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Unravelling the Influence of Online Social Context on Consumer Health Information Technology (CHIT) Implementations

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UNRAVELLING THE INFLUENCE OF ONLINE SOCIAL CONTEXT ON CONSUMER HEALTH INFORMATION TECHNOLOGY (CHIT) IMPLEMENTATIONS

BY
AMRITA GEORGE

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ACCEPTANCE

This dissertation was prepared under the direction of the Amrita George's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

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ABSTRACT

UNRAVELLING THE INFLUENCE OF ONLINE SOCIAL CONTEXT ON CONSUMER HEALTH INFORMATION TECHNOLOGY (CHIT) IMPLEMENTATIONS

BY

AMRITA GEORGE

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While health information technology research has examined a variety of topics (e.g., adoption and assimilation of technology within healthcare organizations, critical success factors), it has remained unclear how the uniqueness of the online context (e.g., users connecting with strangers for social and emotional support) influences consumer health information technology (CHIT) implementations. Towards this goal, this dissertation examines the influence of online social context on CHIT implementations and outcomes. Using theories from social psychology, this dissertation encompasses two empirical research essays. The first essay draws on the environmental enrichment concept to examine the influential role of the online social context of a gamified CHIT on its success. By surveying existing fitness technology users, we demonstrate the influence of the social context enabled by CHITs on behavioral adherence to exercise. The second essay draws on construal level theory to examine the influence of textual information (such as race, geographic location) in online patient communities on a user's trust of the community and the system as well as their intentions to participate in them. Using randomized experiments, we identify some of the propinquity-related factors that influence a user's trust in online patient communities. The key contribution of this dissertation is the advancement of our understanding of the important role played by the social context enabled by the CHITs.

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CHAPTER 1

Introduction

Brief background and overarching research question

Health information technology (HIT) is "*the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, health data, and knowledge for communication and decision making*"[1]. Initially, health-related Information Systems (IS) research focused on Information Technology (IT) artifacts used within an organizational setting because there was a push from regulators to adopt IT within healthcare organizations (Baird et al. 2018). Organizations were grappling to come to terms with an emphasis on operational efficiency that spurred the adoption of new IT. HIT research has subsequently broadened and deepened to inform theory and practice alike by pushing the boundaries with newer methodological approaches such as predictive modeling, sequence analysis, and in-depth qualitative efforts (Baird et al. 2018). As time progressed, industry players also crafted the course of HIT use within healthcare organizations. For example, Kaiser Permanente extended their HIT systems beyond hospital settings by launching an online patient community as part of their population outreach program, on which providers could educate their patients as well as raise health awareness and improve social support for their patients. Consumers felt empowered with these newer innovations. Furthermore, changes in the industry such as the shift in focus to value-based care (i.e. providing quality healthcare at low cost to patients) created demanding patients. Sensing the potential for tapping into a billion-dollar (or even a trillion-dollar) healthcare industry, firms with newer health technologies intended to help patients manage their health and wellbeing emerged (e.g., Fitbit, PatientsLikeMe). Such health-related technologies aimed at the consumer market are called Consumer Health Information Technologies (CHIT). CHIT is defined as computer-based

[1] https://en.wikipedia.org/wiki/Health_information_technology#cite_note-8

systems that are designed to access and exchange information, enhance decision making, provide social and emotional support and help behavior changes that promote health and wellbeing (Or and Karsh 2009). CHIT field has experienced significant growth (Demiris 2016). Yet, most HIT-related IS research remains focused on the organizational use of HIT, with only a few studies beginning to examine newly introduced HITs [e.g., online health communities and wearables (Goh et al. 2016; James et al. 2019)].

IS researchers state the need to expand HIT research to examine how HIT influences various stakeholders (Kohli and Tan 2016; Fichman et al. 2011). One interesting avenue requiring further examination is the social contexts CHITs enable and the effect of these environments on users. People's behaviors can be shaped by the ***online social context***, which can be *defined as* "*people's relationships with those who have requested information or whom they are trying to persuade with information gathered and packaged through the use of ICTs (information and communication technology)"* (Lamb and Kling 2013). Interestingly, users of some CHIT (e.g., online health communities) have been observed to engage in contradictory behavior (such as disclosing personal health related information to strangers), which is generally not observed in an offline setting. This phenomenon of disclosing sensitive health information to strangers can be attributed to ***Apomediation,*** the perceived social and emotional support individuals receive from strangers in a similar situation (Eysenbach 2008). That is, individuals actively engage in disclosing sensitive information to strangers in exchange for emotional and/or social support. Apomediation has been observed to occur when an individual does not need a medical expert's advice (Eysenbach 2008; Colineau and Paris 2010). However, when medical expertise is needed, these individuals have been observed to seek advice from experts (such as a doctor or nurse practitioner or a certified coach) (Eysenbach 2008; Colineau and Paris 2010).

The social behavior in online health-related communities can differ from offline social interactions (McFarland and Polyhart 2015). For example, online users have been observed to engage in information disclosure in public forums or with complete strangers. IS researchers need to examine how the social contexts enabled by CHITs affect users' behavioral intentions (such as trusting an online community and engaging in information sharing or adhering to an intended behavior). A deeper understanding of how technology use is influenced by the (online) social context can help IS researchers develop more effective theories and identify opportunities to improve healthcare delivery by deploying IT more effectively (Kohli and Kettinger 2004). Toward this goal, this dissertation examines the influence of the online social context in CHIT on implementation outcomes, particularly on an individual's behavioral intentions to trust and participate in certain online patient communities or adhere to an intended behavior when using fitness technologies. Therefore, the overarching research question that is being addressed in this dissertation is:

Research Question: How (and to what extent) does the online social context influence CHIT users' behavioral intentions?

As will be described in the proposed empirical studies (i.e., Research Essay 1 and 2), there are several contextual factors in the online social context that can influence a user's behavioral intention when using CHIT. Online social contexts enabled by CHIT are unique and can influence a user's behavioral intentions. In the next section, we elaborate on the uniqueness of the social context within online health communities and how it differs from that in offline settings. We then provide an outline of the two essays and their contribution to HIT research.

Comparison of online and offline social context

The Internet enables *anonymity* (Meshi et al.2015; McFarland and Polyhart 2015; Colineau and Paris 2010) that, in turn, reduces psychological barriers towards seeking or sharing sensitive personal information (Colineau and Paris 2010). Users are often ignorant of the implications of sharing information online, a phenomenon commonly observed among older Internet users and the digital have-nots (Kim and Sundar 2016). These users engage in information sharing behavior with strangers within an online setting assuming anonymity. Such behaviours are less likely to occur within offline settings as their identities are known and can be verified (McFarland and Polyhart 2015).

Many real (online) interactions are dynamic, where people know that they will have a chance to lie, but they do not initially know the exact consequences of the available actions (Barcelo and Capraro 2018). In such situations, communications within online health communities can be said to be less *transparent* (i.e. open and honest). The Internet often acts as a veil to guard one's identity and, therefore, individuals may engage in sharing false information, which affects the *accuracy* of online information (Sbaffi and Rowley 2017; Colineau and Paris 2010). The lack of mechanisms to verify the accuracy of online information can, in turn, reduce the *receptivity* of the users to the information posted within online health communities.

Accessibility to a social network for social and emotional support is quickly facilitated through the Internet (Eysenbach 2008). Less *time and effort* are spent communicating in online health communities compared to offline social settings, since ubiquitous technologies such as mobile facilitate quicker and easier interactions with similar others irrespective of temporal and spatial distances (Meshi et al.2015). Users can now quickly reach individuals in a situation similar to his/hers (i.e. horizontal social linkages) through the Internet (Salehan et al. 2017),

which in turn may reduce any mental barriers they have with disclosing sensitive information. In addition, the ability to remain anonymous can improve *self-disclosure rates* (Salehan et al. 2017). However, the lack of open and honest communications in some online settings can act as a deterrent, thereby reducing the number of individuals engaging in self-disclosures within online health communities.

The *depth and breadth of the relations* formed in online health communities are observed to be shallow and wide; often encouraging connection through weak ties with better access to diverse information and experts while excluding people with low Internet-literacy levels (Salehan et al. 2017). In contrast, offline social relations are likely to encourage stronger ties (e.g., among family members, friends, work colleagues, counselors) with a narrower spectrum of knowledge and expertise while interacting with a homogeneous group due to emphasis on strong ties (Leatham and Duck, 1990). These relationships are often multiplex and evolve around several topics (Leatham and Duck, 1990). On the contrary, relationships between people in online health communities typically stem from one common experience (e.g., having the same medical condition).

Persistence of the information in online health communities can be longer (Meshi et al.2015; Colineau and Paris 2010). Afterall, the internet never forgets. Once posted, the information is retained by the system until the user deletes the information or account. In some cases, the information can remain forever and is even accessible to the public (e.g., public posts on PatientsLikeMe.com) (McFarland and Polyhart 2015). In contrast, information communicated verbally in offline interactions is less likely to persist (Colineau and Paris 2010). In addition, physical cues that are present in offline social interactions are missing in text-based online social interaction. The lack of physical cues in online interaction can affect judgment or perception of

other users because non-verbal cues that may aid interpretation are missing (Colineau and Paris 2010).

The online social context of health communities obviously differs from the offline social context in many ways. Table 1 provides a summarized overview of the key differences discussed above.

Table 1: Comparison of online vs. offline context

Comparison Dimensions	Online social interaction (online health communities)	Offline social interaction (face-to-face health related support groups)
Anonymity	Permits anonymous communication. Improves confidence in disclosing sensitive information particularly when other's disclose similar information.	Anonymous communication is not possible in face-to-face interaction. Lesser confidence in disclosing sensitive information as the identity of individuals is known. Trust plays a critical role in gaining confidence to disclose information.
Transparency	Internet can act as a veil, guarding the identity of the source. Transparency (i.e. open and honest communication) can be impacted.	Identify can be quickly verified and hence individuals are more transparent.
Self-disclosure rate	Self-disclosure is likely to be high as user's can quickly reach others in similar situation through internet. Transparency plays a critical role in improving the number of users engaging in self-disclosure.	Depends on the medium of communication and context. It is likely to be lower than in an online setting due to reach constraints.
Breadth and depth of relations	• encouraging connection through weak ties with less emphasis on how the relationship will evolve • better access to diverse information and experts • excluding people with low internet-literacy levels • relationships between people in online support communities, in contrast, are usually based on one common experience.	• stronger ties (e.g., among family members, friends, work colleague, counsellor, etc.) • narrower spectrum of knowledge and expertise • homogeneous group due to emphasis on strong ties, and hence less diverse • relationships are multiplex and evolve around a number of topics.
Time and effort for communicating	Easier and quicker with ubiquitous technologies like mobile devices	Takes time and effort
Accessibility to social network	Quicker in terms of space and time. Can access similar others at anytime, anywhere.	Needs effort on an individual's part to access similar others at a given time and is restricted to the location of the individual.
Persistence of information	Usually longer. Written information persists in some sites until the user deletes their accounts. In some cases, it persists forever (e.g., public forums).	Shorter if the information is communicated verbally.

Accuracy	Information posted in online support communities may be incorrect. Mechanisms for validating the information is still evolving.	Individual's a less likely to give wrong information when their identity can be known and verified.
Nature of communication	Lack of nonverbal cues in communication making communication single facetted.	Nonverbal cues mostly present, thereby making communication multifaceted.
Receptivity	Information posted in online health support communities may be viewed with skepticism by other users.	Information communicated in offline support communities may be viewed with less skepticism by other participants.

Despite the lack of accuracy, transparency, and strong ties within online health communities, quicker, easier, and in some cases anonymous communication with similar others facilitates Apomediation. Users may feel more confident in disclosing as well as seeking information online, especially when there is no need for an expert opinion. While users often gain emotional and informational support within online health communities, they can be subjected to unpleasant experiences such as cyber bulling. Studying the positive and negative effects of the online social context on a users' attitude/behavior as well as intent to use the system can enable the design of effective CHIT artifacts. The objective of essay 1 in this dissertation is, therefore, to examine the influence of online social interactions (e.g., social competition) in a given CHIT system (i.e. gamified systems such as Fitbit) on a user's intent to adhere to a given behavior.

Users of online health communities seek information from similar others (Salehan et al. 2017; Bernhardt and Felter 2004), which can be influenced by the textual content in the CHIT artifact. For example, a user is likely to look at the profiles of other users of an online health community before deciding to use the information in it (Bernhardt and Felter 2004). Similarity regarding a medical condition or a socioeconomic characteristic might attract users to a particular community. Given the wide array of online health communities available to users, CHITs that present users with informational proxies to assess others' trustworthiness are more

likely to be well-received. The study of the influential role of textual information in a given CHIT on information seeking or sharing behavior can enable the effective design of CHIT artifacts. Therefore, the objective of essay 2 in this dissertation is to examine the influence of textual information (e.g., users' location, race, gender, feasibility statistics) in a given CHIT system (i.e. online patient communities such as PatientsLikeMe) on a user's trust in the system and its users as well as the user's information sharing behavior.

Outline of the two essays

Using theories from social psychology, this dissertation encompasses two empirical research essays. While each one is designed to achieve the same overarching objective – i.e., understanding the influence of online social context on CHIT implementations and outcomes; each essay has its own objectives, motivations, and theoretical and practical contributions. Table 2 presents an outline for the two essays that will comprise this dissertation.

The first essay (Chapter 2) is a quantitative research study that examines the influential role of the online social context of a gamified CHIT on its success. It draws from the *environmental enrichment* concept (Young 2003). This essay examines how the social enrichment of the user's environment (internal to the IT artifact) can result in improved adherence to physical activity. By surveying existing fitness technology users, we demonstrate the influence of the social context enabled by CHITs on behavioral adherence to exercise.

The second essay (Chapter 3) is a quantitative research study that examines the influence of textual information (such as race, geographic location, etc.) in online patient communities on a user's trust of the community and the system as well as their intentions to participate in them. Prior studies have reported initial bias towards trusting others in exchange-based relational trust (Venneste et al. 2014). Initial bias in an online context can be influenced by an individual's

perception of the community and its members. We posit that the *electronic propinquity* (i.e., the psychological closeness with the electronic device and its content) (Carr and Haynes 2015) aspect of HIT will influence the trust perception of users, which in turn will impact sharing and consumption of information on online health communities. The second essay identifies some of the propinquity-related factors that influence a user's trust in online health communities.

Table 2: Overview of the two dissertation essays

Research Essay Title	Research Type	Methodology	Theoretical Background	Context	Contributions to theory
Chapter 2 Gamification : An Environmental Enrichment Perspective	Quantitative	One Online Survey	Environmental Enrichment	Fitness Technologies	• Identify effective HIT platform designs considering the users' perspective. • Bringing forth environmental enrichment to study the influence of social context in IS. • Identify the boundary conditions under which groups/communities enabled by the HIT influence an individual's motivation to perform a persistent health behavior.
Chapter 3 Does Thinking Abstractly Reduce Trust in System? Influential Proximity in HIT	Quantitative	Online Experiments	Construal Level Theory, Trust in IT and Intent to participate	Online Patient Communities	• Identify the influential role of electronic propinquity on user's trust in web-based health infomediaries. Explain how informational proxies aid user's with transcending the perceived risks and uncertainty to trust web-based health infomediaries (i.e. online patient groups/communities) with sensitive personal information. • Empirically validates the influence of multiple propinquity dimensions on the user's evaluation of an IT artifact.

Contribution to Health Information Technology Research

The extant research on HIT has addressed a variety of topics including the adoption of HIT within organization or by providers, factors influencing HIT success within organizations (e.g., alignment with external environment and firm strategy, executive management support, process adaptation, etc.), knowledge management systems in healthcare, HIT outcomes (e.g., consumer health literacy, healthcare performance), and healthcare quality (Gallivan 2018;

Agarwal et al. 2010). However, Kohli and Tan (2016) point out that research that situates IS researchers closer to the patients allows us to better observe patient needs. IS researchers can assist in the improvement of healthcare delivery by deploying IT more effectively if they better understand the users' needs (Kohli and Kettinger 2004). Recent research identifies several areas that deserve further study. Among these, the following topics motivate the two essays in this dissertation: social media and effective design rules for the platforms supporting healthcare communities (Fichman et al. 2011) and consumer's perspective on HIT (Agarwal et al. 2010).

Fichman et al. (2011) suggests that understanding how social media communities that are gaining popularity impact healthcare outcomes is a promising avenue for research. The primary driver of value in these communities has been commons-based peer production, in which individuals (often amateurs) self-select and self-organize to share detailed information about their own medical conditions and treatments (Fichman et al. 2011). In healthcare, there seem to be especially strong appropriation mechanisms (such as a desire to make a social contributions or to increase one's social standing) to substitute for monetary compensation in motivating participation (Fichman et al. 2011). Future research is needed to understand the conditions that influence the vitality of online health communities (Fichman et al. 2011), where community resources (i.e. knowledge base, membership) is essential for its sustenance. Our research seeks to address this gap by using construal level theory to understand the nuances in web content within online health communities that will improve user's trust and participation, which in turn influences the vitality of the community. From a theoretical perspective, we posit that the perceived psychological closeness based on textual information (such as race, geographic location, etc.) will improve a user's trust in the IT system, leading to increased participation. This essay draws on construal level theory to study how (social, temporal, spatial and

hypothetical) proximity of a user with other members' influences trust in a patient community and the intent to participate in the online health community.

