electronic Engineering, Computer Sciences, and Information Studies departments. I received 52 complete responses. Although the use of graduate students may limit the generalizability of the pilot study results, students constitute one of the major groups of participants in virtual communities. The results from pilot study provide support for the instrument design and research model. Measurement validity and reliability were assessed using factor analysis and Cronbach's α. I dropped a few indicators due to their poor internal reliability and validity. Section 5.4 presents the detailed information related to the survey instrument.

5.3 Research Setting and Method

I tested the hypotheses using survey data collected from two online communities. The first selected research site, QuitNet.com, is an online emotional support community for people who want quit smoking. It was first launched on the web in 1995 by a smoking cessation counselor, and later was supported by the Boston University School of Public Health. About 3,000 messages are posted on QuitNet everyday. According to the site, it has over sixty thousands smokers and ex-smokers all over the world getting together online each month to provide support to each other. The second research site, myIS.net, is an online community for the Lexus IS300 sport sedan owners or potential owners. It first launched online in 1999, and has about twenty-six thousands registered members (active or inactive). The two research sites were selected because they represent two different types of online communities categorized by Armstrong and Hagel (1996): a community of relationship or emotional support (QuitNet) and a community of common interest or information exchange (myIS). By examining these two communities, I can explore the importance of identity consonance in various communities and investigate whether members from different types of communities have similar behaviors (e.g., engage in self-presentation). These two sites had all the community IT features I intend to study, except that QuitNet does not have a ranking system and Avatar.

To minimize common method variance, I conducted the survey in two stages. Previous research has suggested that collecting measures at different time is one

effective procedural method to reduce common method variance (Podsakoff and Organ 1986). In my dissertation study, the first survey included questions measuring independent and mediating variables, and the follow-up survey, which was conducted two weeks after, includes the measurement of the dependent variables.

To speed data collection for researchers and reduce participation costs for respondents (Couper 2001; Read 1991), the final study used a web-based survey. The online survey method does not appear to create response bias (Boyer, Olson, Calantone and Jackson 2002) and is gaining acceptance in various research disciplines (Bhattacherjee 2001; Fulk, Heino, Flanagin, Monge and Bar 2004). Both communities agreed to advertise the study to their members. QuitNet has a private message system that administrators can use to make announcement. Community members also use it to contact each other. My study was announced on March 15, 2005 and the announcement was online for one week. I asked the QuitNet administrator to broadcast this study only to its US users so that variance caused by other factors such as language and culture can be minimized. Two weeks after the first survey, I sent the link to the follow-up survey to users who completed the first survey. After another one week, a reminder was sent to those who had not filled out the follow-up. In total, 500 complete responses from QuitNet were received. According to QuitNet administrator, there were 3769 unique US users logged on QuitNet during that week. Because there is no easy way to find out if those users actually checked their private messages during their session, the response rate should be 13.3% or higher.

The data collection at myIS.net followed procedure similar to that used at QuitNet.

MyIS announced my study as site news at the first page of its homepage. I received

166 complete responses. According to the site, there were 790 users who viewed the

news during the two weeks that the first survey was open, so the response rate is

approximately 21.0%. Table 5 presents the demographic information of the

respondents in terms of gender, age, education, Internet experience, and community

tenure.

As shown in Table 5, there are some significant differences between the respondents

from two communities. myIS.net is mainly dominated by male users, while QuitNet

has more female respondents. This difference is not surprising because the IS300 is a

sport sedan, and the discussion in myIS forums focuses on car racing, new car

modesl, auto parts, etc. These topics are typically more attractive to males. Most

users of QuitNet release their gender in their personal profiles. I randomly checked

about 50 users and there are more female users than male. It is possible that females

are more likely to participate in emotional support communities and provide and

receive support. Research in psychology has shown that women are generally more

relational interdependent (Gabriel and Gardner 1999). Other studies on smoking

cessation programs show similar percentage of women participants (e.g., Feil, Noell,

Lichtenstein, Boles and McKay 2003). To determine if gender plays a role in the

relationships in the research model, t-tests were conducted for QuitNet members

comparing means of all major variables for males and females. The results show that

none of these variables are significantly different except satisfaction. Females tent to

be more satisfied with their experience in the community than males (hierarchical

regression conducted later indicates that gender is a significant predictor of

satisfaction, but not as important as other proposed variables: $\Delta R^2 = 0.01$). The

average age of the two communities is also different. On average, members of

QuitNet are older than members of myIS. This difference can be explained by the

fact that younger people are more likely to be interested in sport cars and car racing.

Table 5: Demographic Information of Respondents

		Quitnet.com (N=500)	myIS.net (N=166)
Gender*	Male	105 (21.5%)	155(95.1%)
	Female	383 (78.5%)	8(4.9%)
Age*	18-25	29 (5.9%)	82 (49.7%)
	26-35	122 (24.6%)	65 (39.4%)
	36-45	147 (29.7%)	12 (7.3%)
	46-55	153 (30.9%)	5 (3.0%)
	>55	44 (8.9%)	1 (0.6)
Education*	2 years high school	8 (1.6%)	1 (0.6%)
	4 yrs high school	118 (23.6%)	20 (12.0%)
	2 years college	165 (33.0%)	51 (30.7%)
	4 years college	97 (19.4%)	52 (31.3%)
	> 4 years college	111 (22.2%)	41 (24.7%)
Internet Experience (years)*		8.33 (S.D.= 3.90)	9.38 (S.D.= 2.82)
Tenure (months)		12.10 (S.D. =15.53)	24.34 (S.D. =15.39)

* Due to missing values, the sum of numbers may be smaller than sample size.

I compared means for all the major variables and demographics for early respondents

and late respondents to test for possible non-response bias (Oppenheim 1966). The

results of t-tests for the demographic profiles, Internet experience, community tenure,

satisfaction, group identification, etc. are not significant. The only significantly

different construct is knowledge contribution (self-reported or the count of number of posts). The implication of this difference will be discussed later.

5.4 Measurement

Appendix 2 shows the survey items. They are either adapted from existing scales or developed for this study. Below, I explain the measurement for each variable in the theoretical model.

Independent Variables: I measure four independent variables: the use of community artifacts supporting virtual co-presence, persistent labeling, self-presentation, and deep profiling. These four variables are measured with multi-item instruments that ask respondents to rate the extent to which they use each community feature listed in table 4. The use of some community artifacts may not be treated as uni-dimensional because individuals may use multiple community features to communicate their identities. The use of one artifact may not imply the use of another one, although it would increase the overall level of IT usage. For example, a user may use chat room intensively but not instant messenger (virtual co-presence features), she may use signature instead of an avatar (self-presentation features). Therefore, the use of any artifact combines to define a construct, instead of as the manifestation of a uni-dimensional construct (which is a reflective indicator) (Bollen 1989).

As virtual co-presence and self-presentation may be made up of formative indicators, the recommendations by Diamantopoulos and Winklhofer (2001) on formative index

construction are followed. Unlike scale development for reflective measures (i.e., items are reflective indicators of a latent construct), the validation of formative indicators (i.e., items are observed variables that cause a latent construct) uses different criteria. Because the latent variables are determined by their indicators instead of vice versa, failure to consider any aspect of the latent variable will lead to an exclusion of relevant indicators and therefore part of the latent variable itself (Nunnally and Bernstein 1994). Extensive literature review and explorative interviews with researchers, industry professionals, and virtual community members can ensure that the indicators selected cover the complete content domain of the latent variables.

The other two independent variables, deep-profiling and persistent labeling, are more appropriately measured using reflective items. As show in Appendix 2, respondents were asked whether they use a single user name and whether they use multiple IDs. These two items measuring persistent labeling should be highly correlated. For the measurement of deep profiling, the indicators are likely to be correlated as reflective items as well, because, different from measuring the use of features directly, deep profiling is measured as a focal person's perception of others. The focal person may not know exactly what specific deep profiling features others use, but she probably has a general sense regarding the overall use by other members.

The factor analysis discussed in the next chapter provides support that the measures of virtual co-presence and self-presentation are formative. However, because the line between formative and reflective measures is not always clearly drawn, as suggested by

Chwelos, Benbasat and Dexter (2001) and Fornell and Bookstein (1982), I test another version of the model with all constructs reflective. The result is qualitatively the same in terms of path significance and path signs. Thus, the results can be considered stable and not an artifact of modeling decisions.

Mediating Variable: There are two methods to measure fit in the extant psychology literature: perceptual fit and actual fit. The measurement of actual fit is usually used in studying small groups (2-4 members). Researchers measure the identity (or other constructs) of the focal person first and then other group members' perceptions about the focal person. Based on this, a "fit" score can be calculated. Perceptual fit is usually used to study large groups, such as person-organization (P-O) fit or person-job fit (for a review of subjective fit measurement, see Cable and DeRue 2002). For example, researchers measure P-O fit by asking the responses to rate the extent to which they think their values are consistent with organizational value. Because P-O fit has been measured and used to predict many individual behaviors, I can have some confidence that a perceptual measure of fit is a valid measurement. In this dissertation, virtual communities usually have thousands of members, therefore a measure of "real" fit is impossible. Most importantly, as I have argued earlier, it is an individual's perception of fit that determines her behavior and attitude.