Another research area worth pursuing is the identification of effective HIT platform designs considering a consumer's perspective. CHIT tools are poised to alter patients' engagement with their healthcare (Agarwal et al. 2010). With patient-centric healthcare systems becoming a reality, patients can take an active control in managing their health and well-being. Many health and wellbeing technological systems are now implemented with game elements (e.g., points, badges) to influence user's behaviors or attitudes (Seaborn and Fels 2016). Prior research has, however, reported mixed results on the effectiveness of various game elements on health-related behavioral outcomes (Johnson et al. 2016). The mixed results have been attributed to differences in the context of implementations as well as the heterogeneous nature of gamified elements. Drawing from the literature on *environmental enrichment* in social psychology, we seek to reconcile the mixed results observed in previous studies. Some of the fitness technologies on the market have communities enabled within them (e.g., Fitbit, Strava, Apple Activity). Therefore, we examine how the social context enabled by fitness technologies induces behavioral adherence to physical activity. This study highlights the need to consider appropriate social enrichments when designing fitness technologies to achieve better adherence to physical activity.

The main objective of this dissertation is to provide a deeper understanding of how the social context enabled by CHIT influences critical user outcomes such as participation in online health communities and behavioral adherence to physical activity. The key contribution of this dissertation is the advancement of our understanding of the important role played by the social context enabled by the CHITs.

Practical Implications

Recent changes in healthcare, such as optimization of electronic medical records in response to value-based care, democratization of health records, and patient engagement, are influencing HIT implementations as well as the ways individuals share information[2,3]. In addition, healthcare organizations are implementing new technological innovations (e.g., blockchain, artificial intelligence) with the intent of addressing key challenges plaguing the industry (e.g., the lack of interoperability, difficulty in granting patients access to their own health records, improving diagnostics and shared decision making)[4,5]. Moreover, there is a fundamental shift in users' preferences regarding immersive experiences, which is stimulating competition among HIT vendors[6]. Harnessing consumer technology for education, self-diagnosis, health monitoring, social support and rating healthcare experiences is increasing[7]. Yet, many healthcare organizations struggle to understand what CHIT designs are more effective in catering to the heterogenous group of consumers' they serve. With so much dynamism in the industry and a lack of understanding of effective CHIT designs that aid survival chances, there is a compelling need for research that identifies the factors that impact the effectiveness of CHIT designs and implementations. The aim of this dissertation is to address this need by identifying factors that influence the effectiveness of CHIT implementations. Our findings from essay 1 indicate that designers of fitness technologies need to account for as many social contextual factors (internal and external to the artifact) that can influence the user's motivation to continue use of the system and activity intended. In essay 2, we find that providing informational proxies

[2] https://www.cio.com/article/3251845/ehr/apple-and-the-democratization-of-patient-health-records.html
[3] https://www.gartner.com/doc/3829973/market-trends-healthcare-provider-trends
[4] https://hitinfrastructure.com/news/gartner-names-top-health-it-infrastructure-technology-trends
[5] https://www.cio.com/article/3241472/healthcare/4-predictions-for-health-care-it-2018-steady-as-she-goes.html
[6] https://www.gartner.com/smarterwithgartner/gartner-top-10-strategic-technology-trends-for-2018/
[7] https://www.gartner.com/document/3899984?ref=TypeAheadSearch&qid=b188e3de091cd81de19b77a45

(e.g., user's location) in a system can induce psychological proximity in users, leading to more trust and participation.

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CHAPTER 2

Research Essay 1

Gamification: An Environmental Enrichment Perspective

Abstract

Motivational information systems, such as gamified systems, often incorporate game design elements into a target system while retaining the target system's instrumental functions. The success of these systems lies in the perceived usefulness determined by enjoyment in using the system. Researchers of prior gamification studies have established that the affordances in these systems can psychologically motivate a user towards a particular behavior or attitude. However, a meta-analysis of the gamification literature reveals mixed results with respect to the outcomes. The context and environment are identified to influence gamification outcomes, yet, the influential role of environments in a gamified system have received scant attention. The objective of this research is to examine the influential role of the environment (both internal and external to the gamified system) on gamification success. By bringing forth the concept of environmental enrichment, we establish that gamified systems are just enriched environments within an information system that can nudge a user towards an intended behavior. We examine how one form of enriched environment (i.e., social enrichment) in a gamified system influences a user's motivation and behavioral adherence. Our findings reveal that certain gameful experiences (e.g., social competition and social experiences) can influence a user's perceived acceptance/rejection. This can, in turn, affect the user's intrinsic (or extrinsic) motivation, leading to an increase (or decrease) in behavioral adherence. Despite having the same game elements, the observed variation in a user's behavioral adherence can be attributed to the influence of environmental factors internal and external to the gamified system.

Keywords: Gamification, environment, enrichment, acceptance, rejection, behavioral adherence.

Introduction

Most individuals make New Year resolutions for self-change, with weight loss and smoking cessation being the prominent ones (Polivy and Herman 2002). They often undertake a self-changing task with overly optimistic and unrealistic expectations about what can be achieved, such as the riddance of undesirable but intrinsically-rewarding behavior, such as smoking. These changes, if successfully made, bring internal advantages such as pride, feeling in control, confidence, or improved health or functioning in these individuals (Polivy and Herman 2002), as well as a belief that another's perception of them will be more positive (Brownell 1991). However, some individuals fail in achieving their goals and interpret the failure as far from inevitable, convincing themselves that by making a few adjustments, they will be able to achieve their goal. They then embark on another attempt the following New Year, albeit with limited or no success. Overconfidence breeds false hope, which engenders inflated expectations of success, and eventually, the misery of defeat (Polivy and Herman 2002). This cycle of failure, interpretation, and renewed effort is referred to as the false hope syndrome (Polivy and Herman 2002). Many organizations (e.g., Nike, Fitbit, etc.) offer gamified IT artifacts to motivate their customers so that they will engage in healthier activities and avoid the false hope syndrome.

In prior studies on gamification, researchers have used affordance as a theoretical lens to study gamified artifacts and define gamification as the use of game elements (e.g., points, badges) in a non-gaming context to motivate users towards particular behavioral outcomes (Hamari et al. 2014; Deterding et al. 2011). Self Determination Theory, however, suggests that motivations are of different types (Ryan and Deci 2000), and that people with different types of motivations interact with gamified systems differently (James et al. 2019), which, in turn, results in differing outcomes (Hamari et al. 2014). For example, James et al. (2019) found that different

motivation types (i.e., intrinsic regulations, integrated regulations, identified regulations, external regulations, and non-regulation) had different influences on the use of environmental motivational support (i.e., social interaction features, exercise control features, and data management features) in fitness technologies, which, in turn, influenced subject vitality (i.e., a positive feeling of aliveness and energy) differently.

Gamification has often been conceptualized as an attempt to motivate an attitude/behavior change using motivational game elements in an IT artifact (Seaborn and Fels 2015; Hamari and Koivisto 2013). Prior gamification research, however, suggests that the effect of game elements on behavioral intentions/outcomes (used as a measure of gamification success) is dependent on the context and the heterogeneous nature of game elements in gamified artifacts (Alahäivälä and Oinas-Kukkonen 2016; Johnson et al. 2016; Hamari and Koivisto 2015a; Hamari et al. 2014; DeSmet et al. 2014). As James et al. (2019) point out, "there are characteristics of the environment or social context in which the individual is performing the activity that can be supportive (or unsupportive) of the individual's basic psychological needs of autonomy, competence, and relatedness that are crucial to intrinsic motivation." The more an individual's psychological needs are nurtured in a given context, or in a specific situation, the more they will engage in activities in a self-determined fashion (Vallerand and Lalande 2011).

Much empirical support exists for the hypothesized causal sequence "Social factors → Need Satisfaction → Motivation → Outcomes" (Vallerand and Lalande 2011). The influence of the social context (such as group membership and interactions with others in the system) on an individual's motivation to use gamified systems can potentially explain the heterogeneous effects observed in some of the prior studies. We posit that that online social context (e.g., groups or communities) represents such a context that may influence behavioral outcomes with gamified

artifacts. Our research, therefore, seeks to address the following research question: ***How does environmental motivational support with social interactions embedded in it (such as in groups or communities) influence behavioral outcomes when using gamified artifacts?*** More specifically, we examine whether the online social context in social interaction features within gamified artifacts influence a user's motivation to persist with health-related behaviors (e.g., adherence to fitness regime).

Neuroscientists have observed that game elements in gamified systems can cause feel-good chemical reactions, alter human responses to stimuli, and can improve learning, participation, and motivation[8]. Such an ability to achieve desirable behavior within an artificial setting while controlling for or reducing/eliminating aberrant behavior maps well with the concept of Environmental Enrichment (EE) (Baumans 2005; Hutchinson et al. 2005). EE focuses on physiologically and psychologically stimulating the brain by enriching the environment around the targeted entity to achieve an intended behavior in an artificial setting (Mellen and Sevenich MacPhee 2001; Solinas et al. 2010; Schneider 2006; Jankowsky 2005). Thus, EE is an ideal candidate to study the influence of social context on gamified system use and behavioral change. The concept EE offers the potential to understand how environmental motivation support, when created through a combination of technology and people (such as online social groups in gamified artifacts) can help achieve realistic behavioral outcomes.

EE also offers the ability to reconcile the differential effects observed for various game elements on behavioral outcomes when using gamified systems. We argue that a gamified system can be enriched in a manner that encourages some level of consistency in users' behavioral outcomes. To explain whether this can be achieved, we derive a theoretical model by

[8] http://www.pewinternet.org/2012/05/18/the-future-of-gamification/

invoking theories from social psychology, which demonstrates the influence of social interactions on the level of consistency in users' behavioral outcomes.

Our research contributes to the Information Systems literature in two ways. First and foremost, we have expanded upon the gamification literature by examining the phenomena from the perspective of social psychology and the environment. Our research addresses Santhanam et al.'s (2016) call for the need to investigate the design and use of gamified artifacts from a variety of disciplinary perspectives. In our study, we examine the influence of contextual elements such as groups/communities on the success of a gamified artifact. Prior studies have suggested that the success of gamified artifacts is dependent on the context (Hamari and Koivisto 2013), with researchers of gamification studies reporting mixed results for social game elements (Koivisto and Hamari 2019). However, there is a lack of research on how and why the social contextual elements, such as groups/communities, influence gamification success. Through our study, we seek to address this gap by explaining why some artifacts are more effective in inducing intended behaviors in users than others. Second, we use Environmental Enrichment (EE) as a novel way to understand the influence of environmental factors on behavioral outcomes. EE has been used within other fields based on the assumption derived from practitioners' understanding that giving entities choice and control in their environment stimulates their motivation to perform behaviors that may indicate a heightened state of well-being (Watters 2009). This assumption has remained untested, mainly due the limitation in assessing the motivation of the entities (i.e., animals, autistic individuals, children, etc.) studied in EE research. Through IS research, we aim to expand the EE research domain to understand how and to what extent social enrichments improve motivations and behavioral outcomes. This perspective can be applied in a variety of

contexts, such as the examination of privacy concerns and willingness to disclose information, which will illuminate theory and practice alike.

In the following sections, we discuss the relevant literatures and propose a theoretical model that explains the influence of groups on behavioral adherence (used as a measure of gamification success in this study). Following this, we proceed to describe the research methodology used for this study, and then discuss the implications of our research.

Theoretical Background

In this existing Information System (IS) literature, researchers have frequently studied two types of systems: utilitarian systems and hedonic systems (Koivisto and Hamari 2019). The first type of system aims at achieving operational efficiency and productivity within a given setting (Koivisto and Hamari 2019), such as a decision support system for better decision-making. The second type of system typically focuses on entertainment systems (Koivisto and Hamari 2019), such as Second Life, where users engage with the system to perform a hedonic activity with the intent of having fun. A new class of system that combines the objectives of a utilitarian system and hedonic system have emerged in IS research, where the purpose of the system is to improve productivity through fun (Koivisto and Hamari 2019). These new systems that adopt a "delight by design" strategy (Chitturi et al. 2008) are called *Motivational Information Systems*. Acceptance of Motivational Information Systems is mainly observed to be due to perceived usefulness determined by enjoyment in using the system (Koivisto and Hamari 2019). One form of system that falls under this classification is technologies that combine a utilitarian outcome (e.g., improve productivity) with game-like features (e.g., points, badges). These newer forms of technologies have been studied in IS research under the concept of gamification.

Gamification

Gamification is a concept that has garnered increasing attention across funding agencies, academic disciplines, and various industries (Koivisto and Hamari 2019; Santhanam et al. 2016; Dorling and McCaffery 2012). The term gamification, initially coined by Nick Pelling in 2002, started to gain popularity in academic circles around 2010 (Santhanam et al. 2016). Santhanam et al. (2016) define gamification as "the incorporation of game design elements into a target system while retaining the target system's instrumental functions." The game design elements are intended to motivate and engage information system users to use the system regularly (Aparicio et al. 2012), as well as to induce good habits (Hassan and Hamari 2019). Through the integration of game elements (e.g., levels, badges, rewards, progression, points, etc.) into a system, a given purpose (engagement, participation, better quality data, etc.) is achieved (Hamari et al. 2014; Harms et al. 2014). For example, Ghanbari et al. (2015) demonstrated that the use of serious online games facilitates innovation, creativity, communication, and collaboration amongst stakeholders during requirements elicitation in a distributed software development environment. An individual's playfulness, attitude, and enjoyment was, however, found to affect playing intentions in the context of online gaming (Hamari and Keronen 2017; Hsu and Lu 2004); therefore, playfulness can affect the success of gamified artifacts in achieving a given goal or purpose. In addition, the difficulty of performing a given task would also determine an individual's valence and expectancy belief about achieving a goal when using gamified systems.

Drawing from established theories of intrinsic motivation, gamified systems commonly employ motivational features, such as immediate success feedback, continuous progress feedback, or goal-setting through game elements like point scores, badges, levels, or challenges and competitions; relatedness support, social feedback, recognition, and comparison through

leaderboards, teams, or communication functions; and autonomy support through customizable avatars and environments, user choice in goals and activities, or narratives providing emotional and value-based rationales for an activity (Johnson et al. 2016). In several studies, researchers have used affordance (Gibson 1986; Leonardi 2011; Treem and Leonardi 2013) as a theoretical lens to understand gamification, suggesting that motivational affordances in a gamified system influence behavioral outcomes (Koivisto and Hamari 2019; Hamari et al. 2014). However, Hamari et al. (2014) concluded that game elements provided as motivational affordances in the gamified system produced psychological (e.g., experience, fun) and behavioral (e.g., participation, performance, better data quality) outcomes; however, the positive effect of motivational affordances on behavioral outcome depended greatly on the context in which the activity was performed and the users of the system. Johnson et al. (2016) also echoed a similar finding by pointing out that gamification success depended on the context it was used in, the manner in which it was applied, and the alignment between the gamification technique applied and the needs of the artifact's audience.

Gamification has been criticized for often using certain pre-existing patterns of design elements with presumed motivational effects, regardless of the different implementation situations (Alahäivälä and Oinas-Kukkonen 2016; Johnson et al. 2016). Irrespective of the implementation situation, meaningful engagement in gamified systems, composed of experiential and instrumental outcomes, requires invoking enjoyable experiences and fostering engagement while enhancing task outcomes (Santhanam et al. 2016). Santhanam et al. (2016) suggest that experiential outcomes (e.g., enjoyment, joy) and instrumental outcomes (e.g., greater participation, contribution) need to be factored in separately when designing gamified systems, and can only be achieved by understanding the dynamics of the user-system interactions,

including system-user communications, feedback from the system, as well as interaction with others within the system.

Gamification is a dynamic, cyclical, two-way process in which the technology, the users, and the contextual factors of the systems all contribute to the outcomes achieved (Koivisto and Hamari 2019). While gamification has been implemented in domains (such as healthcare and education) in which long-term commitment and perseverance is needed for gaining results, the context is evidently much more sensitive (Koivisto and Hamari 2019) and must be factored in when designing gamified systems. In addition, Santhanam et al. (2016) note that the manner in which a system sets up game-like interactions and presents feedback influences the quality of user-system interactions. They point out that research on gamification is limited, and that there exists a need to answer follow-up questions such as "what sets apart good gamification designs from poor ones? What theories can inform the development of good designs?" They suggest that researchers need to investigate the design and use of gamified artifacts from a variety of disciplinary perspectives (including social psychology) to understand gamification in its entirety. Research on the influence of various game elements, along with the context (internal and external to the system) on gamification success (conceptualized as a change in attitude or behavior), can aid in understanding what sets apart good gamification designs from bad ones.

Context and gamified systems

The extant literature surrounding gamification has typically focused on elements of gamification and the end results of its application (e.g., Huotari and Hamari 2012). For example, extant research on gamification that uses affordance theory as a theoretical lens to study gamified artifacts explains the phenomena as the influence of motivational affordances (e.g., points, badges, etc.) on psychological outcomes, which, in turn, leads to behavioral outcomes (Hamari et

al. 2014). The current gamification theorization has taken a decontextualized approach to investigate the influence of the independent variable (game design/mechanics or game elements such as points) on the dependent variable (e.g., health-related lifestyle changes or learning) within a given context (Figure 1). This view, however, fails to explain why some gamified systems are more successful than others in a given context. In fact, Johnson et al. (2016) found that the impact of gamified interventions on health and well-being was predominantly positive (with 59% of studies reporting a positive effect), albeit with a significant proportion (41%) of studies reporting mixed or neutral effects. Similarly, DeSmet et al. (2014), in their meta-analysis, reported small but positive effects of gamification on preventive care outcomes. They suggested that the heterogeneous aspect of gamification features influenced the effect, and that further exploration of the game features that created a larger effect was required. James et al. (2019) study on fitness technologies (a gamified system) aids with reconciling some of the differences observed with respect to the heterogenous outcomes reported in gamification studies. They specifically identified the features in wearables that were appealing to its users based on the motivation types proposed by organismic integration theory. Social interaction features were found to be more promising than other types of features. However, Koivisto and Hamari (2019) pointed out that researchers on gamification need to pay attention to the determinants outside of the gamification affordances provided to gain a complete understanding of gamification success.