I used a modified Twenty Statements Test (TST) introduced by Kuhn (1954) to capture salient identities of each community member. TST asks respondents to fill in the blank for 20 statements like "I am ____". It is an open-ended identity measurement that has

been adapted and used in numerous studies (e.g., Hong, Lp, Chiu, Morris and Menon 2001; Rhee, Uleman, Lee and Roman 1995) and validated by Kuhn (1954) and Driver (1969) using independent criteria. An individual has multiple identities and in different contexts, different identities may become dominant. In other words, salient identities may be distinct in different communities. As has been done in many previous studies (Hong *et al.* 2001; Rhee *et al.* 1995), I captured salient identities in a specific community using a modified Twenty Statements Test, which asks respondents to complete statements like "In *** (the name of a community), I am _____" . Also similar to previous studies, I reduced the number of items from 20 to 5 to minimize the effects of fatigue. After TST, the respondents were asked to rate their perception of other community members' recognition and verification of those salient identities.

Dependent Variables: I measured two dependent variables: satisfaction and knowledge contribution. Due to the lack of established scales, I developed the community member satisfaction measures for this study based on the group member satisfaction items by Duffy, Shaw and Stark (2000). Knowledge contribution measures were adapted from Faraj and Wasko (2003), and Koh and Kim (2003). In order to address the potential for common method bias, I include objectively measured contribution by counting the total number of messages posted by each respondent in the two weeks before the survey.

Control Variables: I assessed tenure in a community by asking respondents "how many hours per week do you spend in this community" and "how long have you been with this community". Offline activities measures were adapted from Koh and Kim's

items (2003). The group identification instrument was derived from Mael and Tetrick

(1992)'s scale of organizational identification, which was later adapted by Polzer et

al. (2002) to measure group identification. This study measured information need

fulfillment with items adapted from Dholakia, Bagozzi and Pearo (2004). Public self-

consciousness was evaluated using Buss's instrument (Buss 1980) of self-

consciousness.

5.5 Summary

In this chapter, I reported the results of the preliminary interviews and the pilot study.

The research setting and method were presented and justified. I selected two sites

representing two different types of online communities to test the proposed model and

hypotheses. I summarized the demographic information of participants and presented

the measurement scales that were used in the final survey.

Chapter 6: Results

This chapter explains why PLS is appropriate for testing the research hypotheses. The application of PLS to the measurement and structural models is described. I discuss the empirical findings of this dissertation in detail in this chapter. For easier comparison, the results from the two sites are presented side-by-side.

6.1 Rationale for Statistical Technique

I apply Partial Least Squares (PLS) as the major statistical technique. As in the case with LISREL, PLS is a structural equations approach with unobservable variables (Wold 1981). It is an extension of multiple regressions. Different from LISREL and other factor-based covariance approaches, PLS avoids many restrictive assumptions (such as sample size and normality) required by maximum likelihood techniques (Joreskog and Wold 1981). PLS has been applied in a variety of disciplines, including chemistry (Wold 1981), marketing (Fornell and Bookstein 1982), and information systems (Agarwal and Karahanna 2000).

I apply PLS as the major statistical technique for the following reasons. First, PLS is widely accepted as a technique to conduct exploratory model testing, while LISREL is usually used for theory confirmation (Fornell and Bookstein 1982). In other words, PLS is better suited for testing theories in the early stage. Second, LISREL cannot handle formative indicators (Chin 1998; Fornell and Bookstein 1982). Because my measurement includes formative indicators, PLS is more suitable for this study.

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Finally, PLS places minimal demands on variable distributions. Some of my variables are not strictly normal distributed, which may cause problems for factor-based covariance approaches using software such as LISREL and AMOS (Chin, Marcolin and Newsted 2003)

6.2 Measurement Model

To validate the measurement model, reliability, discriminant validity and convergent validity were assessed to the reflective indicators. Reliability is the degree to which an instrument is consistent and free from random errors (Straub 1989). In my dissertation, it was evaluated with Cronbach's α and Fornell's composite reliability values. Discriminant validity and convergent validity are two sub-categories of construct validity. Convergent validity is the agreement among items measuring the same construct. Discriminate validity is the lack of relationship among items measuring different constructs. They were assessed with principal component factor analysis and Average Variance Extracted (AVE) values.

Table 6 shows the number of items used in the survey, the number of items after factor analysis, descriptive statistics of major variables, and Cronbach's α. Note that virtual co-presence and self-presentation were measured with formative indicators and the assessment of α and factor analysis is not applicable (Edwards 2001). Instead, table 6 presents the α of a reflective measure of perceived virtual co-presence adapted from previous research (see Appendix 2). Later, I assessed the correlation between the reflective and formative measures of virtual co-presence.

Five identities were solicited from the respondents and two items were used to measure consonance for each identity. Hence, there are 10 items in total for identity consonance. Factor analysis showed that the consonance measures for the last three identities did not load on the same factor as the first two identities. It is possible that the first two identities provided by a respondent are the most salient identities. Therefore, only the consonance measures for the first two identities are maintained for later analysis.

Overall, the reliability of the measurement scales is reasonably good. All αs are greater than 0.7 except one (α=0.68). Means for most variables are similar in two sites except "information obtained from the community". MyIS members (Mean = 2.74) generally obtained more information from the site than Quitnet members (Mean = 1.47). It confirms that Quitnet is largely an emotional support community, while myIS is an information exchange and common interests community. Self-reported knowledge contribution in both communities is a little below neutral (Mean = 3.93 and 3.77), while the overall satisfaction of community experience is very high (Mean = 6.57 and 6.56). Though it is not significant, members from Quitnet felt more understood by others than those from myIS. It is plausible that mutual understanding is higher in an emotional support community than in an information exchange community. In both sites, identity consonance is below average (less than 4 on a 1-7 likert scale).

Table 7 provides the rotated (Varimax) loadings of principal components factor analysis. For easier comparison, loadings are reported side-by-side for the two sites, in order of Quitnet, and myIS. The results indicate that indicators load more strongly on their corresponding construct (>=.62) than on other factors in the model (<=.40). The loadings of virtual co-presence and self-presentation measures are not presented. The measurement items of these two constructs do not load on one factor, confirming that they are formative measures.

Table 6: Descriptive Statistics and Measurement Reliability

Construct	No. of Items (before)	No. of Items (after)	QuitNet			MyIS		
			Mean	S.D.	Cronbach's α	Mean	S.D.	Cronbach's α
Knowledge contribution (KNO)	4	4	3.93	1.15	0.89	3.77	1.23	0.91
Satisfaction (SAT)	2	2	6.53	.94	0.68	6.56	.90	0.76
Identity Consonance (IC)	10	4	3.83	1.18	0.91	3.32	1.05	0.89
Virtual co-presence (reflective) (VCR)	2	2	6.42	.72	0.89	6.19	.81	0.82
Persistent labeling (PL)	2	2	5.31	1.17	0.82	5.56	1.10	0.83
Deep profiling (DP)	4	3	3.84	.89	0.77	3.50	1.02	0.82
Group identification (GI)	6	6	4.67	1.14	0.90	4.15	1.25	0.90
Information Need (INF)	5	5	1.47	1.03	0.89	2.74	1.78	0.90
Offline activities (OFF)	4	4	3.97	.882	0.88	4.09	.92	0.94
Public self-consciousness (SC)	6	5	4.89	1.32	0.85	4.32	1.32	0.82

Notes: For formative indicators (for virtual co-presence and self-presentation), internal consistency and factor analysis cannot be used to assess their reliability and validity