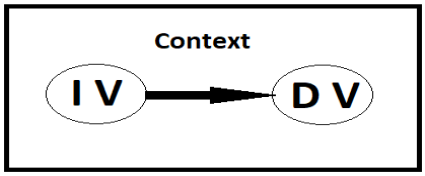


Figure 1: Decontextualized theorization in gamification

Prior studies have emphasized that contextual factors can influence the effect of game elements on behavioral outcomes (see Table 1). Johns (2006) define context as "situational opportunities and constraints that affect the occurrence and meaning of organizational behavior as well as functional relationships between variables." Context, which has the potential to shape the very meaning of behavior and attitudes (Johns 2006), needs to be considered when determining the success of gamification when applied in a given scenario (Alahäivälä and Oinas-Kukkonen 2016; Johnson et al. 2016; Hamari et al. 2014). Context can shape both the experiential and instrumental outcomes of a gamified artifact. For example, extroverts might enjoy playing games in the presence of others and, hence, gamified artifacts with social interactions embedded in them (e.g., groups or communities) might be more successful in achieving a given objective amongst these users. Johns (2006) also points out that situational variables at one level can affect variables at another level (Johns 2006). For example, prior research has established the influence of social groups on individual behaviors in an offline setting (Milgram 1963; Kelman 2006). The influence of contextual factors on gamification success cannot be ignored, thereby necessitating its consideration in future theorizations.

Table 3: Review of gamification studies

Gamification studies	Description	Findings	Role of context
Suh and Prophet (2018)	Literature review of research on immersive technologies with augmented reality/virtual reality embedded in them.	Users of these systems reported positive instrumental outcomes (e.g., learning effectiveness), but negative experiential outcomes (e.g., physical discomfort).	Physical or mental immersion with a system's environment and spatial / social / temporal presence with the users/content of the system influenced outcomes.
Seaborn and Fels (2015)	Review of gamification focusing on empirical findings related to purpose, context, design, approaches, techniques, and user impact	Definitional subjectivity, diverse or unstated theoretical foundations, incongruities among empirical findings, and inadequate experimental design remain concerns.	Findings paint a mixed picture of the effectiveness of gamification in different contexts (i.e., impact was different in different domains).

González et al. (2016)	Studied the influence of gamification of educational activities on healthy lifestyle changes in children.	Gamification positively influenced healthy lifestyle changes in children.	Contextual factors, such as the physical environment, were viewed to be influential on the effect induced by the system.
Hamari et al. (2014)	Literature review of gamification studies to understand if gamification works.	Positive effects of affordances on psychological and behavioral outcomes exist only partly in relationships between the gamification elements and studied outcomes.	Gamification identified as a phenomenon more manifold than the studies often assumed. They suggest the need to investigate the impact of gamified systems in different contexts.

The influence of the context (internal and external) on the success of the gamified IT artifact has been identified in prior gamification research. For example, Gonzalez et al. (2016) established the influence of gamification (active video games, motor games, and the gamification of educational activities) on healthy lifestyle changes in children, but the physical environment was viewed to be influential on the effect induced by the system. Similarly, Hamari and Koivisto (2015) found a positive effect for social influence (recognition and reciprocity) in a gamified artifact on attitude and continuance of use of the artifact, however, this effect was found to be larger when the user had more friends. Suh and Prophet (2018) performed a literature review of research on immersive technologies with augmented reality/virtual reality embedded in them, and found that users of these systems reported positive instrumental outcomes (e.g., improved learning effectiveness, increased learning engagement, reduced disease symptoms, improved learning attitude and task performance), as well as several negative experiential outcomes (e.g., physical discomfort, motion sickness, cognitive overload, distracted attention). The possibility of game elements with different environmental characteristics (e.g., social groups, augmented reality) existing in the gamified artifact can potentially explain the differential effect of game elements on engagement and outcomes observed in prior studies. This, however, requires an understanding of the influential role of the context (internal and external to the system) on the

success of gamified artifacts. The objective of this research is, therefore, to enable future gamification researchers to contextualize theories (Figure 2) by presenting a new perspective using the concept of Environment Enrichment (EE). EE is a concept used in Animal Husbandry and Medical Sciences to describe how the environments of a targeted entity can be changed for the benefit of the inhabitants (Young 2003). The goal of EE is to increase an entity's behavioral choices by drawing out their species-appropriate behavior and abilities in artificial settings (Young 2003), while increasing positive utilization of the environment (Mellen and Sevenich MacPhee 2001).

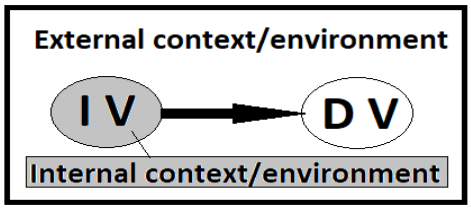


Figure 2: Contextualized theorization in gamification

Influential Role of Environment and Environmental Enrichment

Jean-Baptiste de Lamarck (1744-1829) was probably the first naturalist to propose that living beings are forced to adapt to their ever-changing environments by restructuring their behavior (Lamarck 1802). Lamarck argued that the adaptive force was powered by the interaction of the organisms with their environment through the use and disuse of certain characteristics. Charles Darwin (1809-1882) also established the role of environment on adaptive behavior. These two bodies of work have been considered in psychology as being influential in shaping studies that study the role of environment.

Driven by the proposition that environment influences behavior, Donald Hebb (1947) established a new concept called Environmental Enrichment (EE). He argued that the environment had a role to play in motivation and learning. EE is a concept which describes how

the environments of a targeted entity can be changed for the benefit of the inhabitants (Young 2003). EE is a dynamic process in which changes to structure and practices are made in an artificial setting, such as a zoo. The goal is to increase the entity's behavioral choices by drawing out their species appropriate behavior and abilities, while enhancing their welfare (Young 2003) [see Figure 3]. EE results in the stimulation of the brain by its physical and social surroundings with the aim to achieve multiple goals; namely:

1. Enhancement of the psychological and physiological well-being of the targeted entity.
2. Identify and reduce potential sources of chronic stress and/or enhance the targeted entities ability to cope with acute stress.
3. Reduce or eliminate aberrant behavior and concurrently provide opportunities for entity-appropriate behavior and activity patterns.
4. Enable the entity to exhibit desirable natural behavior in artificial settings.
5. Increase behavioral diversity.
6. Increase positive utilization of the environment.

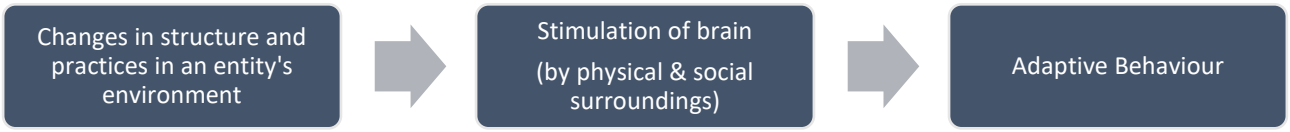


Figure 3: Simplified model of Environmental Enrichment (EE)

EE has been used as a mechanism in animal husbandry to stimulate desired natural behavior in artificial settings while controlling for undesirable behaviors (Mellen and Sevenich MacPhee 2001). EE has also been used within medical science as a mechanism for reducing or eliminating aberrant behaviors, and for correcting the effects of certain illnesses, such as Alzheimer's and autism (Solinas et al. 2010; Schneider 2006; Jankowsky et al. 2005). From an

education perspective, EE has been used to design many learning programs, such as the "Head Start" program.

Gamification has been identified as the enrichment of software with design features known from games to invoke similarly engaging experiences as games do (Morschheuser 2018) with the objective to motivate users towards a certain behavior or attitude. It can, therefore, be viewed as an environment enrichment approach. Figure 4 provides a detailed overview of the environmental enrichment process with the gamified elements identified from a synthesis of the prior literature. An enriched environment will induce physiological and psychological changes in the targeted entity. When appropriate enrichments are applied in the environment, the targeted entity's behavior can be controlled in a manner that only intended behavior is displayed. For example, points or rewards in fitness technologies induce a positive feeling in the user's mind when a given target is achieved, which, in turn, results in more fitness activities (or continuation of existing fitness regime). However, James et al. (2019) note that users of fitness technologies have different motivation levels, which will, in turn, influence the game elements they use.

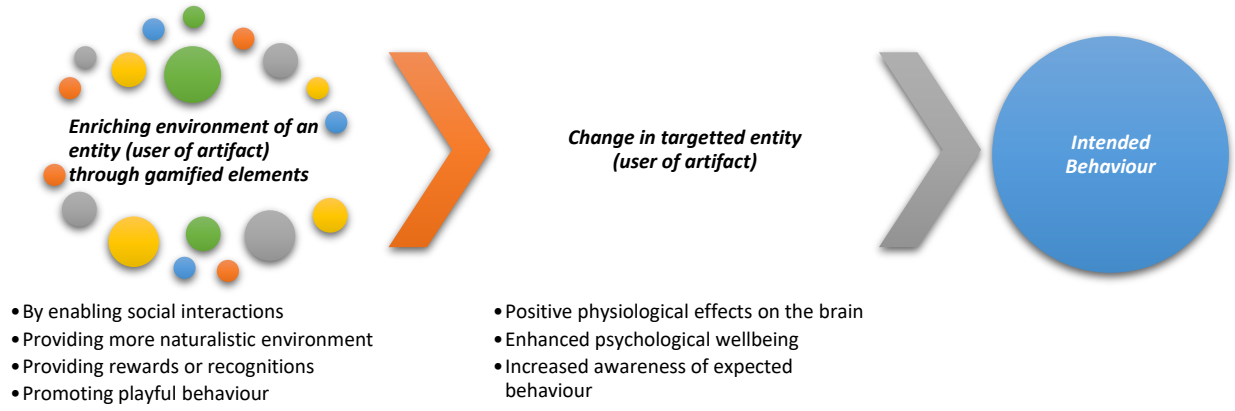


Figure 4: Process overview of EE in technology artifacts with gamified elements

There are two approaches to implementing EE – the *naturalistic approach* and the *behavioral engineering* approach (Young 2003). The naturalistic approach relies upon creating an environment similar to the real environment to invoke natural characteristics in the targeted entity. For example, immersive technologies with augmented reality embedded in them (e.g., PokemonGo) provide users with a naturalistic environment. This approach, however, is costlier to implement and can induce natural behavior, including unwanted ones. On the contrary, the behavioral engineering approach relies on providing just the required amount of enrichment to induce certain behaviors in the targeted entity. For example, fitness technologies provide their users with game elements such as points, rewards, or even social groups (e.g., Fitbit, Fitocracy). Critics of the behavioral engineering approach, however, consider it as promoting the performance of artificial behaviors.

From a psychological point of view, one of the main characteristics of EE is to give individuals some sort of control and choice over its own social and spatial environment (Baumans 2005; Hutchinson et al. 2005) while ensuring their behavior conforms to expectations. It has now been clearly established in medical science that exposure to EE has a variety of positive physiological effects on the brain and behavior, such as increased performance on learning and memory tasks, etc. (Rosenzweig and Bennett 1996; van Praag et al. 2000; Will et al. 2004). The concept of EE, therefore, offers the potential to understand how certain environmental motivation support created by a combination of technology and people (such as online social groups in gamified artifacts) induces more behavioral change than other types of game elements (James et al. 2019).

Enriched environments are often ‘‘a combination of complex inanimate and social stimulation’’ (Rosenzweig et al. 1978) and can be provided through gamified elements that

stimulate curiosity and exploration (Laviola et al. 2008; Nithianantharajah and Hannan 2006; Rosenzweig and Bennett 1996; Rosenzweig et al. 1978; van Praag et al. 2000), as well as enjoyment and fun. EE has been implemented in animal husbandry using one of the many approaches listed in Table 2. Gamified systems commonly employ motivational features, such as immediate success feedback, continuous progress feedback, or goal-setting through game elements like point scores, badges, levels, or challenges and competitions; comparison through leaderboards, teams, or communication functions; and autonomy support through customizable avatars and environments, or narratives providing emotional and value-based rationales for an activity (Johnson et al. 2016). Table 2 contains a mapping of these motivational features provided within existing gamified technology artifacts to the appropriate EE approach identified from animal husbandry literature.

Table 2: Types of EE used in Animal Husbandry and examples of EE in gamified IT artifacts

Type	Animal Husbandry Approaches (Young 2003)	Examples of game design elements used in IT artifacts
Social EE	Contact (e.g., pair, group, etc.)	Social groups, communities
	Non-contact (e.g., visual, auditory, etc.)	Avatars
Occupational EE	Psychological (e.g., puzzles, etc.)	Puzzles, challenges, points, rewards
	Exercise (e.g., mechanical devices, etc.)	Maps integration to show running/walking routes and distance
Physical EE	Enclosure (e.g., larger spaces, etc.)	Virtual reality
	Accessories (e.g., bars, toys, etc.)	-
Sensory EE	Visual (e.g., T.V. tapes, etc.)	Augmented reality
	Auditory (e.g., music, etc.)	Sound, music
	Others (e.g., olfactory, etc.)	Story/theme
Nutritional EE	Delivery (e.g., scheduled, frequency, etc.)	-
	Type (e.g., variety, novel, etc.)	-

Only some of the EE approaches used in animal husbandry can be implemented in an IT artifact due to the lack of physical presence in the artifact. Of the many EE approaches, social EE has been found to be more effective from an economic analysis of behavior perspective in animal husbandry (Young 2003). As demonstrated in Figure 5, one way of enabling social EE is by

facilitating the existence of groups in the captive entity's environment, which, in turn, will influence how the entity behaves in that environment (Young 2003). The entity's behavior is controlled by the social influence of other group members. Groupings in animal husbandry share some commonalities with social groups in humans. In animal husbandry, social companionship provides animals with an increased probability of finding food, as well as the ability to avoid predation. Humans share some similarity in terms of their objective for seeking companionship; that is, they seek companionship to increase their probability of finding information (Young 2003; Festinger 1950; Festinger 1954), as well as reducing risks (Young 2003; Forsyth 2000). Group size has been found to be important in both cases, with larger groups associated with group ineffectiveness (Young 2003; Kreijns et al. 2003). Similarly, roles within groups exist in both cases and is an important factor in maintaining group stability (Young 2003; Arrow 1997). Social life in animals and humans, however, differs in many ways. Groups are usually hierarchical amongst animals, which is also the case in humans, with the exception that the structure of the hierarchy changes from time to time (Arrow 1997). Similarly, the social life of animals in groups is not always harmonious with physical separations alleviating the issue (Young 2003). Disharmony amongst humans exists, but is often alleviated by direct confrontation or through arbitration. Disharmony within the online social context can exist and can be controlled through moderators/admins who are viewed as leaders within the community.

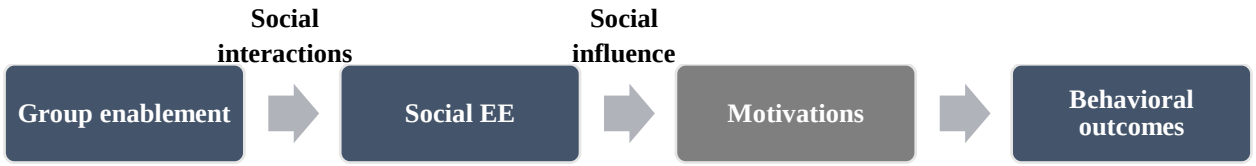


Figure 5: Simplified model of Social Enrichment in Environment

In wearables (a gamified system), IS scholars have observed that environmental motivation support with social interaction were found to be appealing to all the motivation types,

except identified regulations (James et al. 2019). This would mean that most individuals' using wearables were most likely to be part of a group (e.g., Cardio or At-Work group in Fitbit) or have a coach assist them with achieving their goal of achieving physical fitness. Using the Self Determination Theory, James et al. (2019) established that social feature use enhanced the psychological wellbeing (measured as subject vitality) for intrinsic regulation and integrated regulation motivation types of users, as well as for amotivated type of users, while reducing the psychological wellbeing for the introjected regulation and external regulation motivation types of users. However, EE theorists continue to suggest that enrichments in an entity's environment may stimulate that entity's motivation to perform behaviors that may indicate a heightened state of well-being (Watters 2009). So, do the social enrichments provided in wearables directly stimulate a user's goal motivation causing it to behave in a certain way? If yes, how does the social environment in wearables influence a user's goal motivation to behave in a certain way after the user has decided to use social features within wearables? In our study, we seek to answer these questions by bringing forth the *Environmental Enrichment perspective* to examine the effects of the online social context in gamified systems on a user's goal motivations to perform a certain behavior over time. We hypothesize that the online social context can positively or negatively influence a user's goal motivation to perform a persistent behavior. While James et al.'s (2019) study provides insight into the adoption behaviors within wearables and its influence on psychological wellbeing, this study complements their findings by examining post-adoption behaviors after a user has chosen to use the social features within the gamified artifacts (e.g., Fitbit). In this study, we specifically examined whether the online social context in social interaction features within gamified artifacts influence a user's motivation to persist in health-related behaviors (e.g., adherence to fitness regime). In doing so, this study

addresses James et al.'s (2019) call for the need to explore the ramification of using such technologies as environmental motivation support for performing persistent behaviors (e.g., exercising regularly).

Social Motivation and Adhering to a Behavior with Gamified Systems

Motivation: The hierarchical model of motivation states that motivation can be influenced at three generality levels: global (i.e., personality), contextual (i.e., life domain), and situational (i.e., state) (Vallerand and Lalande 2011). At all three levels, the influence of intra-personal and interpersonal factors on motivation (both intrinsic and extrinsic) has been observed (Vallerand and Lalande 2011). These factors influence motivation only when all three psychological needs—autonomy (feeling free to choose one's course of action), competence (interacting effectively with the environment), and relatedness (feeling connected to others)—are met (Vallerand and Lalande 2011). In gamified systems, Xi and Hamari (2019) found that both social features (e.g., competition, networking, etc.) and achievement features (e.g., points, progress bar, badges, medals, trophies, etc.) satisfied an individual's intrinsic need for autonomy, competence, and relatedness. However, the researchers pointed out that with social features, "users have more incentive to make progress and develop skills when they can build stronger social relationships with others."

People's perceptions of their social environment is a key determinant of their motivation (Vallerand and Lalande 2011). The influential role of social environment on an individual's motivation to participate in team sports has been echoed in the sports literature (Hodge et al. 2008; Allen 2005). According to Allen (2005), motivation was considered as a psychological process, but the central energizer of motivation (or goal of action) in a social context, such as team sports, is the desire to develop, maintain, and demonstrate social bonds or connections with

others. This desire for a social connection has been found to be particularly important for middle-aged and older adults participating in sports than for younger athletes (Hodge et al. 2008). Socio-psychological well-being (i.e., affiliation, recognition, relaxation, aesthetics, excitement) were more important to these individuals than achieving goals (Hodge et al. 2008).

Social motivation, "one's desire to orient to the social world, to seek and find reward in social interaction, and to maintain social relationships" (Anderson 2016), has been used in the literature to understand behaviors and examine how deviant behaviors can be changed or controlled (e.g., reducing antisocial behavior in autistic individuals) (e.g., Burnside et al. 2017). Chevallier et al.'s (2012) theoretical distinction of social motivational mechanisms forms the basis for developing knowledge in this area. Chevallier et al.'s (2012) social motivation theory identifies three different mechanisms of social motivation; namely: social orientation, seeking and liking, and social maintaining. Social orientation occurs when social signals (such as a like on a social media post) are granted attentional priority and affect an individual's biological mechanisms (e.g., facial expression) and psychological dispositions (e.g., curiosity, enjoyment) towards the signal (Chevallier et al. 2012). In gamified systems, this is reflected by subjective norms influencing the expectations of others in the group. Seeking and liking occurs when an individual orients to the social world that s/he finds socially rewarding and actively engages in efforts towards obtaining social rewards (such as getting support or approval from others). In a gamified systems, users accept the social influence of others who share their goals and values. This is manifest in behaviors such as joining social groups or communities with similar goals (e.g., Cardio group or At-work group in Fitbit) and abiding to group norms. The group norms, which are a shared agreement among group members about their shared goals and expectations, are internalized (Ren et al. 2012), and users change their behavior to fit in. Finally, social

maintaining occurs when an individual adopts strategies that quench his/her desire to engage with others over sustained periods of time. Users of gamified artifacts establish, maintain, and enhance their relationships with others in a social group by engaging in ingratiating behavior, such as posting flattering comments to other users' posts or unconsciously mimicking others' nonverbal manners (e.g., performing the cardio activity even when they don't feel like doing it). During the social maintaining process, the individual accepts the social influence to establish and maintain a satisfying self-defining relationship to another person or group, and is "a part of an individual's self-concept which derives from his knowledge of his membership of a social group together with the value and emotional significance attached to that membership." (Ren et al. 2012)

The effects of *perceived social exclusion*, ***"****perceived state of being ignored, and excluded in the presence of others"* (Williams et al. 2010) on well-being are a natural consequence of the strength of social motivation (Chevallier et al. 2012). Social rejection can lead to a psychological state that is similar to physical pain and activates similar brain circuits (Chevallier et al. 2012). The impact of social exclusion can manifest in every aspect of social motivation (orienting, seeking and liking, and maintaining) (Chevallier et al. 2012). Perceived social exclusion can enhance attention to social cues and seek social interactions more, and leads to enhanced social maintaining, such as non-conscious mimicry (Chevallier et al. 2012). In gamified systems, perceived social exclusion can lead some individuals to expend more effort in the hope of gaining back the support of the group (Williams et al. 2000). Social motivation thus appears to function like other basic homeostatic systems: relative deprivation gives rise to negative feelings that signal to the individual that his/her needs are not met, and a sophisticated psychological

machinery is then triggered in an attempt to restore balance in the system (by increasing orientating, seeking, and maintaining behaviors) (Chevallier et al. 2012).

An individual's feeling about themselves and their identities depend on inclusion in social groups that sustain their sense of satisfaction and well-being (DeWall and Bushman 2011; Baumeister and Finkel 2010). The effects of *perceived social acceptance*, "*a perception of other people signaling they wish to include you in their groups and relationships*" *(Leary 2010)*, on wellbeing has been documented in prior research. For example, van der Veen et al. (2013) observed that social acceptance can evoke cardiac and brain responses that are important to an individual's wellbeing. The impact of social acceptance can also manifest in every aspect of social motivation (orienting, seeking and liking, and maintaining). Humans are inherently biased towards wanting to see their predictions for being 'liked' confirmed (van der Veen et al. 2013), thereby resulting in gamified users quickly deciphering attentional cues that signal acceptance from other members during orientation. It is particularly rewarding for individuals to learn that people who you expect to like you indeed confirm that they like you (van der Veen et al. 2013). Motivation theory, however, suggests that a drive that is satisfied should temporarily diminish in strength (DeWall et al. 2008). Thus, when people receive feedback conveying a message of social acceptance, their motivation for affiliation should be satiated, and therefore, should be reduced for a while (DeWall et al. 2008). This, in turn, can temporarily decrease orientating, seeking, and maintaining behaviors. The reduced effort could also be attributed to preserving resources for other tasks (DeWall et al. 2008) and can also occur within gamified systems.

Behavioral adherence: The quote "willingly following someone else's ideas in allegiance or with devoted support (thereby an active decision of the adherent party)" (Sandman et al. 2012), in other words, means to be influenced by an individual's motivation towards a given behavior

(Vallerand and Lalande 2011). The influence of motivation on behavioral adherence is so important that non-adherence represents a lack of fit with what the individual finds important themselves (Sandman et al. 2012). The effect of social factors on the motivation to persist with a given behavior has also been documented in social sciences. For example, Deci et al. (1982) found that a teacher's interactive style influenced students' motivation towards education. Similarly, competitive swimmers were observed to persist in a behavior when the social context was autonomy supporting (i.e., the swimmer was not influenced by a controlling coach) (Pelletier et al. 2001). At the contextual level of generality, the influence of social factors on motivations to persist with a behavior was determined by variables that recurred on a regular basis (Vallerand and Lalande 2011). Therefore, temporary social rejection could impact the motivation of individuals to adhere to a group's expectations. Persistence would, however, depend on whether the motivation was self-determined or not. On one hand, recurring factors that led individuals to feel controlled produced a decrease in intrinsic motivation and identified regulation (Vallerand and Lalande 2011), thereby decreasing the persistence with a behavior. On the other hand, recurring factors that led individuals to feel controlled produced an increase in certain types of external motivation (Vallerand and Lalande 2011), thereby increasing the persistence with a behavior. The opposite effect was observed for the influence of autonomy on motivation to persist with a behavior (Vallerand and Lalande 2011).

Social influence can play an important role in the formation of intrinsic motivation towards a behavior (Vallerand and Lalande 2011) and has been shown to significantly drive the voluntary use of IT for non-work related purposes (Ren et al. 2012). In fact, Ren et al. (2012) found that group-based identification was more effective in improving member participation when using IT for non-work-related purposes. Similarly, James et al. (2019) found that social interaction

features of current fitness technologies (a gamified system) showed more promise in assisting well-being outcomes in fitness technologies for the more self-determined subtypes of exercisers in the spectrum of self-determination proposed by organismic integration theory. In their study, the effect of social interaction features on subject vitality (a positive feeling of aliveness and energy) was observed to be stronger than that of data management features. Social influence can play an important role in motivating a behavioral change (i.e. adhering to an intended behavior) with gamified technology, and artifacts with social EE are likely to be more successful. This, however, requires empirical validation and is an objective of this study.

Self-Regulation with Gamified Systems

Self-regulation is the effortful control of behavior and effortless, automatic, or habitual forms of goal-directed behavior and plays an important role in goal pursuits (Milyavskaya et al. 2015). Health-related goal pursuits, such as reducing weight or quit smoking regularly, requires greater sensitivity to temptations or impulsive decision-making to enable goal achievement (Milyavskaya et al. 2015). In goal pursuits, individuals have both *want-to* motivations and *have-to* motivations. The want-to motivation is an autonomous motivation, where the locus of causality explains why a goal is pursued (Milyavskaya et al. 2015). This motivation is more intrinsically-driven, whereby a person pursues the goal out of interest or enjoyment, or even because the goal is important or assimilated into the person's identity. On the contrary, the have-to motivation is a controlled motivation with a regulatory focus that explains how a goal is pursued (Milyavskaya et al. 2015). These motivations are extrinsically-driven, where a person pursues the goal for external reasons (such as rewards) or out of a feeling of shame or an obligation to oneself. Both types of motivation can aid with overcoming temptations or obstacles that prevent an individual from accomplishing their goals (Milyavskaya et al. 2015). Yet, the

want-to motivation has been observed to be more effective at reducing temptations by increasing self-regulation through decreased impulsive attractions to goal-disruptive temptations (Milyavskaya et al. 2015). The effect of have-to motivation on overcoming temptations or obstacles that prevent goal accomplishment was, however, mixed suggesting that people who pursue more have-to goals are less likely to attain their goals, which may not necessarily lead to increased motivation for subsequent goals (Werner and Milyavskaya 2018; Milyavskaya et al. 2015).

Bazerman et al. (1998) proposed that a *want* self and a *should* self coexist within individuals, and that these selves are susceptible to conflicting preferences termed as the *want-should* conflict. The want self is usually impulsive, whereby the individuals choose an action that gives immediate rewards, but impacts goal attainment (Milkman et al. 2008). On the contrary, the should self is more controlled, whereby an individual chooses an action that considers both short-term rewards and long-term rewards (such as attaining the goal) (Milkman et al. 2008). Users of gamified systems, such as fitness technologies, often encounter situations where they face conflicting preferences and the want-should conflict arise. For example, a user might have to choose between running/walking on a rainy day (should self) vs. watching a movie in a nice and cozy environment (want self). The choice between the want self and should self depends on how an individual construes (i.e., interprets) the action (Milkman et al. 2008). Should self is associated with high-level construal, where the abstract, superordinate, goal-relevant attributes of pursuing the action are obvious to the individual (Milkman et al. 2008). Want self is associated with the low-level construal, where the concrete attributes and tangible implications of the action that will be implemented in the near future are obvious to the individual (Milkman et al. 2008). When encountering temptation, an individual's construal of the obstacle, as well as the motives

of achieving the goal, are likely to decide the choice of action (Milyavskaya et al. 2015). The want-to motivations that are tied to a person's identity are more likely to play a role in the subjective experience of fewer obstacles, thereby reducing susceptibility to temptation and increased goal attainment (Milyavskaya et al. 2015). Hence, want-to motivations can be said to be related to greater implicit preference for goal-promoting (should self) rather than goal-thwarting (want self) stimuli.

The want-should conflict could also exist when making decisions based on social interactions in gamified systems, such as abiding with group norms (the should self) or performing counteractive activities (the want self) that might hurt the chances of winning a social competition. The choice would be determined by the user's goal motivation. However, when a user chooses the want self, he/she can experience temporary social rejection in the form of group members ignoring the user's post or refusing to respond to the user's comments/questions. In such situations, researchers have shown that individuals react differently based on the degree of ostracism perceived by them and their sensitivity to rejection (Williams et al. 2000). Some individuals respond by increasing orientating, seeking, and maintaining behaviors (Chevallier et al. 2012), while others might choose to rebel and engage in counteractivities (DeWall and Bushman 2011) that further hurt the chances of winning a competition, as well as goal attainment.

Role of Playfulness

According to Barnett (2007), playfulness is defined as "the predisposition to frame (or reframe) a situation in such a way as to provide oneself (and possibly others) with amusement, humour, and/or entertainment." Webster and Martocchio (1992) were the first to introduce cognitive playfulness in the context of computer interactions. A situation-specific measure of

cognitive playfulness—microcomputer playfulness—was conceptualized as part of their study. As the researchers assert, "microcomputer playfulness describes an individual's tendency to interact spontaneously, inventively and imaginatively with microcomputers." Some of the positive effects identified as a part of playfulness were exploratory behavior, increased involvement, positive mood, improved satisfaction, improved learning, and motivation to engage with the system futuristically. The negative effects identified for playfulness were longer task completion time and over-involvement with the system, including undesirable unproductive behavior, which, as per the medical science literature, can be controlled by environmental enrichment.

Perceived playfulness, a derivation of cognitive playfulness, has been found to influence the intention to use the technology (Moon and Kim 2001). Perceived playfulness is the degree to which a player believes an artifact will bring him/her a sense of enjoyment and pleasure (Sledgianowski and Kulviwat 2009). Research has shown that players with a playful disposition are guided by internal motivation, an orientation towards self-imposed goals, a tendency to attribute their own meanings to objects or behavior, and active involvement (Barnett 1991). In addition, adult playfulness is also found to be positively associated with an inclination towards performing enjoyable activities (Proyer 2014). Design features within gamified systems that improve perceived playfulness are desirable, and can improve adoption and maintenance of regular physical activity (Ehlers and Huberty 2014). Therefore, perceived playfulness needs to be considered in the context of gamified IT artifacts in which the artifact's use and associated behavioral outcome (e.g., adhering to a physical fitness regime) depends on the playful attitude of its user.

Role of goal difficulty

Researchers of prior goal-setting studies have found that more difficult goals negatively influence goal valence (the anticipated satisfaction or attractiveness of outcome) and expectancy beliefs (the degree to which individuals believe that effort will lead to a performance level required to attain the goal) (Lee et al. 2015). Individuals with a difficult goal anticipate a lower level of satisfaction for any given performance level than individuals with an easy goal. Goal difficulty is also negatively associated with expectancy beliefs (which are lower when goal difficulty is higher) because difficult goals are harder to attain than easy goals (Lee et al. 2015). Therefore, goal difficulty can limit the attractiveness and the expectancy beliefs of adhering to a given behavior.

In fitness technologies (a gamified system), use of social interaction features can increase participation in fitness activities as social comparison theory states that the presence of an audience is likely to invoke an individual's competitive spirit. However, the goal difficulty is likely to limit participation in fitness activities as social facilitation theory states that the socially facilitating effects of an audience decreases as task difficulty increases. Hence, in the context of gamification, we posit that goal difficulty will affect the influence of environmental motivational support on behavioral adherence.

Research Model and Hypotheses

Social Enrichments and Gamified Systems

Environmental enrichment theorists suggest that to achieve a naturalistic behavior within any environment requires users being given some control and choice over their own social and spatial environment (Baumans 2005; Hutchinson et al. 2005). In gamified systems, *socially enriched environments* can be enabled by creating online communities that users can join (e.g.,

Cardio group in Fitbit), with users given a choice to join the respective group(s) and contribute to its success. By joining groups, individuals instinctively satisfy not only their need for self-worth but also their need for belonging, information, control, and identity (Chevallier et al. 2012; Baumeister and Finkel 2010; Kelman 1958). When individuals perceive acceptance by others, their basic social needs (feeling of belonging, perceived control over the environment, self-esteem, and belief of meaningful existence) are met (Williams et al. 2000). By meeting the innate psychological needs for contact, support, and wanting to form a community with other human beings when utilizing the social support elements within gamified systems, individuals feel encouraged to achieve a given goal (Santhanam et al. 2016).

Being exposed to other people's opinions and attitudes can shape a person's behavior, and even nonconformists tend to eventually adopt the standards of the groups to which they belong (Baumeister and Finkel 2010). Groups within gamified systems are, therefore, likely to prompt their members to endorse certain ideas and attitudes. Disagreeing with other members (on norms or opinions) can trigger cognitive dissonance and can also influence members' affect and emotional adjustment (Baumeister and Finkel 2010). As a result, people's thoughts change to reduce this unpleasant mental state and are most conspicuous at the behavioral level (Chevallier et al. 2012; Baumeister and Finkel 2010). Users of gamified systems abiding with group norms and performing requested activities may, therefore, be attributed to this emotional adjustment process.

Groups create affectively-rich relationships between people, and they are often the source of the motivational drive needed to accomplish difficult, taxing goals (Baumeister and Finkel 2010). When an individual's social motivation (i.e., orienting, seeking, and maintaining) is high, he/she will both knowingly and unwittingly amend their actions and preferences to match the

actions of others (Chevallier et al. 2012; Baumeister and Finkel 2010). For example, DeWall et al. (2008) have found that social acceptance/rejection influences an individual's self-regulation and behavior. Such transformation in behavior might occur to the point that the behavior of a person in a group may have no connection to that person's behavior when alone (e.g., Milgram, 1963; Kelman 2006). This is particularly the case in offline socializations because people restrict their social lives through obtaining and maintaining a small set of close, caring relationships instead of wanting a great many (DeWall et al. 2008). While this observation holds true for offline socializations, users of gamified systems often have the option to quit and join other groups easily compared to their offline counterparts. In addition, gamified systems provide its users a platform to validate their sense of self by gaining social status (e.g., top performer in the leaderboards) and social recognition (e.g., positive feedback), which can impact their feelings and attitudes towards a given action. More research on the motivational aspects of such online social interactions is needed, particularly because gamified systems increasingly involve users connecting and interacting with one another through communities.