Table 7: Results of Factor Analysis

	KNO	SAT	IC	VCR	PL	DP	GI	INF	OFF	SC
KNO1	**.73,.77**	.29,.24	.19,.21	.16,.05	.08,.09	.18,.02	.08,-.01	.05,.07	.10,.25	-.03,-.07
KNO2	**.72,.76**	.31,.21	.12,.17	.15,.21	.08,.05	.21,.21	.12,.12	.11,.11	.08,.18	-.07,.01
KNO3	**.80,.81**	.11,.11	.19,.28	.09,.05	.13,.18	.13,.16	.06,.00	.04,-.05	.12,.18	-.01,-.13
KNO4	**.79,.80**	.09,.14	.21,.23	.19,.15	.05,.02	.22,.16	.06,.10	.04,.01	.12,.21	-.03,-.12
SAT1	.17,.32	**.74,.83**	.01,-.02	.21,.07	.06,.02	-.06,-.10	.15,.11	.17,.18	-.03,-.05	.02,.02
SAT2	.36,.39	**.62,.73**	.17,.18	.28,.12	.15,.00	.12,.14	.10,.17	.03,.12	-.00,-.09	-.01,.11
IC11	.15,.13	.27,.05	**.82,.78**	.03,.23	-.02,-.05	.12,.03	.04,.01	-.02,-.02	.04,.22	.02,.07
IC21	.20,.27	-.14,-.04	**.78,.77**	.24,.04	.09,.09	.12,.09	.06,.17	.05,.07	.06,.22	.06,.04
IC12	.12,.14	.28,.06	**.81,.83**	.00,.12	.05,.07	.14,.18	.07,.06	-.04,-.07	.06,.12	.04,.01
IC22	.19,.26	-.14,-.09	**.72,.78**	.28,.06	.12,.14	.18,.14	.05,.15	-.01,.01	.07,.11	.01,-.03
VCR1	.12,.20	.24,-.05	.11,.15	**.86,.83**	.04,.06	.13,.07	.15,.21	.08,.05	.04,.14	-.02,.02
VCR2	.12,.14	.17,.08	.13,.10	**.88,.86**	.03,.02	.09,.11	.08,.22	.14,.09	.06,.11	-.03,.02
PL1	.14,.19	.09,.04	.08,.24	.04,.01	**.90,.95**	.13,.15	-.02,.05	-.01,.13	-.03,.08	-.00,-.02
PL2R	-.00,-.06	.04,.00	.00,.06	.00,.04	**.91,.92**	-.02,-.03	.01,.11	.01,.10	-.11,-.03	-.02,.00
DP2	.13,.21	.01,-.07	.09,.12	.05,.02	-.08,.00	**.83,.82**	.09,.10	.06,-.04	.09,.18	.07,.05
DP3	.17,.34	.03,.00	.11,.24	.09,.27	.08,.09	**.85,.68**	.03,.04	.03,.04	.09,.20	.00,.07
DP4	.14,.02	.05,.09	.20,.13	.18,.03	.25,.14	**.65,.81**	.03,.23	.07,.09	.04,.18	.03,.00
GI1	.09,-.11	.10,.15	.04,.05	.17,.05	.01,.00	.11,.14	**.79,.74**	.14,.08	.05,.10	.07,.15
GI2	.10,.09	.20,.09	-.01,.10	.18,.10	-.04,-.06	.07,.20	**.74,.82**	.21,.13	.01,.05	.10,.10
GI3	.12,.10	.11,.10	.04,.09	.12,.09	-.04,-.01	.08,-.11	**.85,.85**	.16,.17	.01,.02	.11,.03
GI4	.08,.01	.18,.00	.14,.03	.07,.17	.05,.09	.05,.02	**.76,.83**	.14,.27	.09,.09	.15,.11
GI5	.09,.24	.14,.05	.19,.07	.22,.15	.02,.04	.16,.09	**.64,.75**	.18,.14	.12,.04	-.04,-.06
GI6	.08,-.05	.15,.18	.08,.05	.19,.02	.08,.18	.05,.11	**.73,.75**	.16,.02	.00,.10	.08,.21
INF1	-.06,-.07	.40,.05	-.04,-.12	.04,.07	.08,.11	.01,-.07	.06,.22	**.69,.81**	-.00,-.05	-.00,-.02
INF2	.05,-.03	.20,.06	.01,-.12	.05,.06	.01,.07	.04,-.02	.16,.17	**.84,.88**	.00,.07	.09,.02
INF3	.07,.19	.20,.06	-.01,-.07	.15,.04	.01,.10	.09,.13	.08,.10	**.82,.79**	-.04,-.05	.08,.08

INF4	.10,.06	-.02,-.02	.02,.09	.22,.12	.00,.02	.07,.03	.21,.06	**.83,.91**	.01,.12	.09,.03
INF5	.12,.00	-.03,.13	.01,.06	.12,.13	-.03,-.04	.09,.02	.24,.15	**.78,.78**	.01,.12	.12,.01
OFF1	.11,.17	-.01,-.01	.10,.26	.12,.10	-.00,.03	.10,.13	.07,.06	.01,.06	**.78,.80**	-.04,-.11
OFF2	.09,.16	-.00,.11	.08,.18	.06,.06	-.04,.06	.07,.17	.03,.03	-.02,.04	**.90,.87**	-.03,.02
OFF3	.08,.19	-.00,.02	.04,.13	-.00,.03	-.11,.03	.05,.14	.02,.18	-.03,.17	**.88,.88**	-.04,.03
OFF4	.07,.19	.03,.03	-.01,.11	.01,.12	-.03,.02	.06,.10	.01,.15	.02,.17	**.88,.88**	-.01,.05
SC2	.09,.07	-.04,-.08	.02,.08	-.02,.01	-.05,.02	-.09,-.03	.06,.09	.11,.08	-.01,.00	**.77,.82**
SC3	-.11,-.04	.13,.07	.03,.08	.06,.09	-.06,.05	.13,.11	.01,.08	.00,.00	-.01,-.01	**.74,.84**
SC4	-.02,.12	-.03,.10	-.00,-.18	-.03,.03	.03,.02	.00,.09	.06,.25	.12,.00	-.03,.06	**.84,.73**
SC5	.05,.08	-.06,.07	.03,.17	-.04,.02	.12,.09	-.01,.16	.09,.25	.07,.03	-.05,-.04	**.82,.71**
SC6	-.12,-.06	.07,.00	.05,.18	.01,.10	-.08,.12	.13,.19	.12,.04	.04,.02	-.06,.03	**.74,.68**

Kno = Knowledge Contribution; Sat = Satisfaction; VCR = Virtual Co-presence; PL = Persistent Labeling; DP= Deep Profiling; GI= Group Identification; INF = Information obtained; OFF = Offline Activities; IC= Identity Consonance; SC = Self Consciousness;

Note: Loadings are reported in order of Quitnet, and myIS. Total Variance Explained: 73.32% for QuitNet and 77.69% for myIS

Table 8 shows the correlations between constructs, Fornell consistency, and the square root of average variance extracted (AVE). The diagonal elements represent the square root of AVE. To assess discriminant validity, the square root of AVE should be larger than the correlations between constructs, i.e., the off-diagonal elements in Table 8 (Chin 1998; Fornell and Larcker 1981). All constructs meet this requirement. Similar to Cronbach's α, composite reliability is a measure of internal consistency. Unlike Cronbach's α, the composite reliability takes account of the actual loadings used to construct the factor score, and thus is a better measure of internal consistency. All composite reliability values (for reflective measures) are greater than .80, indicating good internal consistency.

Table 8: Construct Correlations, Discriminant Validity, and Reliability.

	Composite Reliability	SAT	KNO	IC	VC	PL	SP	DP	GI	INF	OFF	SC
QuitNet												
SAT	.87	.76										
KNO	.92	.52**	.75									
IC	.90	.35**	.50**	.70								
VC	NA	.25**	.39**	.35**	NA							
PL	.90	.20**	.21**	.15**	.084	.83						
SP	NA	.26**	.45**	.34**	.39**	.11*	NA					
DP	.87	.24**	.47**	.44**	.37**	.16**	.43**	.68				
GI	.92	.39**	.33**	.25**	.31**	.05	.32**	.29**	.67			
INF	.92	.32**	.22**	.11*	.20**	.03	.27**	.19**	.44**	.70		
OFF	.92	.05	.26**	.18*	.23**	-.10*	.34**	.23**	.13**	.02	.75	
SC	.89	.02	-.04	.06	.00	-.01	.03	.09*	.19**	.19**	-.07	.79
myIS												
SAT	.90	.81										
KNO	.94	.57**	.79									
IC	.92	.27**	.54**	.73								
VC	NA	.24**	.30**	.28**	NA							
PL	.87	.05	.15	.19*	.08	.77						
SP	NA	.24	.39**	.28**	.41**	-.01	NA					
DP	.90	.20*	.42**	.39**	.41**	.13	.57**	.75				
GI	.92	.28**	.22**	.35**	.33**	.15	.31**	.34**	.67			
INF	.93	.27**	.15	.07	.24**	.25**	.27**	.10	.34**	.72		
OFF	.96	.25**	.48**	.44**	.41**	.14	.40**	.43**	.26**	.25**	.85	
SC	.88	.07	-.09	.04	.07	-.01	.09	.05	.29**	.05	.02	.77

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Composite Reliability: $\rho_c = (\Sigma\lambda_i)^2/((\Sigma\lambda_i)^2+\Sigma\Theta)$; $AVE = \Sigma\lambda_i^2/(\Sigma\lambda_i^2+\Sigma\Theta)$; $\Theta_i = 1- \lambda_i^2$

Common method variance is a potential threat to internal validity particular to research using survey to collect responses in a single setting. A factor analysis was performed to test for the potential of common method variance in the data set. According to Harman's one-factor test, the threat of common method bias is high if a single factor can account for a majority of covariance in the independent and dependent variables (Podsakoff and Organ 1986). My factor analysis did not detect a single factor explaining a majority of the covariance, and hence common method variance should not be a serious problem. Further, the number of posts during the two weeks before data collection was collected from the sites and its correlation with self-reported knowledge contribution was assessed. There is a significant correlation (0.22 for QuitNet and 0.33 for myIS, $p<0.01$) between self-reported knowledge contribution and number of posts, further underscoring the reliability of knowledge contribution measures.

Finally, I use two reflective items adapted from a previous study (Biocca et al. 2003, see Appendix 2) to measure member perceived virtual co-presence. The correlation (0.39 for QuitNet and 0.48 for myIS, $p<0.01$) between perceived virtual co-presence and the use of IT artifacts supporting virtual co-presence is significant, providing additional supporting evidence for the validity of the formative virtual co-presence indicators (Diamantopoulos and Winklhofer 2001).

6.3 Theoretical Model

I use PLS Graph Version 3.00 to test the structural model. The significant levels of the paths were determined using a bootstrap re-sampling technique (Chin 1998). Re-sampling technique establishes confidence intervals based not on assumptions such as multivariate normal distributions but on repeated samples from the researcher's own data. Thus, the normality of the survey data will not influence the PLS results. Table 9 presents outer model loadings of all reflective measures on their respective constructs. All loadings are greater than 0.75 and significant at the $p < 0.001$ level.