Users of gamified systems have plenty of opportunities to orient, seek, and maintain social relations that will motivate them towards a given behavior. Therefore, we need to investigate whether the motivational aspect of groups on an individual's behavior for accomplishing goal-related tasks exist within gamified systems. Are users of social support elements in gamified systems motivated alike, considering the fact that they are all empowered with the ability to quickly quit, as well as join social groups within these systems? Or does the motivational aspect of groups on behavioral outcomes hold true only when the user feels socially accepted in the fitness group? Being socially accepted would diminish the drive (DeWall et al. 2011), leading to lesser conformance to the action. On the contrary, cyber-ostracism, in the short-term, has been

observed to threaten an individual's need to belong, leading to conformity in action (Williams et al. 2000). The difference in the impact of social acceptance and social rejection on an individual's behavior indicate why we need to compare and contrast the influence of perceived acceptance and rejection on a user's goal motivation when using social enrichments in gamified systems. To study this phenomenon, we propose the research model shown in Figure 6 based on the understanding of the influence of social-environmental factors (such as perceived social acceptance and perceived social rejection) on an individual's goal motivation and goal attainment when using gamified systems.

EE theorists suggest that the factors in an entity's environment can nudge the entity's motivation towards behavioral change. Therefore, the overarching theoretical framework used to guide the proposed model comes from the hierarchical model proposed by Vallerand and Lalande (2011), which suggests that social factors in an entity's environment can nudge the entity's motivations to induce attitudinal/behavioral outcomes when its needs are met. Outcome variations when using the social support elements in gamified systems are depicted in the proposed model through the study of the influence of perceived social acceptance vs. rejection on a user's motivation.

In the proposed model, we posit that groups in gamified systems can still induce some transformation in an individual's behavior because social recognition, affiliation, and attaining social status lie behind a user's motive of joining a group within a given gamified system. When individuals pursue goals using gamified artifacts, transformation in behavior (i.e., intended behavior) and conformance to group norms are more likely to be observed when the want-to motivation (i.e., intrinsic motivation) of an individual towards a given goal is induced through the perception of social acceptance/rejection because social recognition, attainment of social

status, and affiliation with others are important for meeting the user's basic social needs. In fact, when the need for competency and autonomy are met, any perception of social acceptance (and even social rejection) can act as a boost for the want-to goals (intrinsic) of an individual as they affect a person's need for relatedness. Deviance from an intended behavior is likely to occur when a user's have-to motivation is positively induced through the perception of social acceptance as their basic social needs are temporarily satiated. Finally, an individual's want-to motivation (i.e., intrinsic motivation) is less likely to be negatively influenced by social factors, mainly because the interest in performing the activity is a part of the individual's identity.

Gameful experiences and its effects on behavioral outcomes can be influenced by the user's perceived playfulness when using the gamified system (Koivisto and Hamari 2014). When a user's perceived playfulness is high, they are likely to enjoy using the gamified system. In such scenarios, they are more likely to try to meet group expectations when using the social support elements in the gamified system. However, these users are likely to be skeptical about using the gamified system when the task at hand becomes difficult, particularly the social support elements in the system, in an effort to reduce any embarrassment that could arise from not meeting group expectations. The moderating role of perceived playfulness and task difficulty should, therefore, be considered when studying the influence of social factors on a user's motivation and behavioral outcomes.

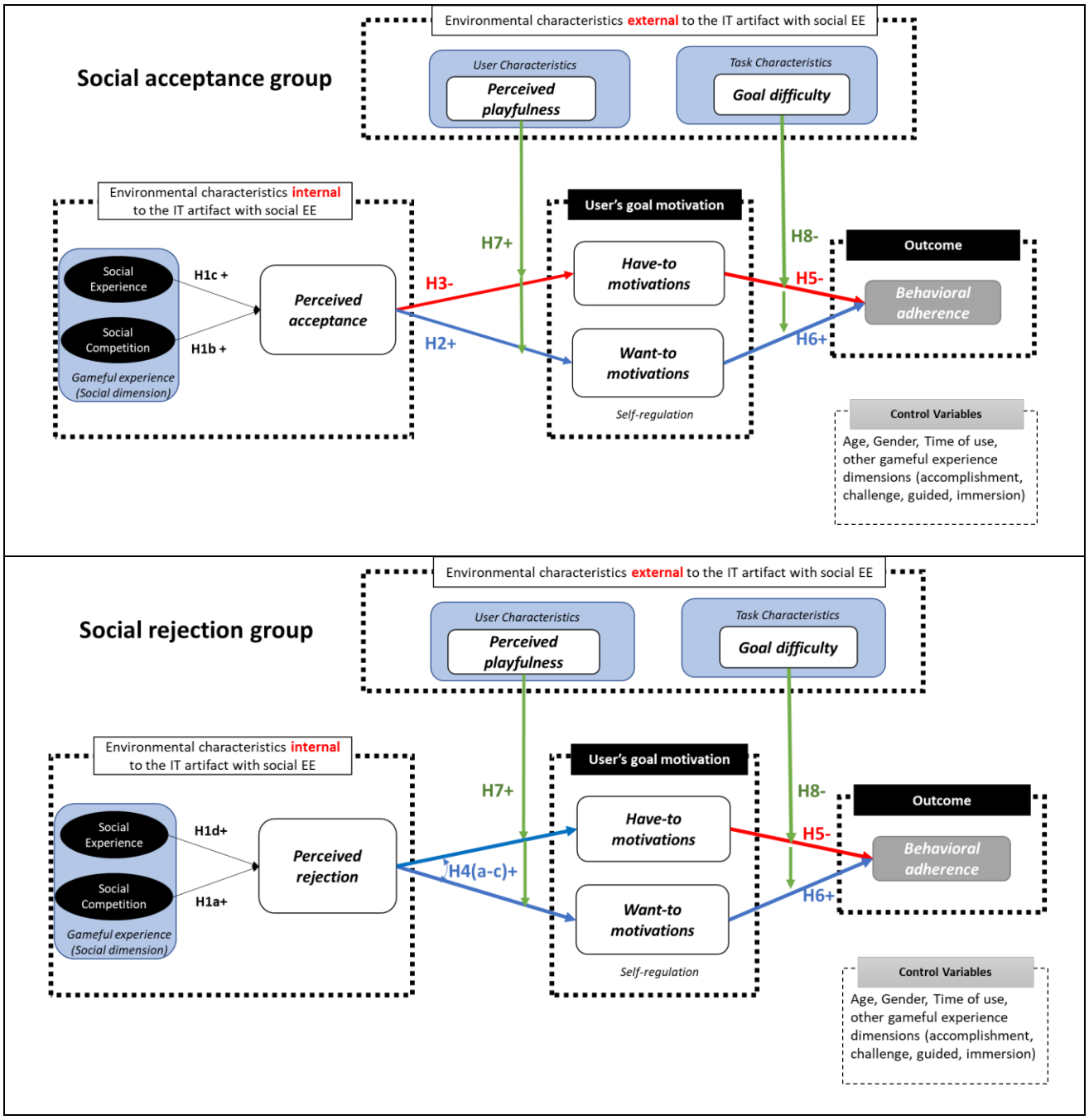


Figure 6: Proposed research model

The introduction of social support elements, such as groups in gamified systems, can induce certain gameful experiences (e.g., social competition) can influence behavioral outcomes (Högberg et al. 2019). In a user-to-user environment, some gamification design elements (e.g., leaderboards) can harness users' competitive instincts (Högberg et al. 2019), induce social

comparison processes (Festinger 1954), and result in greater engagement (Santhanam et al. 2016). Comparisons to those ahead of us may motivate our own self-improvement, while comparisons to those behind us may create "competitive behavior to protect one's superiority" (Aral and Nicolaides 2017). Hyper competitiveness can sometimes be viewed as a demotivator for other group members to participate in group activities, with some of them deciding to not participate in the activities or even engaging in negative behaviors such as bullying (Hassan and Hamari 2019). In such scenarios, an individual's achievement is not likely to be socially recognized by other group members. The lack of social recognition can lead the overly-competitive individual to perceive social rejection from the social group. Therefore, we hypothesize that:

H1a: Social competition experience in gamified artifacts is positively associated with a user's perceived rejection in a given group or community.

On the contrary, competing with peers of the same level in gamified systems can fuel positive engagement, improve cooperation, and group-advancing behavior (Hassan and Hamari 2019), as well as a feeling of belonging to the group (Xi and Hamari 2019). In such scenarios, an individual's achievement is likely to be positively recognized by other group members and the individual will work towards attaining social status within the fitness group. Social recognition will also signal acceptance by the group. Therefore, we hypothesize that:

H1b: Social competition experience in gamified artifacts is positively associated with a user's perceived acceptance in a given group or community.

Similarly, social experience (another aspect of gameful experience) involves users engaging in socializing, forming relationships, and/or engaging in teamwork (Högberg et al. 2019). The goal of creating such gameful experiences is to spur motivation for both continued system use

and for a targeted behavior (Högberg et al. 2019). Positive social experiences within gamified systems, such as positive feedback, likes, etc. can improve an individual's desire for affiliation with the group, as well as perception of social acceptance (Hamari and Koivisto 2015), which, in turn, can satiate an individual's need to belong (DeWall et al. 2008). These experiences can induce a feeling of connectedness with the group (Xi and Hamari 2019; Högberg et al. 2019). When the feelings of connectedness and belonging are met, the relatedness need of an individual is met (Hamari and Koivisto 2015). This, in turn, can affect an individual's perception of social recognition (i.e., his/her achievement is recognized by group members), as well as status attainment (i.e., his/her popularity in group). Therefore, we hypothesize that:

H1c: Social experience in gamified artifacts is positively associated with a user's perceived acceptance in a given group or community.

Gameful experiences are subjective, and the degree of connectedness perceived by individuals varies. Only some participants of gamified systems reported having received support from others and being energized through friends' encouragement (Högberg et al. 2019). Attaining social status and being recognized are important to users of the social support elements in a gamified system. However, a user in a given gamified system can engage in activities that are counteractive to the group's norms. For example, a user can post a demotivating comment on another user's post. This can be viewed negatively by other group members, resulting in harsh responses (e.g., suggestions that the user leave the group) from some members in the group. Such activities can lead the user to perceive rejection from the group he/she wants to belong to. This, in turn, can threaten a person's feeling of belonging to a group, thereby affecting the individual's relatedness need. In such scenarios, an individual is less likely to work towards

social status attainment within that group, and his/her achievement might not be positively recognized by some group members. Therefore, we hypothesize that:

H1d: Social experiences in gamified is positively associated with a user's perceived rejection in a given group or community.

Through cooperative group living, humans can share and receive resources from each other, thereby making it unnecessary for individuals to carry the entire burden of their well-being on their own shoulders (DeWall and Bushman 2011). In an online setting, prior studies have shown that supportive social interactions can motivate users towards a behavior that might benefit themselves and the group (Chen and Pu 2014a; Chen et al. 2014b; Allam et al. 2015). Users of gamified systems who feel accepted in a social group are more likely to be motivated to contribute towards its goal. Being accepted could also signal that the user is identified by group members as being competent to perform a prescribed activity. When the need for competency and autonomy is met, recognition by group members might act as a motivator for both the want-to goals (intrinsic) and have-to goals (extrinsic) of an individual as it meets a person's need for relatedness (Vallerand and Lalande 2011). The perceived acceptance can be viewed to boost the external motivation (have-to motivations) and internal (want-to motivation) of these individuals to continue the activity. However, DeWall et al. (2008) point out that a drive for affiliation that is satisfied should temporarily diminish in strength, whereas one that is thwarted may become more intense. When people receive feedback conveying a message of social acceptance, their motivation for affiliation should be satiated, and therefore, should be reduced for a while (DeWall et al. 2008). The diminished drive will have a pronounced effect on an individual's have-to motivation to continue the activity because it is externally driven, with social affiliation, social recognition, and/or social status attainment being important for this motivation. When

acceptance is perceived, the have-to motivation is likely to diminish in strength as the relatedness need is satiated. Want-to motivations that are intrinsically motivated are, however, unlikely to diminish in strength when a related need is met due to the individual's interest or enjoyment in performing the activity. Therefore, we hypothesize that:

H2: Perceived social acceptance in fitness groups will improve the want-to motivation of an individual to perform the intended activities.

H3: Perceived social acceptance in fitness groups will reduce the have-to motivation of an individual to perform the intended activities.

Baumeister and Leary (1995) suggest that the tendency of human beings to seek social connections and avoid isolation is generated by a basic need to belong to social groups. This need to belong is thoroughly satisfied by a group that actively seeks them out, but any group that accepts the person is preferred to one that refuses to permit entry (Baumeister and Finkel 2010). Individuals who are made to feel as though they will be excluded from groups display several dysfunctional side-effects, including increased aggression, risk-taking, procrastination, and tentativeness when interacting with others in offline settings (DeWall and Bushman 2011; Baumeister and Finkel 2010). While supportive social interactions can motivate users towards a behavior (Chen and Pu 2014a; Chen et al. 2014b; Allam et al. 2015), the feeling of being rejected by a group within a gamified technology can induce dysfunctional behaviors, such as social loafing and procrastination.

Social rejection also diminishes state self-esteem, which is defined as temporary feelings of self-worth (Williams et al. 2000). Self-esteem is associated with a person's basic social need satisfaction and can affect a person's emotions. Studies suggest that individuals who feel ignored from a social group are more likely to respond aggressively by revolting against group norms in

an attempt to get even with the group that just rejected them (a response to the unpleasant emotion they are experiencing) (DeWall and Bushman 2011). In offline socializations, people restrict their social lives through obtaining and maintaining a small set of close, caring relationships (DeWall et al. 2008). However, in fitness groups, users have the option to quit the group whenever they want and can also join other groups easily. Instead of retaliating against the group that rejected them, users who perceives complete rejection can quickly change groups in an effort to regain their self-esteem.

DeWall et al. (2008) point out that motivation theory features standard patterns (i.e., that a drive that is satisfied should temporarily diminish in strength, whereas one that is thwarted may become more intense). Williams et al. (2000) also suggest that temporary ostracism can induce conformance behavior in internet users. Therefore, when the relatedness need of an individual is temporarily thwarted due to social rejection from a fitness social group, s/he is only likely to increase their own engagement in an activity with the hope of eventually gaining acceptance. If achieved, s/he can satiate any deficit created in one's relatedness need, particularly because the primary intent of joining the fitness group was for affiliation, social recognition, and/or status. Hence, we hypothesize that:

H4a: Perceived social rejection in fitness groups will improve the want-to motivation of an individual to perform the intended activities.

H4b: Perceived social rejection in fitness groups will improve the have-to motivation of an individual to perform the intended activities.

Perceived social rejection is more likely to act as a stimulus for the want-to goal motivations of an individual. If the activity to be performed is of interest to the individual, then social rejection is only likely to act as a boost to one's motivation to perform the activity. That is, an

individual is less likely to engage in anti-social behavior when the expectation of the fitness group is to perform an activity of interest/enjoyment to the individual. Instead, by doing something they enjoy doing, they feel they will eventually be able to please the social group in the long term, and, in turn, gain social recognition. More importantly, they can meet obligations to self in the presence of others. Therefore, we hypothesize that:

H4c: Perceived social acceptance in fitness groups will improve the want-to motivation more than the have-to motivation of an individual to perform the intended activities.

Goals pursued for have-to goals are either for external reasons (e.g., to please others or attain an external outcome) or are accompanied by introjects, such as feelings of shame or an obligation to oneself (introjected motivation). These motivations are collectively termed by self-determination theory as controlled/have-to motivation. (Milyavskaya et al. 2015). Irrespective of the presence of social support in the social environment, temporal and recurring factors that can thwart the have-to motivations temporarily can result in a decrease in an individual's practice and maintenance of desired health behavior (Vallerand and Lalande 2011), which can thus lead to reduced participation and agreement over time. Hence, we hypothesize that:

H5: Have-to motivations will be negatively associated with adherence to a given activity over time.

Want-to goals are goals that reflect a person's genuine interest and values and are personally important and meaningful (Milyavskaya et al. 2015). Such goals are pursued out of interest or enjoyment (intrinsic), because of the inherent importance of the goal (identified), or because the goal has been assimilated into the person's core identity (integrated); these motivations are collectively termed by self-determination theory as autonomous/want-to motivation (Milyavskaya et al. 2015). Social environmental factors that are supportive of the want-to

motivations can result in an increase in an individual's practice and maintenance of desired health behavior, which leads to more participation and agreement. This behavior is likely to persist even in the presence of temporal and recurring factors that thwart the want-to-motivations temporarily as the behavior is assimilated as part of the user's core identity. Hence, we hypothesize that:

H6: Want-to motivations will be positively associated with adherence to a given activity over time.

Festinger (1950, 1954), in his theory of social comparison, suggested that people affiliate with others because they provide an excellent source of information about social reality. When people find themselves in ambiguous situations within a social context, and conventional sources of information do not provide enough information to erase their doubts and apprehensions, they join with other people to compare their personal viewpoint to those expressed by others to determine if they are "correct," "valid," or "proper" (Forsyth, 2000). Gamified artifacts provided a platform for individuals to associate with others in situations where the consequence of an intended behavior is ambiguous (e.g., withdrawal symptoms associated with smoking cessation). By doing so, individuals can join those who can provide them with some social-comparison information. However, from a technology use stand-point, Moon and Kim (2001) viewed playfulness as an intrinsic motivator to use a system. This was influenced by the user's experience with the environment (Sledgianowski and Kulviwat 2009). According to the authors, individuals with a more positive playfulness belief in the specific technology should view their interactions with the technology more positively than those with a less positive playfulness belief. Therefore, we hypothesize that:

H7: Perceived playfulness of the user will moderate the relationship between perceived social acceptance/rejection and user's goal motivation such that the relation will be stronger at higher levels of perceived playfulness (of the user).

Triplett (1898) succeeded in sparking interest in a phenomenon that is now known as social facilitation: the enhancement of an individual's performance when that person works in the presence of other people. Zajonc (1965), after reviewing prior research, noted that the facilitating effects of an audience usually occur only when the task requires the person to perform dominant responses; i.e., ones that are well-learned or based on instinctive behaviors. If the task requires non-dominant responses—novel, complicated, or untried behaviors that the organism has never performed before or has performed only infrequently—then the presence of others inhibits performance. Bond and Titus (1983), in their review of 241 studies of social facilitation, confirmed Zajonc's (1965) insight by finding that facilitation occurs primarily when people perform simple tasks that require dominant responses. When the task is easy, people display a challenge response. At the physiological level, they appear to be ready to respond to the challenge that they face (elevated heart rate and activation of the sympathetic nervous system). But when the task is difficult, people display a threat response; they appear to be stressed rather than ready for effective action. In gamified technology systems, the level of difficulty of the instrumental outcomes to be achieved (e.g., improving participation or contribution vs. abandoning unhealthy lifestyles) can, therefore, influence the behavioral intention of an individual, even in the presence of other individuals. Hence, we hypothesize that:

H8: Members of social groups in gamified artifacts will persist with simpler behaviors (or tasks). As the task (or behavior) at hand becomes more complex, members are less likely to persist with it.

Control variables

Koivisto and Hamari (2014) studied the demographic difference in perceived benefits from gamification in the context of exercise. They found differences based on gender, age, and time of using it. As per them, perceived enjoyment and usefulness of gamification both decline with use. Women were found to report greater social benefits from the use of gamification. Hence, controlling for gender, age, and time of usage is required for this study.

Högberg et al. (2019) identified seven dimensions of gameful experiences, namely: accomplishment, challenge, social competition, guided, immersion, playfulness, and social experience. These experiences can be induced by any of the three sets of environmental motivational support (i.e., social interaction features [SIF], exercise control features [ECF], and data management features [DMF]) in fitness technologies (see figure A1 in appendix A) (James et al. 2019). Each set influenced outcomes differently, with the social interaction feature being the most influential. Many gamified artifacts provide a combination of these environmental motivation support factors and users of these artifacts can customize them as per their preference. Therefore, in this study, to avoid any potential confounding effect, we controlled for the experiences due to the data management feature set and exercise control feature set on behavioral adherence.

Research Context

Health professionals and policymakers consider serious games as an alternative to other computer-delivered interventions (DeSmet et al. 2014). The effect of gamified artifacts on the promotion of healthy lifestyles has been found to be significant (Portnoy et al. 2008; Krebs et al. 2010), and hence, is used for health outreach programs. We use the healthcare context for this research since the healthcare domain contains many gamified IT artifacts that can be utilized for empirically validating our propositions.

In addition, individuals often tend to favor short-term rewards over long-term rewards. This cognitive bias, called hyperbolic discounting, results in individuals neglecting behaviors that would be beneficial to them in the end. They tend to procrastinate or skip exercise, smoke, and overconsume certain products. To avoid these behaviors, these individuals seek novel ways to motivate themselves, such as buying gamified wearable devices to track their fitness regimes (e.g., Fitbit) or joining gamified patient communities (e.g., QuitNow).

Gao et al. (2015) investigated wearable healthcare device acceptance from a behavioral perspective and found that a consumer's decision to adopt wearable healthcare technology is affected by factors from the perspectives of technology, health, and privacy. In particular, fitness device users cared more about hedonic motivation, functional congruence, social influence, perceived privacy risk, and perceived vulnerability. Interestingly, many of the fitness trackers available in the market are now implementing social environments in healthcare-related wearables (e.g., groups in Fitbit, whereby users can share their statistics with users in their network) with the intent to prevent abandonment, and, in turn, improve the firm's survival chances. The existence of wearable devices with and without social environments enabled in them (or in gamified artifacts) for monitoring lifestyle changes makes the healthcare domain an ideal candidate to study the influence of social environments (such as groups) on gamification success.

Research Methodology

Survey research involves the examination of the phenomena in its natural setting (Pinsonneault and Kraemer 1993). The central question answered with a survey research is "what is happening" and "how and why it is happening." When using survey research, the researcher needs to have a clearly defined independent variable and dependent variable, as well as a specific

model of the expected relationship between them (Pinsonneault and Kraemer 1993). In the context of this study, the variables are clearly identified and the expected relationships are specified. The nature of this research is explanatory, where the central question is focused on whether the hypothesized relationship exists (Pinsonneault and Kraemer 1993). The phenomena of interest is best understood within its natural settings as the influence of the environment is considered important. Hence, the use of a survey approach for this study seems appropriate. Dillman (2000) and Fowler (2013) suggest three key elements (research design, sampling procedure, and data collection methods) in the conduct of surveys.

Research Design

The unit of analysis in this study is the individual and the hypotheses described in the previous section are identified at this level. Informants for this study, therefore, can be anyone who is using a gamified fitness artifact (e.g., Fitbit). A cross-sectional survey was administered to participants randomly selected from the population through Amazon Mechanical Turk (AMT). Targeted participants were users of a gamified IT artifact, such as Fitbit (wearable), Fitocracy (mobile apps), QuitNow (mobile apps), etc. Scale administration was done in accordance with the tailored design method (TDM) proposed by Dillman (2000). To ensure that the questionnaire is understandable, two pilot studies were conducted with respondents from different demographic backgrounds. The aim of conducting pilot studies was to collect feedback about clarity of wordings and expressions of the questionnaire items, as well as the time taken to complete the survey. It also helped establish the reliability and validity of the adapted instruments (Hinkin, 1998).

Survey Instrument Development

Research instruments were developed based on Straub's (1989) suggestion that "validation should precede other core empirical validations." Instrument validation includes content validity, construct validity, and reliability (Straub 1989). Following the suggestion by Straub (1989), wherever possible, the measurement items for constructs are adapted from the extant literature (given in Table 3). Adaptation of the borrowed instrument to the current study context is required. Multi-items per construct were used to avoid mono-operation bias (Cook and Campbell 1979; Straub et al. 2004). Measurement of the items was mostly done using a five-point Likert scale. Using the criteria offered by Petter et al. (2007), all constructs in the proposed research model (i.e., social experience, social competition, perceived acceptance/rejection, perceived playfulness, goal difficulty, want-to motivation, and have-to motivation constructs) were identified as reflective. Verifying construct validity was an important step and was ensured by using the stages proposed by Moore and Benbasat (1991). A pilot test of the instrument was also performed to refine the instruments (Boudreau et al. 2001), as well as ensure clarity, reliability, and validity (Straub et al. 2004). Items were ordered randomly to avoid common method bias (Straub et al. 2004).

Table 3: Constructs and scales

Construct	Scale
Social Competition (SC) * (Högberg et al. 2019)	1. When interacting with the community in the artifact, it feels like I am participating in a competition. 2. When interacting with the community in the artifact, the community inspires me to compete. 3. When interacting with the community in the artifact, the community involves me through its competitive aspects. 4. When interacting with the community in the artifact, it makes me want to be in first place. 5. When interacting with the community in the artifact, it makes victory feel important. 6. When interacting with the community in the artifact, it feels like being in a race. 7. When interacting with the community in the artifact, it makes me feel that I need to win to succeed.
Social Expérience (SE) * (Högberg et al. 2019)	1. When interacting with the community in the artifact, it gives me the feeling that I'm not on my own. 2. When interacting with the community in the artifact, it gives me a sense of social support. 3. When interacting with the community in the artifact, it makes me feel like I am socially involved. 4. When interacting with the community in the artifact, it gives me a feeling of being connected to others. 5. When interacting with the community in the artifact, it feels like a social experience. 6. When interacting with the community in the artifact, it gives me a sense of having someone to share my endeavors with. 7. When interacting with the community in the artifact, it influences me through its social aspects. 8. When interacting with the community in the artifact, it gives me a sense of being noticed for what I have achieved.
Perceived Playfulness (PP)* (Högberg et al. 2019)	1. Using the artifact gives me an overall playful experience. 2. Using the artifact leaves room for me to be spontaneous. 3. Using the artifact taps into my imagination. 4. Using the artifact makes me feel that I can be creative. 5. Using the artifact gives me the feeling that I explore things. 6. Using the artifact feels like a mystery to reveal. 7. Using the artifact gives me a feeling that I want to know what comes next. 8. Using the artifact makes me feel like I discover new things. 9. Using the artifact appeals to my curiosity.

Have-to motivation (HM)* (James et al. 2019; Markland and Tobin 2004; Wilson et al. 2006)	1. I don't see why I should have to exercise. 2. I can't see why I should bother exercising. 3. I don't see the point in exercising. 4. I think exercising is a waste of time. 5. I take part in exercise because my friends/family/partner say I should. 6. I exercise because others will not be pleased with me if I don't. 7. I feel under pressure from my friends/family to exercise. 8. I exercise because other people say I should. 9. I feel ashamed when I miss an exercise session. 10. I feel like a failure when I haven't exercised in a while. 11. I would feel bad about myself if I was not making time to exercise. 12. I feel guilty when I don't exercise.
Want-to motivation (WM)* (James et al. 2019; Markland and Tobin 2004; Wilson et al. 2006)	1. It's important to me to exercise regularly. 2. I value the benefits of exercise. 3. I think it is important to make the effort to exercise regularly. 4. I get restless if I don't exercise regularly. 5. I consider exercise part of my identity. 6. I consider exercise a fundamental part of who I am. 7. I consider exercise consistent with my values. 8. I exercise because it is consistent with my life goals. 9. I enjoy my exercise sessions. 10. I find exercise a pleasurable activity. 11. I exercise because it's fun. 12. I get pleasure and satisfaction from participating in exercise.
Accomplishment (AC) * (Högberg et al. 2019)	Based on my experience with the artifact, it... 1. Makes me feel that I need to complete things. 2. Pushes me to strive for accomplishments. 3. Inspires me to maintain my standards of performance. 4. Makes me feel that success comes through accomplishments. 5. Makes me strive to take myself to the next level. 6. Motivates me to progress and get better. 7. Makes me feel like I have clear goals. 8. Gives me the feeling that I need to reach goals.
Challenge (CH)* (Högberg et al. 2019)	Based on my experience with the artifact, it... 1. Makes me push my limits. 2. Drives me in a good way to the brink of wanting to give up. 3. Pressures me in a positive way because of its high demands. 4. Challenges me. 5. Calls for a lot of effort in order for me to be successful. 6. Motivates me to do things that feel highly demanding. 7. Makes me feel like I continuously need to improve in order to do well. 8. Makes me work at a level close to what I am capable of.

Guided (GD)* (Högberg et al. 2019)	Based on my experience with the artifact, it... 1. Makes me feel guided. 2. Gives me a sense of being directed. 3. Makes me feel like someone is keeping me on track. 4. Gives me the feeling that I have an instructor. 5. Gives me the sense I am getting help to be structured. 6. Gives me a sense of knowing what I need to do to do better. 7. Gives me useful feedback so I can adapt.
Immersion (IM)* (Högberg et al. 2019)	Based on my experience with the artifact, it... 1. Gives me the feeling that time passes quickly. 2. Grabs all of my attention. 3. Gives me a sense of being separated from the real world. 4. Makes me lose myself in what I am doing. 5. Makes my actions seem to come automatically. 6. Causes me to stop noticing when I get tired. 7. Causes me to forget about my everyday concerns. 8. Makes me ignore everything around me. 9. Gets me fully emotionally involved.
Goal difficulty (Yukl and Latham 1978)	When interacting with the artifact, how difficult do you think the goal is? a) very easy, b) slightly difficult, c) moderately difficult, d) very difficult, e) nearly impossible
Behavioral Adherence (BA) (Cohen 2009)	On average, how many minutes per week do you spend on recreational activities? ***Vigorous-intensity activity*** *causes large increases in breathing or heart rate, like running or playing basketball for at least 10 minutes continuously.* ***Moderate-intensity activity*** *causes small increases in breathing or heart rate, such as brisk walking, bicycling, or swimming for at least 10 minutes continuously.* According to the definitions in Life's Simple 7 {obtained from NHANES), behavioral adherence can be: • Ideal [150 min/week moderate, or 75 min/week vigorous, or 150 min/week moderate vigorous] • Intermediate [1–149 min/week moderate, or 1–74 min/week vigorous, or 1–149 min/week moderate vigorous] • Poor [None]
Basic Needs (Williams et al. 2000)	***Feelings of belonging***: On a scale from 0-10, how much do you feel you belong to the group or community? ***Control***: On a scale from 0-10, how true is the statement: "I am in control of my physical fitness?" ***Self-esteem***: On a scale from 0-10, to what extent do you think the other participants in the group or community value you as a person?

* Likert scale was used (*1 Strongly disagree… 5 Strongly agree*)

Data Collection

We adopted a cross-sectional approach to the data collection process. This approach is less costly and less time-consuming; however, it does introduce potential validity concerns of common method variance (CMV), which can be ruled out using Harmon's single factor test (Podsakoff et al. 2003).

An online version of the questionnaire was created using Qualtrics to be distributed to users on Amazon Mechanical Turk (AMT). Data were collected via AMT. One of the main advantages of using the AMT population is that it improves the generalizability of inferences, in addition to several other advantages compared to traditional data collection methods (Buhrmester et al. 2011; Lowry et al. 2016a). IS scholars are increasingly adopting AMT for behavioral studies, such as studying the effects of identifiability, social presence awareness, timing of warning messages, connecting individual through network ties, providing reputation signals, etc. on cyberbullying behaviors or task performance (e.g., Havakhor et al. 2018; Lowry et al. 2017b). Our study bears similarities with these studies as we try to understand the effect of various social factors embedded in an IT artifact design on an individual's behavioral adherence. Therefore, the use of AMT seems appropriate. The AMT workers received a small monetary reward for participation.

Scale administration was done in accordance with the tailored design method (TDM) proposed by Dillman (2000). TDM emphasizes considering aspects of the survey process that can likely affect the quality and quantity of data collected. The errors that needs to be considered are sampling error, coverage error, measurement error, and nonresponse error. Sampling error was addressed by distributing the survey to all potential participants, instead of just lead users of the artifact. In AMT, the survey was available to every worker, irrespective of his/her

qualification level. Coverage error was addressed by ensuring the targeted users were representative of similar artifacts. In the survey, respondents included users of other artifacts (e.g., Garmin, Strava, etc.). All participants were asked questions such as: “Are you a member of a social group in a fitness technology (e.g., Fitbit)? If yes, please tell us more about your experience with the social group in that technology.” This was done to ensure the sample was representative of the population we were studying. Measurement error required attention to missing data and erroneous data during data analysis. Finally, nonresponse error was addressed by comparing early responders and late responders. No significant differences were found.

Sample Characteristics

In this study, our objective was to examine the influence of online social interactions on a user’s behavior when using gamified fitness technology (e.g., Fitbit). Hence, we restricted the sample to AMT workers who used gamified systems (e.g., Fitbit, Garmin, etc.) for fitness-related activities and were members of a social group within these systems. A total of 590 AMT workers participated in the cross-sectional survey. Participants were asked an attention check question designed to reflect very low difficulty, such that answering incorrectly would reflect negligence by the participant. A total of 196 participants failed the attention check question. In addition, a total of 91 participants failed to complete the survey. These responses were excluded from further analysis. A total of 302 usable responses were used for analysis after excluding those who failed the attention check, as well as those who did not complete the survey. Table 4 presents the demographic statistics of our sample.