PLS estimates the measurement model and the structural model simultaneously. Hence, the weights of formative items indicate the importance of their impact on their respective constructs. Weights can be interpreted in a manner similar to beta coefficients from a multiple regression (Chwelos et al. 2001). Table 10 shows the outer model weights for the two formative constructs—virtual co-presence and self-presentation. For virtual co-presence, three of the six items are significant for both communities (one item is different). For self-presentation, four of seven items are significant for Quitnet, and five of seven are significant for myIS. The items that are not significant may reflect the approaches less effective or efficient for identity communication. For example, a personal webpage may be too time-consuming to create for general users or it may include too much information that is irrelevant to the specific community.

As shown in Figure 3, exogenous variables explain considerable proportions of the variance—the R^2 for the endogenous variables ranges from 0.19 to 0.42. All the paths in the model are either significant in one site or both, except the one between Persistent Labeling and Identity Consonance. As is evident from Figure 4, data from Quitnet supports hypotheses 1, 3, 4, 5, and 6. Data from myIS supports hypotheses 1,2,5, and 6 (see summary in Table 11). In both communities, identity consonance significantly and positively relates to satisfaction (H5) and knowledge contribution (H6), which is consistent with self-verification theory that individuals always want to be understood as who they are, no matter in a virtual world or in a physical world. Both communities also support self-presentation (H3) and virtual co-presence's (H1) links to identity consonance. However, the relationship between persistent labeling and identity consonance (H2) is not supported.

The moderating effect of self-consciousness was tested following the procedure recommended by Chin et al. (2003). Product indicators were developed by creating all possible products from the two sets of items of identity consonance and self-consciousness, which were centered first to lower the correlation between the product indicators and their individual components. As shown in Figure 3, all the moderating effects are positive but only one is significant. Figure 5 presents the moderating effect of self-consciousness that is significant. The chart shows that when self-consciousness is high, there is a positive relationship between identity consonance and knowledge contribution. However, when self-consciousness is low, the positive

link disappears. It partially supports H7b. I will discuss possible explanations in the next chapter.

Table 9: PLS Outer Model Loadings (for Reflective Measures)

Construct	PLS Outer Model Loading	
	QuitNet	MyIS
Satisfaction		
Sat1	0.83	0.86
Sat2	0.91	0.94
Knowledge Contribution		
Kno1	0.88	0.87
Kno2	0.87	0.89
Kno4	0.84	0.91
Kno4	0.87	0.89
Identity Consonance		
IC11	0.84	0.81
IC12	0.85	0.88
IC21	0.84	0.87
IC22	0.81	0.86
Persistent Labeling		
PL1	0.98	0.95
PL2	0.83	0.80
Deep Profiling		
DP2	0.80	0.85
DP3	0.86	0.90
DP4	0.82	0.83
Group Identification		
GI1	0.83	0.71
GI2	0.81	0.87
GI3	0.88	0.87
GI4	0.82	0.86
GI5	0.77	0.85
GI6	0.80	0.72
Information Need		
INF1	0.75	0.77
INF2	0.88	0.86
INF3	0.87	0.87
INF4	0.86	0.91
INF5	0.81	0.83
Offline Activity		
OFF1	0.87	0.89
OFF2	0.93	0.92

OFF3	0.84	0.94
OFF4	0.82	0.93

Note: All loadings are significant at .001.

Table 10: PLS Weight for Formative Measures

Construct	Weight	
	QuitNet	myIS
Virtual Co-presence		
VC1	-0.01	0.55**
VC2	-0.03	0.14
VC3	0.48**	0.14
VC4	0.07	0.04
VC5	0.46**	0.29*
VC6	0.30*	0.37*
Self-Presentation		
SP1	0.38**	0.26*
SP2	0.25**	0.44**
SP3	0.34**	0.56**
SP4	0.24**	0.44**
SP5	0.17	0.20
SP6	0.12	0.41**
SP7	-0.14	-0.09

* indicates that the weight is significant at the 0.05 level
** indicates that the weight is significant at the 0.01 level

Figure 4 shows the PLS results using merged data from two sites. Overall, the

findings using merged data are similar to the results from two separate sites. A site

dummy variable was added to the PLS and it is a significant predictor of identity

consonance and knowledge contribution. Members from Quitnet had a higher sense

of identity consonance and contributed more knowledge to the community.

Appendix 3 shows the regression results, which are qualitatively identical to the PLS

results. All F statistics of the regression are significant. Appendix 4 presents the

regression results using data merged from two sites. In addition, both figures also

report the regression results using the actual number of posts as a dependent variable (instead of self-reported knowledge contribution). Identity consonance is still a significant predictor of knowledge contribution, while the coefficients for other control variables have some difference. This finding confirms the result that identity consonance is strongly associated with knowledge contribution, no matter whether subjective or objective measures were used.

Although not shown in the PLS and regression results, significant links are found between some demographic variables and the dependent variables. Specifically, in both communities, previous experience of online community is significantly related to knowledge contribution. For Quitnet.com, gender is positively linked to satisfaction. None of the demographic variables are associated with identity consonance though.

Table 11 summarizes the hypotheses supported and not supported. The positive effects of identity consonance on satisfaction and knowledge contribution are strongly supported in both communities, indicating the importance of this newly developed identity-oriented construct in community sustainability. Also, the overall pattern of IT usage contributes to identity consonance. Hypotheses not supported by the empirical study will be discussed in the next chapter.

As presented earlier in this dissertation, direct links between the use of artifacts and satisfaction and knowledge contribution may exist. In other words, identity

consonance may not fully mediate the relationship between the dependent and independent variables. Baron and Kenny (1986) laid out three conditions for mediation. First, there should be strong relationship between the independent and dependent variables. Second, independent variables have to predict the mediating variable, and the mediating variable has to predict the dependent variables. Finally, the path between the independent variables and dependent variables should decrease (preferably to non-significant, but not required) when the mediating variable is added. Hence, two additional PLS models were run, one contains only direct paths, and the other has both direct and mediated paths. Considering the increased number of paths, only data from Quitnet were used for this test due to the relatively small sample size from myIS. Table 12 shows the PLS path coefficients of the two models. There are direct links between the use of some IT artifacts and the dependent variables. However, overall, the direct paths between the use of IT artifacts and satisfaction and knowledge contribution decrease when identity consonance is added as a mediator. Hence, according to Baron and Kenny (1986), the identity consonance construct is in fact a strong mediator.

Figure 3: PLS Results

Use of community artifact supporting identity communication

Information need fulfillment

Group Identification

Offline Activity

.14, .02

.25**, .15

.14*, .22**

.22**, .20*

.16*, .02

Satisfaction (R² = .25, .19)

Knowledge Contribution (R² = .33, .41)

.23**, .18*

.39**, .39**

.09, .15*

Public Self-consciousness

.09, .10

Offline Activity

Tenure

.01, .19**

.04, .18**

Identity Consonance (R² = .27, .42)

.23**, .16*

.04, 0.11

.22**, .33**

.14*, .04

Virtual Copresence

Persistent Labeling

Self-Presentation

Deep Profiling

Note: Coefficients are reported in order of Quitnet, and *myIS (path coefficients for myIS shown in Italic)*
*denotes significance at the $p < 0.05$ level
**denotes significance at the $p < 0.01$ level

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Figure 4: PLS Results Using Merged Data