Table 4: Sample Descriptive Statistics of Participants (N=302)

	N	Percent		n	Percent
Age			**Fitness technology used**		
18 – 24	62	*20.6%*	Apple Watch/Apple Health	9	*3.0%*
25 – 34	150	*49.8%*	Endomondo	1	*0.3%*
35 – 44	56	*18.6%*	Fitbit	205	*67.9%*
45 – 54	18	*6.0%*	Fitocracy	37	*12.3%*
55 – 64	12	*4.0%*	Garmin	5	*1.7%*
65 – 74	3	*1.0%*	Garmin Vivoactive activity tracker	1	*0.3%*
			Garmin Vivosmart HR+	1	*0.3%*
Gender			GO FIT	1	*0.3%*
Female	141	*46.7%*	Google Fit app	2	*0.7%*
Male	161	*53.3%*	Healthify	2	*0.7%*
			Huawei Health	1	*0.3%*
Smoking status			MapMyRun	1	*0.3%*
Non-smoker	182	*60.3%*			
Smoker	120	*39.7%*	MyFitnessPal	3	*1.0%*
			Nike Run Club	1	*0.3%*
Exercise frequency			PatientsLikeMe	9	*3.0%*
Daily	97	*34.2%*	Pokemon Go	2	*0.7%*
2-3 times a week	75	*26.4%*	Samsung Gear Smartwatch	1	*0.3%*
4-6 times a week	89	*31.3%*	Samsung Health	3	*1.0%*
Never	4	*1.4%*	SavA	1	*0.3%*
Once a week	19	*6.7%*	Smart Watch	1	*0.3%*
			Step Counter	1	*0.3%*
			Strava	4	*1.3%*
Fitness technology usage frequency			Xiaomi Mi Band 3	2	*0.7%*
Daily	156	*51.7%*	Other	7	*2.3%*
2-3 times a week	46	*15.2%*			
4-6 times a week	72	*23.8%*			
Once a month	6	*2.0%*			
Once a week	22	*7.3%*			

To be able to test the proposed multi-group model using the cross-sectional data collected, we split the data into two groups. We created a “needs met” group for those participants whose reported higher basic needs scores (above 7) and a “needs threatened” group for those who reported lower basic needs scores (7 and below). To validate our categorization, we ran a t-test on the samples to check whether the participants’ reported self-esteem scores, feelings of being in control of the fitness program, and belongingness to the social fitness group were statistically different between groups. When individuals experience cyber ostracism, their

feelings of belonging and self-esteem are reduced (Williams et al. 2000). The results of our analysis show that the two groups reported different scores, with those in the rejected group reporting lower scores for belonging and self-esteem (see Table 5).

In addition, social status achievement has been found to be a predictor of interest/enjoyment in sports and is correlated with an individual's perceived belongingness to the sports team (Allen 2005). In gamified systems, we assume that when a user perceives rejection (i.e., need for belonging is threatened), s/he is less likely to feel that they have achieved social status within the group. To validate this, we performed t-tests for the social status achievement scores reported for both groups. Our results confirmed our assumption that the rejected group perceived lesser social status achievement than their accepted peers.

For our analysis, we ran the acceptance model with the "needs met" group and the rejection model with the "needs threatened" group.

Table 5: T-test for rejection and acceptance group

	Rejected Group **N = 121**	**Accepted Group** **N = 181**	**t-test**
Basic needs met	5.76 (1.12)	8.54 (0.86)	t = -25.057 p-value < 0.001
Self-esteem reported	5.72 (1.92)	8.46 (1.21)	t = -15.447 p-value < 0.001
Control over fitness program	6.13 (2.06)	8.70 (1.21)	t = -13.869 p-value < 0.001
Belonging to social fitness group	5.43 (1.73)	8.49 (1.15)	t = -18.88 p-value < 0.001
Social status achieved in fitness group	3.92 (1.19)	4.29 (1.48)	t = -3.5727 p-value < 0.001
Social recognition in fitness group	4.21 (1.05)	4.53 (1.48)	t = -3.4487 p-value < 0.001

Results

Partial Least Squares Analyses

Partial Least Squares (PLS) analysis with R was used to validate the psychometric properties of our measures and to test the paths hypothesized in Figure 6. We chose PLS because it permits the modeling of latent variables and the simultaneous assessment of the measurement and structural models, while placing minimal demands on sample size and distributional assumptions (Chin 1998; Hair et al. 2013). Additionally, we chose PLS to accommodate the moderating relationships in our research model. We first examined the psychometric properties of our measures through the measurement model and then tested our hypotheses through the structural model.

Measurement Model

We examined standardized loadings to assess convergent validity of our reflective constructs. To ensure that the variance between each item and the associated construct exceeds the error variance, it is suggested that the standardized loadings (shown in Appendix A - Table A1) should exceed 0.707 (Chin 1998). However, it is still acceptable for a measure to have a loading of 0.6 or higher if all other measures associated to the same construct have high loadings (Chin 1998). Three measures, InjReg2. InjReg3 and InjReg4, failed to meet the minimum threshold of 0.6; hence, these measurement items were dropped. With the exception of two measurement items—social_experience_1 and playfulness_1—all of the remaining measures exceeded the 0.707 threshold. While the loadings associated with social_experience_1 and playfulness_1 were 0.688 and 0.653, respectively, we decided to retain both items for reasons of content validity (MacCallum and Austin 2000).

In order to assess the internal consistency of our measures for each construct, we examined the Cronbach's alpha, composite reliability, and average variance extracted for each construct. For Cronbach's alpha and composite reliability, it is suggested that values of 0.7 or higher are adequate (Nunnally 1994). All values were above the 0.7 threshold. With regard to AVE, Fornell and Larcker (1981) suggest that values should exceed 0.50 to ensure that more variance is captured by the measures relative to measurement error. AVEs for all constructs were 0.509 or higher. Given the assessment of convergent validity, all measures, with the exception of InjReg2, InjReg3, and InjReg4, were retained for subsequent analysis.

To assess discriminant validity, we first examined the item loadings and cross-loadings on each construct (see Appendix A Table A2). All measures had higher loadings for the intended construct than other constructs, thus providing evidence of discriminant validity. Additionally, we calculated the squared correlation of all construct pairs and compared it with the AVE of each construct to ensure that more variance associated with each construct was captured by its indicators rather than the indicators of other constructs (Fornell and Larcker 1981) (see Appendix A Table A3). The AVE for each construct exceeded the squared correlation of all construct pairs, thus providing further evidence of discriminant validity.

Based on the assessment of convergent and discriminant validity, we concluded that the measurement model was sufficiently robust to allow us to proceed to evaluate the structural model.

Common Method Bias Analysis

Because social experience, social competition, perceived acceptance/rejection, want-to motivation, have-to motivation, and behavioral adherence were obtained using the same survey instrument, we conducted a test to examine common method bias in our data. The test we

conducted was Harmon's single factor test (Podsakoff et al. 2003), which involved an exploratory factor analysis, with all items used to measure the main variables in our study. The unrotated factor solution produced 13 factors with eigenvalues greater than 1, and together, they explained 69.7% of the variance in the data. The first extracted factor accounted for 17.5% of the variance in the data. These results suggest that common method bias is unlikely to be a significant problem in our data, given that more than one factor emerged from the factor analysis and that the first factor did not account for the majority of the variance in our data.

Structural Model

Before testing our hypotheses, we assessed the explanatory power of our structural model by examining the R^2 value of the final dependent variable for both scenarios (perceived acceptance vs. perceived rejection). The R^2 for behavioral adherence for the acceptance group was 0.86, indicating that approximately 86% of the variance was accounted for. The R^2 for have-to motivation was 0.26, which indicates that 26% of the variance has been explained by perceived social acceptance. The R^2 for want-to motivation was 0.08, which indicates that only 8% of the variance has been explained by perceived social acceptance. The R^2 for perceived social acceptance was 0.18, which indicates that 18% of the variance has been explained by social experience in gamified systems. For the rejection group, the R^2 for behavioral adherence was 0.26, indicating that approximately 26% of the variance was accounted for. The R^2 for have-to motivation was 0.26, which indicates that 26% of the variance has been explained by perceived social rejection. The R^2 for want-to motivation was 0.18, which indicates that 18% of the variance has been explained by perceived social rejection. The R^2 for perceived social rejection was 0.13, which indicates that 13% of the variance has been explained by social competition in gamified systems.

To test our hypotheses, we estimated four models each for the acceptance and rejection groups using WarpPLS. Model 1 is the base model that examines the effect of the control variables (i.e., accomplishment, guidance, immersion, challenge, age, gender, time of use) on the dependent variable (i.e., behavioral adherence). Controlling for the accomplishment, guidance, immersion, challenge, age, gender, and time of use was essential to isolate the direct effects. Model 2 is the direct effects model that tested the influence of social experience and social competition on perceived acceptance (rejection), as well as the influence of perceived acceptance (rejection) on behavioral adherence. Model 3 was the mediation model that builds on model 2 by including have-to motivations and want-to motivations, but excluding the moderators (perceived playfulness and goal difficulty). Model 4 includes the moderators to the mediation model. The results of the four models for the acceptance group are shown in Table 6, while the results for the rejection group are shown in Table 7.

Table 6: WarpPLS Model Results [Acceptance Group]

Acceptance Group				
WarpPLS Model Results (Standardized Estimates; N=128)				
	Controls only	Direct model	Mediation model	Full Model
	Model 1	Model 2	Model 3	Model 4
Age	n/s	n/s	n/s	n/s
Time of use	0.33 (0.120) *	0.28 (0.123) *	0.27 (0.123) **	0.33 (0.120) *
Gender	n/s	n/s	n/s	n/s
Accomplishment	n/s	n/s	n/s	0.33 (0.120) *
Challenge	n/s	n/s	n/s	0.22 (0.125) **
Guided	n/s	n/s	0.60 (0.109) *	0.63 (0.108) *
Immersion	n/s	n/s	n/s	n/s
Perceived acceptance --> Behavioral Adherence (*Direct effect*)		0.27 (0.123) **	0.05 (0.134) n/s	0.14 (0.129) n/s
Social competition --> Perceived acceptance		0.11 (0.131) n/s	0.09 (0.131) n/s	0.11 (0.132) n/s
Social experience --> Perceived acceptance		0.32 (0.121) *	0.36 (0.119) *	0.32 (0.119) *
Perceived acceptance --> Have-to motivation			-0.28 (0.123) **	-0.40 (0.118) *
Perceived acceptance --> Want-to motivation			0.18 (0.127) †	0.22 (0.125) **
Have-to motivation --> Behavioral Adherence			-0.34 (0.120) *	-0.19 (0.127) †
Want-to motivation --> Behavioral Adherence			0.27 (0.123) **	0.28 (0.122) **
Perceived acceptance * Perceived playfulness --> Have-to motivation				0.20 (0.126) †
Perceived acceptance * Perceived playfulness --> Want-to motivation				0.13 (0.128) n/s
Have-to motivation * Goal Difficulty --> Behavioral Adherence				0.09 (0.132) n/s
Want-to motivation * Goal Difficulty --> Behavioral Adherence				0.14 (0.129) n/s
R-squared				
BAC	0.28	0.37	0.84	0.86
HMC	-	-	0.08	0.26
WMC	-	-	0.03	0.08
SARC	-	0.18	0.19	0.18

Stone-Geisser's Q2-value				
BAC	0.321	0.381	0.504	0.548
HMC	-	-	0.093	0.273
WMC	-	-	0.042	0.100
SARC	-	0.175	0.189	0.175
Averaged R-Squared (ARS)	0.285	0.285	0.285	0.341
Average adjusted R-Squared (AARS)	0.176	0.216	0.259	0.306

* p<0.01; ** p<0.05; †p<0.10; n/s: not significant; standard error terms are shown in brackets.

Table 7: WarpPLS Model Results [Rejection Group]

Rejection Group				
WarpPLS Model Results (Standardized Estimates; N=122)				
	Controls only	Direct model	Mediation model	Full model
	Model 1	Model 2	Model 3	Model 4
Age	0.15 (0.100) †	0.19 (0.099) **	0.18 (0.099) **	0.15 (0.100) †
Time of use	0.06 (0.102) n/s	0.06 (0.103) n/s	0.05 (0.103) n/s	0.07 (0.102) n/s
Gender	0.03 (0.103) n/s	0.00 (0.104) n/s	0.05 (0.103) n/s	0.03 (0.103) n/s
Accomplishment	0.19 (0.099) **	0.26 (0.097) *	0.25 (0.097) *	0.25 (0.097) *
Challenge	0.23 (0.098) *	0.19 (0.099) †	0.25 (0.097) *	0.16 (0.100) †
Guided	-0.31 (0.096) *	-0.20 (0.098) **	-0.18 (0.099) **	-0.06 (0.102) n/s
Immersion	0.24 (0.097) *	0.29 (0.096) *	0.28 (0.096) *	0.25 (0.097) *
Perceived rejection --> Behavioral Adherence (*Direct effect*)		0.25 (0.097) **	0.18 (0.091) **	0.03 (0.103) n/s
Social competition --> Perceived rejection		0.32 (0.095) †	0.32 (0.095) *	0.41 (0.093) *
Social experience --> Perceived rejection		0.10 (0.101) n/s	0.10 (0.101) n/s	-0.06 (0.103) n/s
Perceived rejection --> Have-to motivation			0.47 (0.096) *	0.34 (0.095) *
Perceived rejection --> Want-to motivation			-0.27 (0.099) *	-0.19 (0.099) **
Have-to motivation --> Behavioral Adherence			-0.20 (0.099) **	-0.19 (0.099) **
Want-to motivation --> Behavioral Adherence			-0.13 (0.100) †	-0.12 (0.101) n/s
Perceived rejection * Perceived playfulness --> Have-to motivation				0.23 (0.098) *
Perceived rejection * Perceived playfulness --> Want-to motivation				-0.30 (0.096) *
Have-to motivation * Goal Difficulty --> Behavioral Adherence				-0.06 (0.103) n/s

Want-to motivation * Goal Difficulty --> Behavioral Adherence				0.19 (0.099) **
R-squared				
BAC	0.01	0.25	0.19	0.26
HMC	-	-	0.22	0.26
WMC	-	-	0.08	0.18
SARC	-	0.16	0.15	0.13
Stone-Geisser's Q2-value				
BAC	0.219	0.25	0.31	0.339
HMC	-	-	0.214	0.269
WMC	-	-	0.084	0.189
SARC	-	0.173	0.173	0.147
Averaged R-Squared (ARS)	0.011	0.202	0.159	0.209
Average adjusted R-Squared (AARS)	0.072	0.156	0.125	0.167

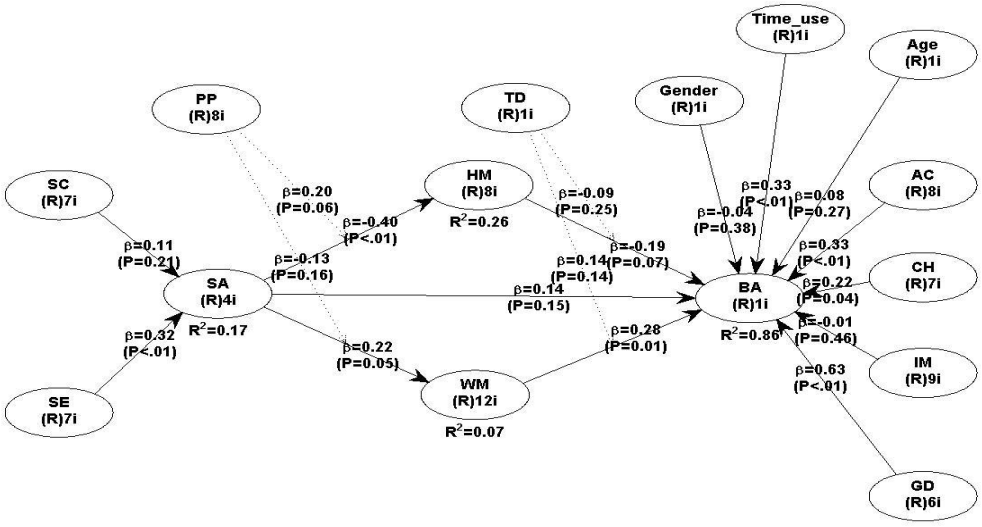
* p<0.01; ** p<0.05; † p<0.10; n/s: not significant; standard error terms are shown in brackets.

To test H1-H8, we assessed the structural model by examining the path coefficients and their significance levels for each of the models. We computed the path coefficients for each group-(results shown in Figure 7). The significance levels for the effects were computed in WarpPLS using 100 bootstrap samples (Preacher & Hayes, 2008).

As shown in Figure 7a, social experience had a significant positive effect on perceived acceptance ($\beta = 0.32$, $p < 0.01$). Specifically, users who have more positive social experience with fitness groups were more likely to perceive acceptance than their peers who encountered negative social experience, thus supporting H1c. The effect of social competition on perceived social acceptance was insignificant, thereby providing no support for H1b. There was a significant positive effect of perceived acceptance on want-to motivation ($\beta = 0.22$, $p < 0.10$), supporting H2. In support of H6, the effect of want-to motivation on behavioral adherence ($\beta = 0.28$, $p < 0.05$) was also significant and positive. Perceived acceptance in fitness groups within gamified systems would, therefore, nudge an individuals' intrinsic motivation to continue the activity. There was a significant negative effect of perceived acceptance on have-to motivation ($\beta = -0.40$, $p < 0.01$), thereby providing support for H3. The effect of have-to motivation on

behavioral adherence ($\beta = -0.19$, $p < 0.10$) was also significant and negative, providing support for H5. Perceived acceptance in fitness groups within gamified systems would, however, not nudge an individuals' extrinsic motivation to continue the activity. This is particularly important as we often assume positive social experience provided through social support elements in gamified systems can induce extrinsically motivated individuals to adhere to an intended behavior.