Use of community artifact supporting identity communication
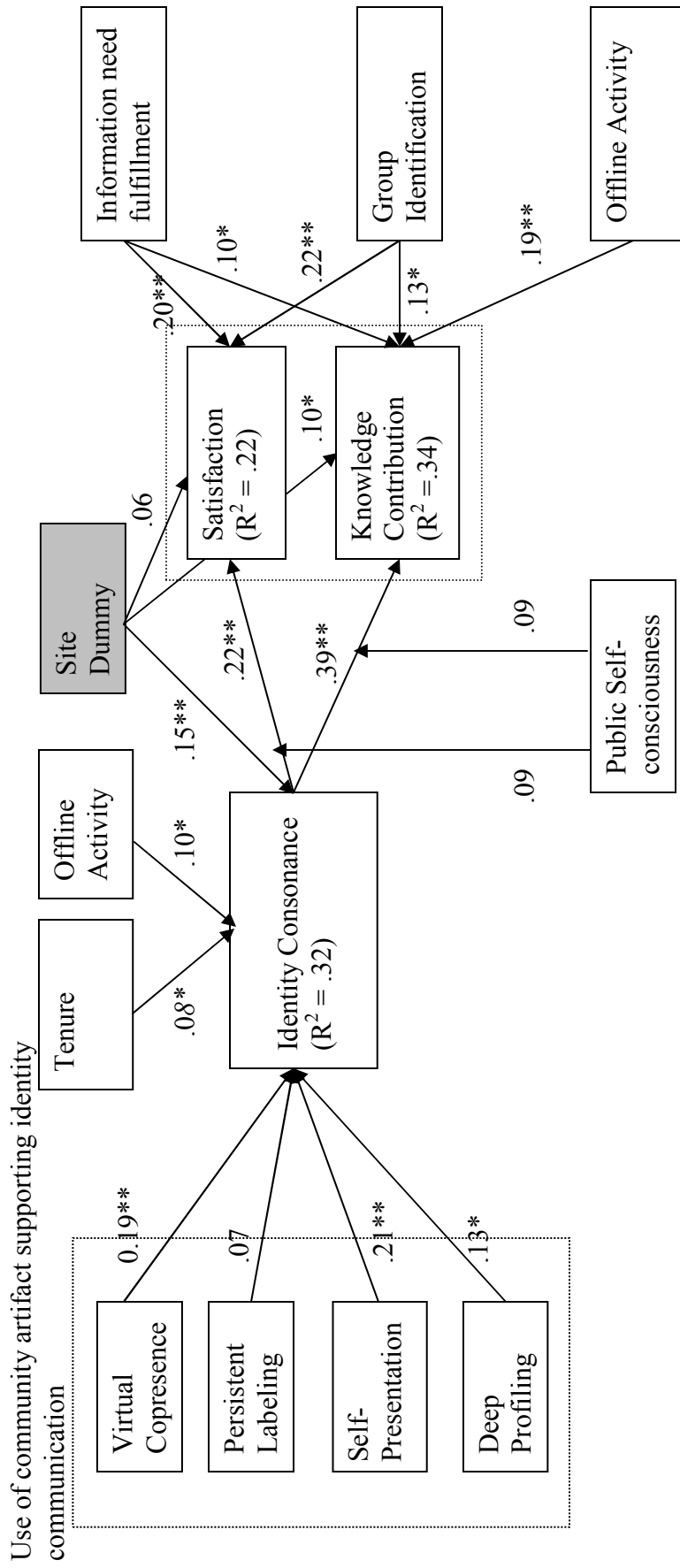
Figure 5: The Moderating Effect of Self-Consciousness
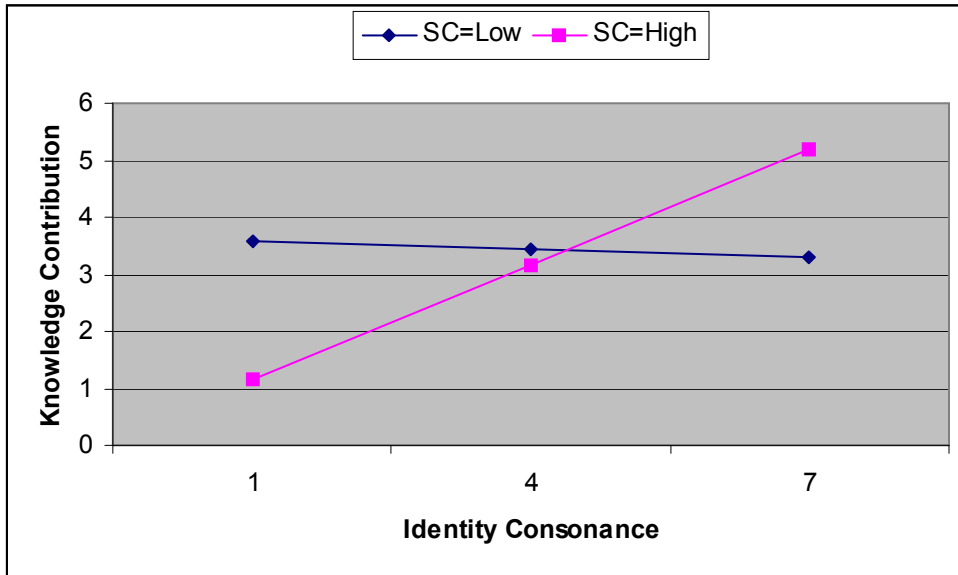
Table 11: Summary of the Results

Hypothesis	QuitNet.com	MyIS.com
H1: A virtual community member's use of community artifacts facilitating virtual co-presence is positively related to his/her identity consonance.	Supported	Supported
H2: A virtual community member's use of community artifacts supporting persistent labeling is positively related to his/her identity consonance.	Not Supported	Not Supported
H3: A virtual community member's use of community artifacts facilitating self-presentation is positively related to his/her identity consonance.	Supported	Supported
H4: Other virtual community members' use of community artifacts supporting deep profiling is positively related to the focal person's identity consonance.	Supported	Not Supported
H5: A virtual community member's identity consonance is positively related to their satisfaction with the community.	Supported	Supported
H6: A virtual community member's identity consonance is positively related to his/her knowledge contribution.	Supported	Supported
H7a: The relationship between identity consonance and member satisfaction will be stronger for a	Not Supported	Not Supported

virtual community member with a high public self-consciousness.		
H7b: The relationship between identity consonance and knowledge contribution will be stronger for a virtual community member with a high public self-consciousness.	Not Supported	Supported

Table 12: Path Coefficients of PLS (Test for Mediating Effects)

	(1) Model with direct links and without mediator		(2) Model with direct links and identity consonance as mediator	
Dependent Variable	Satisfaction	Knowledge Contribution	Satisfaction	Knowledge Contribution
Virtual Co-presence	.28**	.14*	.18*	.03
Persistent Labeling	.11	.06	.12	.02
Self-presentation	.23**	.47**	.14*	.21**
Deep-profiling	.04	.10*	.00	.08

*denotes significance at the $p < 0.05$ level
**denotes significance at the $p < 0.01$ level

6.4 Summary

In this chapter, results from factor analysis and PLS were reported. I examined the

reliability, convergent, and discriminant validity of the measurement scales. Overall,

the survey instrument demonstrates adequate psychometric properties. I described

the use of PLS to evaluate the structural model. The path coefficients of the PLS

results provide support for most of the hypotheses. The dependent and mediating

variables explain a significant amount of variance in the independent variables. I also

conducted an analysis to verify the mediating effect of identity consonance. The next

chapter presents the interpretation, discussion, and implications of the findings.

Chapter 7: Discussion

In this last chapter, I conclude the dissertation with a detailed discussion of the empirical results. This chapter presents possible explanations and interpretations of unsupported hypotheses. I also discuss the limitations of the dissertation. Finally, the key academic and managerial implications, together with promising future research directions are explored.

7.1 Discussion

Despite the rapid growth of online communities and the wide use of various community technologies, a theory relating the design of community technology to virtual community sustainability is still lacking. The goal of this dissertation was to analyze community member satisfaction and knowledge contribution from an identity perspective. It represents one of the first attempts to bridge the gap between virtual community practice and research. To this end, I developed a theoretical model centering on a new concept—identity consonance, defined as the *perceived fit between a focal person's belief about his or her identity and the recognition and verification of this identity by other community members*. I explored the antecedents and consequences of identity consonance, focusing on the community IT features that support the formation and communication of online identity. Surveys were conducted in two online communities (one emotional support community and one common interest community) to provide empirical support for the structural model.

Overall, the findings support the proposed framework. The first important conclusion is that in both communities, identity consonance plays an important role in member satisfaction and knowledge contribution. The data suggest that perceived identity confirmation from other people has important consequences in terms of community success. In other words, when individuals felt that other community members verified their identities, they were more pleased with their community experiences and were more likely to continue their membership actively. This finding extends previous evidence linking self-verification to satisfaction and group identification in an offline context (e.g., Swann, 1988). The fact that identity verification is also important for computer-mediated communication indicates that a need for mutual understanding is not only important for face-to-face communication, but also necessary for online social interaction, where an individual may not disclose her real name.

In our daily language, the word "identity" sometimes is used interchangeably with "name" or other identification information. For example, identity theft refers to the stealing of a person's information, especially social security number or credit card number, with the intention of using that identification data to commit fraud. However, throughout this dissertation, the "identity" that I refer to is a different concept defined in social psychology that includes an individual's personality, social background and roles, and value systems. In an online context, community members do not need to be known by their real names, but by their screen names, together with their personality, social background and roles, and value systems. And the mutual

understanding of such "identity" is found to predict satisfaction and knowledge contribution, regardless of whether the interaction is occurring online or offline.

According to previous literature, people are more satisfied with their group experience when their needs are satisfied and when they identify themselves as group members (for example, Tajfel and Turner 1986). The results of my dissertation are consistent with these previous findings. In both communities, I find that a member was more satisfied with the community when he or she obtained the information desired and/or had higher group identification (for Quitnet members).

In addition, prior studies also suggest that pro-social behavior in a community is partially due to reciprocation (e.g., Wasko and Faraj 2000) and group affiliation (e.g., Constant et al. 1996). Thus, individuals whose information needs are better met and who identify more closely with the community may more actively engage in helping others. Data from this dissertation provides some support for these assertions. Group identification significantly relates to knowledge contribution and satisfaction in QuitNet, while reciprocation (i.e., to reciprocate other members for the information/help received) does not contribute to individual knowledge contribution in both communities. Offline activities link to knowledge contribution but not satisfaction in two communities.

Another aspect of the findings that is consistent with previous research on identity is that individuals assume multiple identities in the same online community. The

participants' answers to the question "In this community, who are you?" surfaced

both personal identities and social identities. Sample personal identities are

"helpful", "quiet", "happy", "", "scared", "encouraging", "knowledgeable", "funny",

"healthy", and "active". Examples of social identities include "woman", "teacher",

"student", "lurker", "democrat", "mother", "daughter", "non-smoker", etc.

In addition to establishing the links between identity consonance and satisfaction and

knowledge contribution, the results also show that users intentionally engaged in self-

presentation in online communities. The active use of some IT features supporting

identity management significantly relates to identity consonance (R^2 = .28 and .43).

Though results from the two communities are slightly different, overall, the use of IT

artifacts (and therefore their availability) is important for successful online social

interaction. Data from Quitnet shows support for the use of three of four artifacts

relating to identity consonance. Among these three, the hypothesis on deep profiling

is not supported in myIS. A plausible explanation is that the impact of perceived

deep profiling is more significant in a social/emotional support oriented community

like Quitnet, but less important in a community like myIS that focuses predominantly

on information exchange.

An unexpected finding is that data from both communities failed to support the

hypothesis on persistent labeling. According to the interviews conducted before data

collection and the observation of multiple online communities, I found that users

usually change ID or use multiple IDs for the following reasons: (1) the old ID did

not work anymore (for example, the old ID was temporally banned or the old password was forgotten); (2) two or three IDs were used simultaneously for some reason (e.g., to obtain more community space and resource); (3) an individual want to change ID to reflect his or her current preference or mood; (4) the old ID was stolen or became a target of spam. In many cases, individuals usually informed other community members that they had changed ID or used multiple IDs. It possibly explains the weak link between persistent labeling and identity consonance. Being informed the change of ID, other users would know whom the new ID belonged to before and their understanding of the focal person's identity may not be influenced by the use of a different ID.

Data from both communities support the link between virtual co-presence and identity consonance. Individuals perceiving the presence of others are more likely to engage in identity communication activities, which results in a higher identity consonance. According to the accountability theory of social psychology, they are also more likely to make accurate attribution of others and themselves (Tetlock 1985). Identity attribution difference will be minimized for members who feel a higher co-presence and accountability.

As I expected, self-presentation is one of the strongest factors related to identity consonance. Intuitively, community members who actively engage in presenting their identities should be understood better compared to those who do not do so. Outer model weights from PLS indicate that many self-presentation strategies

employed, including sharing photos, telling stories in the posts, sharing personal information in profiles, and expressing opinions in forums, significantly contribute to the self-presentation construct. The use of a signature and a personal webpage did not have a significant impact, probably because other methods are richer and more convenient ways to express oneself.

The study finds that two control variables—offline activity and tenure—link to identity consonance in myIS but not Quitnet. It is possible that offline activities are more important for an information exchange oriented community, where relatively less social and emotional interactions exist solely online. When members from such communities interact offline, they significantly improve and reinforce their mutual understanding. In contrast, the extensive online social interaction in Quitnet may have been already sufficient for forming shared understanding. Similarly, it may require a relatively long time for members to understand each other in an information exchange community, while the mutual understanding and sympathy can be formed faster in Quitnet, resulting in a less significant effect for tenure.

H7 proposes a moderating effect of public self-consciousness. The PLS results show that the effects are positive as proposed but only one is significant. The role of self-consciousness might be more complex or less strong than I discussed earlier. Public self-consciousness should have a positive moderating effect because individuals with a higher need for social acceptance should be more satisfied with their community experience when others verify their self-concept. However, the effect of this

personality difference is not strong enough according to the empirical results of this dissertation. The moderating impact of self-consciousness is unclear and interesting future research can be conducted to investigate its influence.

The final interesting finding of this dissertation is the significance of a few direct effects between the use of IT artifacts and satisfaction and knowledge contribution. This finding is consistent with symbolic interaction theory from sociology and common ground theory from linguistic research. Symbolic interaction theory argues that individuals adjust their reactions and attitudes according to their interpretation of others' behavior. Therefore, an accurate interpretation based on mutual understanding and shared social norms is necessary for smooth social interaction. Self-presentation online can help others build an accurate interpretation of the focal person's behavior and communicate social norms. Using the community artifacts facilitating communication promotes a sense of familiarity, understanding, and interpersonal attraction, which may lead to satisfaction and pro-social behavior (e.g., Clark et al. 1987). Similarly, common ground theory in the linguistics literature argues that people interacting with each other need to develop shared understanding in a conversation, i.e. common ground. The establishment of common ground facilitates constructive and satisfactory social interaction. Media features, such as co-presence, simultaneity, reviewability, and visibility, may affect the ease with which common ground is established (Preece and Maloney-Krichmar 2003).

In sum, the findings of the important role of identity formation and communication in successful online interaction open up exciting opportunities for further theoretical development of the present model and practical development of new virtual community or virtual team features. In essence, these findings suggest that there is a gap in previous research on pro-social behavior in computer-mediated communication and community sustainability. Formerly proposed factors such as group identification and generalized reciprocation cannot account for all the variance in individual behavior. We need to further investigate individuals' fundamental need for identity verification, which has been explored in an offline setting for decades.

Furthermore, although it is difficult for community leaders and administrators to manipulate group identification and reciprocation of individual members, they can initiate a community design facilitating identity communication by adopting features suggested in this dissertation. The findings from this dissertation provide pragmatic guide to promote sustainable and successful online communities.

7.2 Limitations

Some limitations that imply interesting and fruitful further research are noteworthy. First, the perceptual measure of identity consonance is partially due to the difficulty to assess the actual fit between individual identity belief and the verification by others. It is impractical to measure hundreds or thousands of community members' belief about the focal person's identity. Perceptual fit can be biased. Although in the previous chapter, I argued that it is an individual's perception of fit that ultimately

determines his or her attitude and behavior (e.g., satisfaction and knowledge contribution) in the community, it is worth noting that the identity consonance measure used in this dissertation has its limitation. Particularly, according to attribution theory, the use of the IT features supporting identity communication should promote the actual fit of identity belief between the focal person and other members rather than the perceptual fit. This gap between my theoretical argument and the operationalization of identity consonance is a limitation of my dissertation worth further research efforts.

In addition, the high level of satisfaction in both surveyed communities (Mean = 6.53 and 6.56, Table 6) raises concern that the sample is possibly biased. Quitnet.com and myIS.com are two successful online communities, therefore, the overall member satisfaction may be relatively high. However, it is also possible that only satisfied users were motivated to respond to my survey. To address this issue, future study should solicit responses from less satisfied community users.

Third, although the tension of sacrificing generalizeability for internal validity is somewhat alleviated in this dissertation by coupling semi-structured interviews of members from various online communities, only members from two communities were surveyed. Hence, some of the findings reported here may not extend to other community settings. Individual identity and its impact appear to be highly context-dependent. As shown in the last chapter, path coefficients and significance are

different for two sites studied. Further investigation with other types of online

communities is necessary to generate more robust and generalizable findings.

Forth, because of the cross-sectional design of this dissertation, no causation can be

determined. The significant paths between constructs can only be interpreted as

correlation and the causal inferences are solely based on theoretical argumentation.

Further studies employing longitudinal or experimental design may provide even

more convincing evidence for the critical roles of community design and identity

consonance.

Finally, because all the constructs were collected from the same respondents, the

results presented may be subject to common method variance. This dissertation study

adopts several methods to overcome this shortcoming. First, the data were collected

at two different periods of time. Predictors were collected at time zero and outcomes

were collected 2 weeks later. Podsakoff and Organ (1986) have recommended this as

one efficient procedural method to reduce common method variance. Second,

Harman's one-factor test was applied. It has been suggested that if the selection of

method causes the majority of the variance, the factor analysis of all items should

load on one single factor (Podsakoff and Organ 1986). I did not detect such single

factor that can account for the majority of the variance. Finally, this study collected

the total number of posts during the two weeks before data collection and assessed its

correlation with self-reported knowledge contribution. There is a significant

correlation between self-reported knowledge contribution and number of posts,

indicating the reliability of self-reported knowledge contribution. Nonetheless, although this study makes several efforts to detect and reduce common method variance, it may still be a noteworthy issue in considering the results of this study.

7.3 Implications

Virtual communities help organizations reach their customers and/or coordinate knowledge exchange among their employees. Such value creation by virtual communities can only be achieved when ongoing community activities are supported (Butler 2001; Finholt and Sproull 1990). Paradoxically, although the past few years have witnessed a significant growth in the number of online virtual communities, many attempts to build them were unsuccessful, and little vigorous academic research has been conducted to study what contributes to the sustainability of a virtual community. This dissertation makes several important contributions to the research literature.

First, a new construct, identity consonance, and its measurement were developed in this study. It is a concept that can be equally applied to both online and offline settings even though this dissertation only tests it in an online environment. In contrast with prior literature where the importance of identity formation and verification has been mostly overlooked, this study theoretically integrates the identity construct into virtual community research. Empirical results and interviews show that identity consonance is a critical factor for online communication satisfaction and motivates knowledge contribution. Understanding the role of identity

in computer-mediated communication sheds light on virtual collaboration in virtual teams or virtual communities of practice.

Second, centering on the new identity consonance concept, this dissertation developed an identity-based theory of online community sustainability. The antecedents and consequences of identity management were explored and empirically tested. I particularly focused on virtual community design features that can help efficient and effective identity management. Investigation of virtual community design can help us better understand what features of the community technology can efficiently improve the sustainability of a virtual community. More significantly, the theory highlights possible causal mechanisms underlying these effects. The extant community design literature usually proceeds in a pragmatic style that employs guidelines without formal theoretical justification (Turoff, Hiltz, Bahgat and Rana 1993), and the mechanics through which community features increase the sustainability of a virtual community have not yet been precisely explained. Drawing upon attribution theory, this dissertation provided a theoretical underpinning for understanding how four categories of virtual community artifacts (virtual co-presence, persistent labeling, self-presentation, and deep profiling) improve community sustainability. The empirical results suggest that, depending on the type of communities, certain features are critical for member identity consonance, and thereafter, satisfaction and participation.

This dissertation has also developed a new survey instrument with adequate psychometric properties. As a brand new concept, identity consonance was measured

using modified TST and two additional items. Factor analysis, Cronbach's α, and the PLS results show that the newly developed identity consonance measurement has satisfactory reliability and validity, hence can be adopted for further research. In addition, the use of IT artifacts supporting identity management and communication was measured with new instruments due to the lack of the existing measures. These measures were developed based on an extensive literature review and online community observation. They were also pre-tested in a pilot study with adequate validity and reliability. Other researchers can adopt the instrument developed for this study for their own investigation of various research topics.

Fourth, by testing the proposed theory in two representative but different types of online communities, I am confident that the key concept—identity consonance, and its importance in online community communication can be applied to various kinds of online communities, including information exchange communities and emotional support communities.

Finally, the framework developed in this dissertation can not only be applied to virtual communities, but also other research areas such as online knowledge creation, accumulation, and dissemination. The practice of online knowledge management (such as WiKi and Blog) has attracted a great amount of research attention, while few current studies have adopted an identity-based view. In addition, the framework introduced here offers a fresh perspective on computer-mediated coordination and collaboration. Instead of reinventing the wheel, this dissertation borrows established studies and concepts from social psychology and sociology and applies them to our

own field. To summarize, this study has broader research implications and numerous future research on computer-mediated knowledge management and collaboration can be built on it.

This dissertation also has important practical implications. First, the research model and empirical findings provide practical guidelines for organizations that expect to create value by supporting customer or employee communities. The framework and results of this research are useful for community developers to design their IT infrastructure to support a sustainable virtual community. While the specific community IT features described and studied in this dissertation are widely available in most virtual communities, the finding provides a general guideline for the development of new interactive features that support virtual co-presence and self-presentation beyond what are available now. For example, communities can consider allowing users to submit video clips that introduce themselves; design more vivid online presentation richer than a motionless avatar; visualize users real time activities in a communities; generate user profiles automatically from their past activities. Such features may simplify and encourage identity communication and promote a better and healthier online community.

Second, by understanding the key role of identity management in computer-mediated communication, this dissertation suggests that community design supporting effective identity formation and communication will lead to successful social structures. Geographically distributed organizations can gain insight into the importance of identity management in a virtual team.

7.4 Future Research

Computer-mediated communication has become increasingly important due to the growing number of global organizations. The use of virtual teams to complete work has become more prevalent and the performance of virtual team can be directly or indirectly affected by the identity management of team members. For future research, it would be necessary to quantitatively examine the impact of identity management on virtual teams. I believe that for work-oriented virtual groups, identity management is also likely to be a significant predictor of satisfaction and performance. However, which type of identity (personal identity or group identity) is more critical in a virtual team setting is a question worthy of further study. Prior research on work groups usually focuses on the positive effect of group identity, while I believe that the mutual understanding of individual identity is also a key factor for virtual team performance.

Further work is needed to design new community functions, tools, or features supporting identity management based on the theoretical framework proposed in this paper. Some HCI researchers are developing new community tools that can increase a sense of virtual co-presence. For example, IBM has recently developed the "Babble" and "Loops", communication tools that provide visual feedback regarding who are currently present in a conversation[1]. Also, many communities use a reputation or ranking system to help individuals form their expert identity in particular areas. However, as highlighted throughout my discussion, identity is a

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[1] More information about Babble and Loops is available online:
http://www.research.ibm.com/SocialComputing/

significantly richer and more nuanced construct as compared to reputation. Individual identity not only includes one's expertise, but also social background, personality, value systems, group affiliation, etc. Reputation or ranking systems commonly used today cannot capture such rich identity information, indicating the need to design new tools for facilitating richer and easier identity formation and communication online.

It would also be interesting to apply the framework developed in this study to research on computer-mediated knowledge creation and dissemination. For example, wikipedia.com is an online encyclopedia and its articles are solely contributed and updated by its users from all over the world. Many researchers and practitioners are amazed by how fast and complete that knowledge can be gathered from volunteers. There are increasing research interests on how the mechanism of wikipedia can be applied to organizational knowledge management. For future research, I can adopt a similar identity-based perspective to investigate whether self-concept verification promotes online knowledge creation, dissemination, and coordination.

Finally, the proposed framework focuses on the verification of online identity. It would be interesting and useful to examine the extent to which an individual's online identity is different from her real world identity. People who are dissatisfied with their identity in the real world or who want try a new identity may well seek to establish a very different identity online. It would also be interesting to study the extent to which community members like to disclose their identities online. Although I believe that people want to be understood and identified as who they are even in a

virtual world, inevitably such desires must be traded off with privacy and safety

concerns. Mechanisms that not only help individuals reveal their identity but also

safeguard their privacy are worth further study.

Appendix 1: Interview Questions and Response Summary

1. Do you think that some members from this virtual community recognize your user ID or user name? If so, how many of them? Do you feel satisfied and more motivated when you found that some other people recognized you?

2. Do you hope other people in the community know a little bit of you? For example, your expertise, your hobby, and so on.

3. Do you recognize some Ids in this community? Do you feel like that you know what kind of people they are?

4. Are you satisfied with this virtual community?

5. Will you continue to participate in this virtual community?

6. When you contribute some information/knowledge or provide some support, do you think that other members appreciate your help? Do they recognize your ID because of your previous help?

7. Besides the theme of the forum, do you express other things about yourself to the community? For example, do you from time to time mention your family? Your worldviews? Your work? Your hobbies? Or show a picture of yourself?

8. Do you disclose some of your information in your member profile? Why or why not?

9. Do you tell stories about yourself to other community members? What kind of stories?

10. Do you have a special nickname, avatar, or signature? Why do you choose it? Does it express who you are?

11. What other ways do you use to let other community members know who you are? For example, showing them your personal website.

12. How long have you been a member of this community? Do you express your opinions in this community a lot?

13. Are you sometimes aware of that others are online? How?

14. When you log on the community, do you think that some people know you are online?

15. Do you feel that some other community members are together with you even though they are located in different places?

16. Do you use chat room or IM to chat with your friends from this virtual community?

17. Do you meet some members off-line or talk with them on the phone?

18. Do you go through other members' profiles and previous posts to find out more about who they are?

19. Do you pay attention to other members' feedback?

20. Do you feel like being understood by some community members? If so, how many of them?

21. Do you use multiple Ids in this community?

Table: Response Summary

Respondent	1	2	3	4	5	6	7
Type of Community	Technical support	Technical support	Information	Information	Event planning	Emotional support	Emotional support
Virtual co-presence	High	Low	Medium-low	High	Medium	High	High
Persistent labeling	Medium-High	High	High	High	High	High	High
Self-presentation	High	Low	Low	Medium	High	Medium	High

Deep profiling	Medium-High	Medium	Medium-low	Medium	High	High	High
Tenure	6 months	4-5 months	24 months	12 months	4 months	29 months	48 months
Off-line activity	Low	Low	Low	Medium-High	Medium	Medium	Low
Size	>10,000	>10,000	400	>1,000	small	>10,000	>10,000
Identity consonance	High	Medium	Low	Medium	High	High	High
Satisfaction	High	Medium	Medium-low	Medium-High	High	High	High
Knowledge Contribution	High	Medium	Low	Medium	High	Medium-High	High
Group Identification	High	Medium-High	Low	Medium	Medium	High	High

Illustrative quotes:
Identity consonance and its consequence
"I think what I've observed in part is a refutation of that hoary old 'on the Internet, no one knows you're a dog'."

"It's pretty neat that many people (most from the Graphics/Sig Testing) recognize my username. I think it adds a lot to the forums! It's what makes me want to stay most and not just come here for support! I feel that a lot of people there already know some stuff about me, and because we always post stuff there for fun, we really get to know each other through the forums ☺ Everyone (EVERYONE) who regularly posts in the Graphics/Sig Testing boards is recognized by me and I know plenty about them and they know plenty about me! All forums need a place like the Graphics/sig Testing boards where people just communicate and get to know each other. You'll see me and other users get involved in each others' lives. For example I know Bay Wolf is really computer smart, has a tech support website, is very friendly to new people, and willing to give out help! I know that msil217's mother is ill and we made a thread about it where we posted our sorry about that, etc...(it keeps going on!)! One user even posted a picture of his baby."

"Nobody really knew me in this community. And I didn't know other people either. It was also not my purpose to browse this community. It is a place for information (local classifieds, like car ride, roommate seeking etc.). I don't participate it anymore. I don't think I was part of the community. I can get some information I needed but was not excited about this place. I didn't answer questions. I knew somebody else would. "

"I feel great that people recognize me, and recently, I've even been getting private messages of people asking me advice, quite flattering really!"

"I think it is good for other people in the community to know a little bit about me. It helps for others to take my suggestion seriously. Also, it's good to be understood by some community members that you care."

"There are many different levels of friendship. Some are just superficial and you recognize their names, read what they post. Others touch you for another reason. One friend who has

quit longer than I have and I clicked I think because we had both lost brothers in the fairly recent past. It was something that drew us together. Others share the same occupation or religion"

"My history, being known as a member (and with my profile available for view), I believe, gave me a lot of credibility."

Virtual co-presence
"Well there is a page that shows who are online but if someone is marked as private you just have to see how recently they last posted. I guess if they are looking at the page showing all logged in users (i'm not marked private) [they will know if I am online], but besides that I don't think so ☹"

"I have a few people from the DELL forums on my AIM/AOL buddy lists. But for most this [forum] is our main way to contact because they don't tell their screen name or don't have any IM services."

"Sometime, when I got response so quickly after my posting [, I felt like some other members were together with me]."

"We can actually add some to our own 'buddy list' so we know when they are on."

Persistent labeling
"My username is ***, which is close to my name. And it is my AOL/AIM/MSN/YAHOO/HOTMAIL usernames."

Self-presentation
"If it applies to another persons post/question, I sometimes go on and on telling about myself!"

"My signature just shows how much I love animation!"

"I will have a personal website up soon which they can all see which will have a collection of all the animations I have made (A LOT)."

"In a way, I'd like to keep my privacy, but far more of me doesn't really care."

"My Avatar is a Canadian Flag. I am patriotic and like showing that I am proud to be Canadian."

"I sometime told stories about myself in this community, usually the stories that other members will experience or have experienced. For example, I had a lot trouble in doing something and I told the story. I guess my intention is both seeking compassion and warning the members that bad thing could happen in doing that thing."

"I have a signature, and may change it frequently according to the situation. It's a way to express my feelings and experience during that time."

"There's a main focus, like breast cancer. So all participants are dealing with this main issue, concerned with that.   In the COURSE of seeking support & info and expressing what they need to let out – they talk about their lives, kids, concerns – all of it. And doing so, they build identity."

Example quotes from a respondent's profile:
> "…If you've read this far, I feel you know me – as well as some, and better than most others. Thank you for taking the time to follow my meandering – so many of my rambles stuck here one following the other, like kindergarten papers on the fridge... I can trace my own progress through them, and picture my status at the time I wrote each one.
>
> But I gave little in the way of solid fact. Here, then, is a measure of those external truths: I am a medical librarian. I work at a large teaching hospital, and divide my time between searching the medical …"

<u>Deep profiling</u>
"Yes I do [check others' profiles] sometimes if someone just joined but is posting a whole lot and doesn't look like they are leaving so I can get to know them as they will probably become like me (be there for a while)"

"Yes, I always [pay attention to other members' feedback], if it concerns me or a thread I am posting in."

"I check the information of other forum regulars, so I know a little more about what kind of people they are."

"Yes, I definitely care about others' feedback. It's like you talk, talk and talk, and you want to see what others respond."

"I read profiles. Many of them at first. I had never been a part of anything on the computer, and was scared to post. It is a great way of finding out about someone, though not everyone puts a profile in. Then [I read] some others journal a lot, so you can get a good feel about who they are and how they might think."

"[If I want know more about others,] I can do a search for posts and it goes back I think about 3 months so you can find all that they have written."

Appendix 2: Construct Measures and Sources

Use of virtual co-presence artifacts Formative I use instant messenger to talk to people from this community frequently. I use chat room to talk to people from this community frequently. I am usually aware of who are logged on online. I pay attention to others' online or offline status in this community. I find that people respond to my posts quickly. I find that people respond to my private messages quickly. Reflective measure of perceived virtual co-presence: To what extent, if at all, did you ever have a sense of "being there with other people" in this community? To what extent, if at all, did you have a sense that you were together with other members in the virtual environment of this community? Adapted From (Biocca et al. 2003; Schroeder, Steed, Axelsson, Heldal, Abelin and Wideström. 2001)
Use of persistent labeling I consistently use a single ID to communicate with other members in this community. I use more than one ID in this community (reversed).
Use of self-presentation I tell my stories to other community members in this community. I share my photos or other personal information with people from this community. I express my opinions in my posts. I present information about myself in my profile. I use a special (or meaningful) signature in this community that differentiates me from others. I use a special (meaningful) name or nickname in this community that differentiates me from others. I let other community members visit my personal webpage.
Use of deep profiling I think that other people consider my ranking (reputation) when they interact with me. I think that other people search the archive to find out more about me. I think that other people have read my previous posts. I think that other people look at my profile to find out more about me. Scale: Strongly disagree – Disagree – Somewhat disagree – Neutral – Somewhat agree – Agree – Strongly agree or Never 1---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 Always

Identity Consonance

Below are 5 fill-in-the-blank areas for you to answer the question "In this community, who am I?" Simply type in an answer next to the numbered item and make each answer different (e.g., high, smart, happy, animal-lover, anti-social, dependable, conservative, student, computer geek, Linux expert, father, board master, Democrat, Catholic, woman, engineer, Asian, etc.). Answer as if you were giving the answers to yourself, not to somebody else. Write the answers in the order that they occur to you. There are no right or wrong answers.

    3. In this community, I am _____
2. In this community, I am _____
3. In this community, I am _____ ………..
4. In this community, I am _____
5. In this community, I am _____

Please think about your interactions with people in this community and indicate the extent to which others know that you define yourself as… (list the 5 responses just answered by the respondent one by one)
Other people in this community understand that I am (list the 5 items just answered by the respondent one by one).

Scale: Not at all 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 Very much

Adapted from Twenty Statement Test (TST)(Kuhn and McPartland 1954)

Satisfaction

All in all, I am satisfied with my experience in this community.
Overall, I am pleased to interact with other people in this community.
Scale: Strongly disagree—>Strongly agree (1-7 scale)

Adapted from (Duffy et al. 2000)

Knowledge Contribution

Objective: total posts in two weeks (from the site) or content analysis

I often help other people in this community who need help/information from other members.
I take an active part in this community.
I have contributed knowledge to this community.
I have contributed knowledge to other members that resulted in their development of new insights.
Scale: Strongly disagree—>Strongly agree (1-7 scale)

Adapted from (Faraj and Wasko 2003; Koh and Kim 2003)

Group Identification When someone criticizes this community, it feels like a personal insult. This community's successes are my successes. When someone praises this community, it feels like a personal compliment. I'm very interested in what others think about this community. When I talk about this community, I usually say "we" rather than "they" If stories in the media criticize this community, I would feel bad. Scale: Strongly disagree—>Strongly agree (1-7 scale) *Adapted from (Mael and Tetrick 1992)*
Public Self-consciousness I care a lot how I present myself to others. I am self-conscious about the way I look. Before I leave my house, I check the way I look. I usually worry about making a good impression. I am concerned about what other people think of me. I am usually aware of my appearance. Scale: Strongly disagree—>Strongly agree (1-7 scale) *Adapted from (Buss 1980)*
Tenure On average, how many hours per week do you spend in this community? _____ How many months have you been a member of this community? _____
Offline activities I contact other members from this virtual community by phone. I meet other members from this virtual community in informal off-line meetings. I actively participate in the regular off-line community meetings with other members. I participate in a variety of off-line activities held for this virtual community. Never 1---- 2 ---- 3 ---- 4 ---- 5 ---- 6 ---- 7 Always *Adapted from (Koh and Kim 2003)*
Size of social network About how many people have you interacted with in this community?_____

Information need fulfillment
The extent to which this online community helps you:
To get information
To learn how to do things
To generate ideas
To solve problems
To make decisions

Adapted from Dholakia et al. (2001)

Appendix 3: Regression Results

Dependent Variable	(1) Identity Consonance	(2) Knowledge Contribution	(3) Satisfaction	(4) Number of Posts
Virtual Co-presence	.22***, *.19**			
Persistent Labeling	.05, *.12*			
Self-presentation	.19***, *.20**			
Deep Profiling	.21***, *.07*			
Offline Activity	-.01, *.17**	.14***, *.25***	.03, *.06*	.07, *.18**
Tenure	.05, *.18***	.07, *.00*	.01, *.06*	.07, .03
Identity Consonance		.39***, *.41****	.24***, *.18**	.12**, *.13**
Group Identification		.16***, *.06,*	.25***, *.15,*	.03, .06
Information Need		.14**, *-.02*	.20***, *.18**	.07, *.28***
SC*IC		.07 , *.13**	.07, *.11*	.00, .05
Self-consciousness		-.11**, *-.11*	-.09*, *-.03*	-.02, -.05
R^2	.29, *.35*	.33, *.40*	.24, *.18*	.04, .13
F	33.5***, *14.0***	34.0***, *14.9****	22.3***, *4.8****	2.78**, *3.3***

*: p<0.05, **: p<0.01, ***: p<0.001

Note: Beta coefficients, R^2, and F are reported in order of QuitNet (N=500) and *myIS* (N=166).

Appendix 4: Regression Results Using Merged Data

Dependent Variable	(1) Identity Consonance	(2) Knowledge Contribution	(3) Satisfaction	(4) Number of Posts
Virtual Co-presence	.20***			
Persistent Labeling	.07*			
Self-presentation	.17***			
Deep Profiling	.16***			
Offline Activity	.06	.18**	.05	.09
Tenure	.07	.04	.02	.04
Identity Consonance		.39***	.23***	.12**
Group Identification		.10**	.23***	.04
Information Need		.09	.19***	.15*
IC*SC		.07	.09	.00
Self-consciousness		-.11*	-.06*	-.03
Site Dummy	.15***	.15**	.06	.14*
R^2	.29	.33	.22	.10
F	38.9***	23.8***	18.2***	3.1**

*: p<0.05, **: p<0.01, ***: p<0.001

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