(A) Acceptance Group



(B) Rejection Group

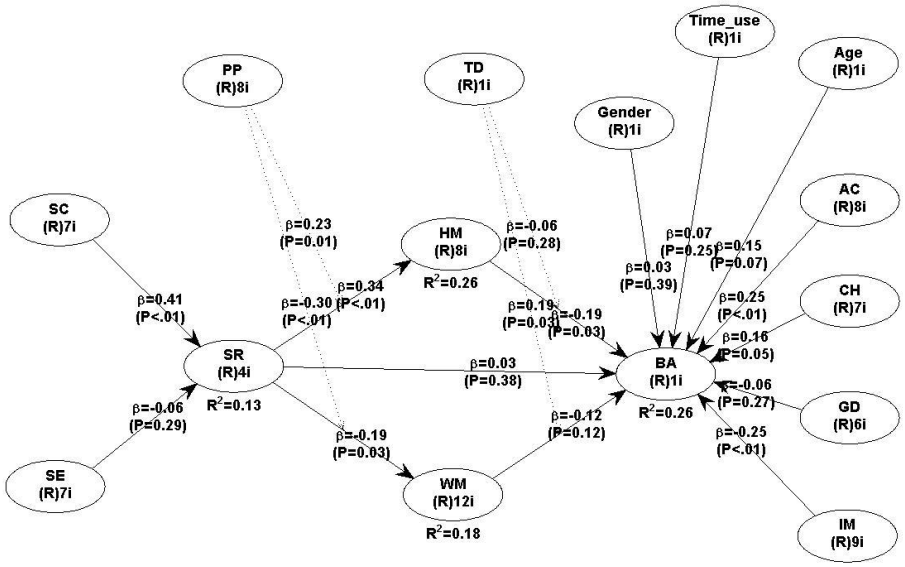


Figure 7: Bootstrapped Path Estimates

Since perceived acceptance appeared to have an indirect effect on behavioral adherence through the have-to/want-to motivations, we conducted a mediation test using the Shrout and Bolger (2002) approach to test whether a significant amount of the influence of the independent variable (IV) (i.e., perceived acceptance) on the final dependent variable (DV) (i.e., behavioral adherence) was expressed through the mediator (i.e., have-to/want-to motivation). As shown in Table 6, when the mediator (i.e., have-to/want-to motivation) is introduced, the direct effect of perceived acceptance on behavioral adherence ($\beta direct = 0.05$, n/s) becomes insignificant, indicating full mediation through multiple mediators (Baron and Kenny 1986).

As shown in Figure 7b, social competition had a significant positive effect on perceived rejection ($\beta = 0.41$, $p < 0.01$), thus supporting H1d. Specifically, social competition within fitness groups was more likely to induce a feeling of rejection in users. The effect of social experience on perceived social rejection was insignificant, thereby providing no support for H1a. There was a significant negative effect of perceived rejection on want-to motivation ($\beta = -0.19$, $p < 0.05$), providing no support for H4a and H4c. This was contrary to our hypothesis, in that the perception of rejection would still improve the intrinsic motivation of a user to perform an activity of interest to them. However, the effect of want-to motivation on behavioral adherence ($\beta = -0.12$, $p=0.12$) was insignificant, thereby providing no support for H6. This would suggest that the negative effect of perceived rejection on want-to motivation was less likely to impact behavioral adherence. Perceived rejection in fitness groups within gamified systems was also unlikely to improve an individuals' intrinsic motivation to continue the activity that is of interest to the user. Hence, intrinsically-motivated individuals are less likely to be affected by rejection within social fitness groups, but it requires further empirical validation. We observed a significant positive effect of perceived rejection on have-to motivation ($\beta = 0.34$, $p < 0.01$),

thereby providing support for H4b. The effect of have-to motivation on behavioral adherence ($\beta = -0.19$, $p < 0.05$) was also significant, supporting H5. Perceived rejection in fitness groups within gamified systems would, therefore, nudge an individuals' extrinsic motivation to continue the activity, but adherence to the behavior that require persistence over time was unlikely as other temporary factors could impede adherence.

Since perceived rejection appeared to have an indirect effect on behavioral adherence through have-to motivation, we conducted a mediation test using the Shrout and Bolger (2002) approach to test whether a significant amount of the influence of the independent variable (IV) (i.e., perceived rejection) on the final dependent variable (DV) (i.e., behavioral adherence) was expressed through the mediator (i.e., have-to motivation). As shown in Table 7, when the mediator (i.e., have-to motivation) is introduced, the direct effect of perceived rejection on behavioral adherence ($\beta direct = 0.18$, $p<0.05$) was significant, indicating partial mediation (Baron and Kenny 1986). The indirect effect (i.e., described by the product of point estimates for the SR-HM and HM-BA paths) mediated through have-to motivation was -0.094, with a bias-corrected 95% confidence interval (CI) of -0.463 to -0.085. Since the CI does not contain zero, this indicates that have-to motivation plays a significant mediating role (Shrout and Bolger 2002).

Finally, H7 concerned the moderating role of perceived playfulness on the relationship between perceived acceptance (rejection) and a user's have-to/want-to motivations. We found that the interaction term between perceived playfulness and perceived acceptance was only significant ($\beta = 0.20$, $p < 0.10$) for have-to motivation in the acceptance group, thus providing partial support for H7. The interaction term between perceived playfulness and perceived rejection was significant for both have-to motivation ($\beta = 0.23$, $p < 0.05$) and want-to motivation

($\beta = -0.30$, $p < 0.01$) in the rejection group, thus providing support for H7. Figure 8 illustrates the moderating effects of perceived playfulness on the relationship between perceived acceptance (rejection) and a user's have-to\want-to motivations. Following the approach suggested by Aiken and West (1991), we tested whether the simple slopes differed from zero. The results (as shown in Table 8) indicated that when individuals perceive rejection, perceived playfulness significantly moderated the relationship between perceived rejection and have-to/want-to rejections. On the contrary, H8 concerned the moderating role of goal difficulty on the relationship between a user's have-to/want-to motivations and behavioral adherence, but no significant moderation effect was observed. The findings suggest that goal difficulty does not affect a user's intent to continue an activity when they are part of a social fitness group within gamified system. In other words, both intrinsically- and extrinsically-motivated individuals, when in the presence of others within gamified systems, are less likely to be affected by the level of difficulty of the task at hand.

Table 8: CI test for Moderation

Group	**Interaction**	**95% Confidence Interval**		**Zero included?**	**Support?**
		Lower	**Upper**		
Acceptance Group	Perceived acceptance * Perceived Playfulness → Have-to motivation	-0.043	0.452	Yes	No
	Perceived acceptance * Perceived Playfulness → Want-to motivation	-0.386	0.122	Yes	No
Rejection Group	Perceived rejection * Perceived Playfulness → Have-to motivation	0.038	0.421	No	Yes
	Perceived rejection * Perceived Playfulness → Want-to motivation	-0.491	-0.116	No	Yes

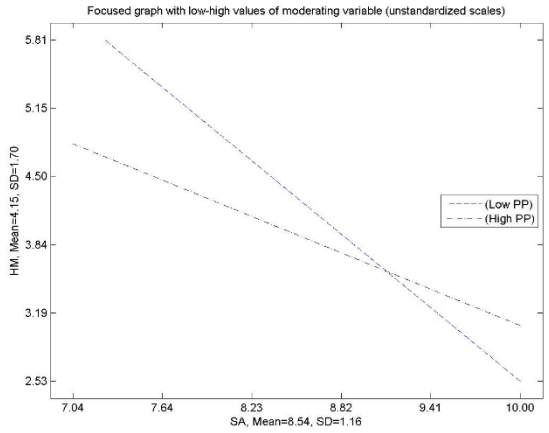
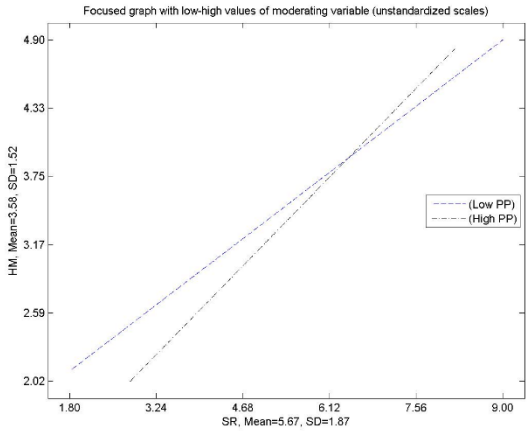
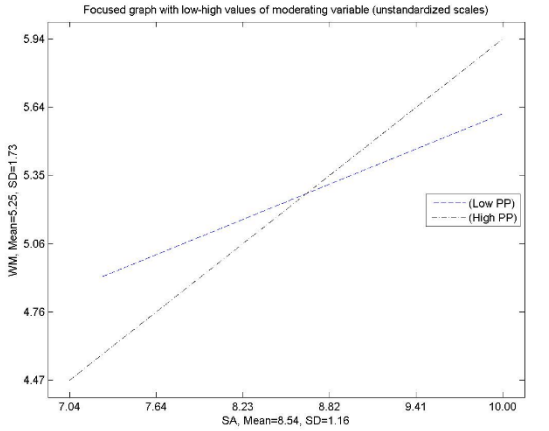
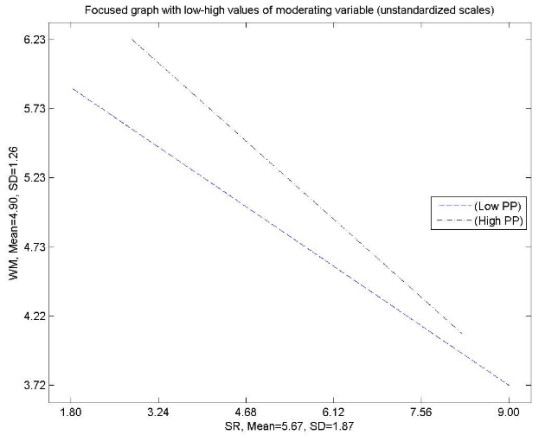
Acceptance Group	Rejection Group
	
Perceived acceptance → Have-to motivation	Perceived rejection → Have-to motivation
	
Perceived acceptance → Want-to motivation	Perceived rejection → Want-to motivation

Figure 8: Interaction plot showing the moderating effect of perceived playfulness on the relationship between perceived acceptance (rejection) on user's have-to/want-to motivation

Discussion

The success of gamified systems (such as Fitbit) depends on the system's ability to motivate a user towards a particular behavior, demanding practice and maintenance of the behavior over time. Groups are often enabled in gamified systems with the objective of nudging individuals positively. However, users of these systems can encounter negative competition (e.g., hyper-

competition), thereby influencing a user's perception of rejection. Perceived rejection has been found to have a positive influence on the extrinsic motivation of an individual. Despite having the option of quitting and joining groups easily within these systems, users are likely to stay in the group and put more efforts in the hope of eventually gaining recognition and/or status. Yet, the adherence to a persistent behavior is unlikely to occur because the temporal and recurring factors in their environments (e.g., inclement weather) can quickly thwart the have-to motivations, which temporarily results in a decrease in an individual's practice and maintenance of desired health behavior. For example, Fitbit provides its users with groups (e.g., Cardio group), whereby the user is expected to perform cardio activities with the intent of leading a healthy lifestyle. Extrinsically motivated users of this group can be negatively influenced by group members' behavior (e.g., hyper-competitiveness), as well as being in the presence of other temporal and recurring factors that thwart their motivation (e.g., performing the cardio activity outdoor when it is raining) can cause the user to temporarily (or even permanently) abandon the cardio activity. Extrinsically motivated users are also less likely to adhere to the behavior when they perceive social acceptance in social fitness groups. When they are part of a social fitness group that accepts them, the motivational drive of groups on an individual's behavior has been found to be similar to that of an offline setting. That is, when their social need for recognition and/or status is satiated, the social need drive diminishes, leading to lesser practice of the particular activity. Providing social enrichments in gamified systems are, therefore, less effective for someone who is extrinsically motivated.

On the contrary, intrinsically motivated individuals are found to adhere to the behavior when they perceive acceptance by the social fitness group. The practice of the expected behavior is imbibed to their identity. By joining a fitness group in gamified systems and gaining acceptance,

these users receive social recognition for their behavior, which, in turn, boosts their motivation to continue the behavior. Supportive social elements in gamified systems for achieving a persistent behavioral change are, therefore, likely to be more effective for intrinsically motivated users. While social support elements have shown promise in prior studies (James et al. 2019), adherence to a behavior can occur only when an intrinsically motivated individual belongs to a group they fit in with well. Joining any group does not guarantee success in achieving persistent behavioral changes. When these individuals engage in unhealthy social competition, their motivation to perform the activity is observed to diminish. A plausible explanation for this decrease is that any perceived rejection can induce an unpleasant state of mind in these individuals, which, in turn, reduces the motivation to perform an activity they enjoy doing. However, practice and maintenance of the activity over time are less likely to be affected.

Finally, gamification success in inducing persistent behavioral change using social enrichments (i.e., enabling groups or communities) is limited by the user's perceived playfulness. The effect of perceived playfulness has been found to be more profound when a user perceives rejection, which can also be potentially attributed to the unpleasant state of mind induced that affects the level of enjoyment the user experiences.

Theoretical Implications

Our study contributes to the existing gamification literature by challenging the widely embraced assumption in published gamification research. Prior gamification literature often assumes that providing motivational elements can lead to behavioral outcomes. This has led to a misconception that employing game elements in gamified IT artifacts will aid with achieving intended behavioral or attitudinal change, irrespective of the influence of context or heterogeneity of the game elements. However, prior meta-analysis studies have found

differences in the effects of game elements on gamification success (i.e., achieving attitudinal/behavioral change). In our study, we have tried to reconcile the differential effects observed in prior studies by bringing forth the influential role of the environment and enrichments in them that will, in turn, influence users' motivation and intent to use gamified systems. Through the study of socially-enriched gamified systems, we identify the boundary conditions under which groups/communities influence an individual's motivation to perform a persistent behavior.

We also contribute to the Information Systems literature in general by bringing forth Environmental Enrichment (EE). EE, as described in our study, can be extended to other information system contexts to understand the influential role of environment. For example, EE can be used to study how the online environments can be regulated to deter negative online behaviors, such as social loafing. Similarly, it can be used to possibly explain why individuals tend to engage in certain irrational activities (e.g., bitcoin trading) when they belong to a particular environment (e.g., Reddit user groups).

Our study contributes to the existing EE literature by demonstrating how social enrichments in gamified systems can influence an individual's motivation. The applications and successes of EE have been studied for captive animals (Watters 2009). Practitioners and researchers have often assumed that giving animals choice and control in their environment will stimulate their motivation to perform behaviors that may indicate a heightened state of well-being (Watters 2009). This assumption also forms the basis for EE research within medical sciences. EE theorists are, however, limited in terms of evaluating this assumption because the subjects of their study (i.e., animals or medically-challenged individuals) are unable to report the level of motivation they perceive.

Finally, this study provides new theoretical insight for social motivation theorists, who often assume that social motivation drive diminishes when the need for relatedness is satiated for both extrinsically and intrinsically motivated individuals. Social motivation theory suggests that a diminished drive can intensify the drive, while a satiated drive can diminish the drive (DeWall et al. 2011). Our study finds that a diminished drive influences the user's have-to motivation positively but reduces the user's want-to motivation. That is, the intensity of the drive does not seem to intensify when the social need drive is diminished through perceived rejection for intrinsically-motivated individuals.

Practical implications

The findings of our study suggest several implications for gamified system users, as well as organizations building these systems. The key concept for both of these entities is that of awareness of the importance of various environmental factors that influence behavioral change when using gamified systems.

Practitioners often assume that competition can lead to behavioral change. The competition aspect is often built into gamified systems (e.g., leaderboard) to facilitate behavioral change. Our study finds that social competition is less likely to nudge individuals positively. Unhealthy social competition has, in fact, been found to induce perceived rejection in users. While competition in gamified systems might enable behavioral change, it could also lead a user to perceive rejection, and, in turn, affect behavioral adherence. The effects of healthy social competition on a user's acceptance and behavioral adherence was not observed in this study. Hence, managers in organizations should not assume that providing social support elements with competition aspect embedded in them (e.g., leaderboard) will positively nudge users towards changing their behavior. If practitioners are enabling social support elements that harness competitiveness, we

would recommend the inclusion of some form of moderator to control for the level of competitiveness expressed by users within these platforms.

Gamified system users join social groups for social recognition and/or social status. Some users can get drawn into these systems, leading to discouraging behaviors, such as over competitiveness. The effect of such behavior on the user's motivation is often subliminal, such that the user is not aware of it. Through our study, we highlight the influence of negative behaviors on the user's perceived acceptance/rejection, and in turn, their motivation. Users of gamified systems need to be cognizant that social fitness groups can sometimes negatively influence their behavior, thereby challenging the primary intent of purchasing and using the system. On the other hand, users can also derive additional benefits by joining social groups in these systems. This, however, depends on the experience they have within those groups such that positive experiences boost their motivation to achieve a given goal. Users should try to join groups where their social needs will be met. This is only possible when they join a group that fosters a positive social environment.

Finally, gamified system designers need to be aware that the effect of various game elements on a given outcome are influenced by the environment. Different game elements exist with differing effects on outcomes. This differential effect can be caused due to various internal and external characteristics in the gamified system. For example, we observed that socially competitive elements and social experiences in a gamified system can influence a user's perceived acceptance (or rejection). This would, in turn, influence a user's motivation to continue with an activity. Similarly, the user's perceived playfulness affects his/her motivation levels; therefore, designers need to account for as many internal and external factors that can influence the user's motivation to continue use of the system and activity intended.

Limitations and future research

We believe that enriching a user's environment in gamified artifacts with groups or communities will lead to more realistic behavioral outcomes, adjusting for any optimistic bias that may arise when using the artifact alone (i.e., without a group). However, the heterogeneity of environments in gamified artifacts (i.e., some have social groups while others have augmented reality embedded in them) can result in varying degrees of success of gamified artifacts. In addition, prior studies have reported that some game elements, such as augmented reality, have negative experiential effects, such as physical discomfort, motion sickness, cognitive overload, and distracted attention. While we have attempted to control the effects of other forms of game elements, future research needs to examine the effect of various game elements on gamification success to identify the ones that provide the most value for organizations and the users.

EE studies in animal husbandry and medical sciences have focused on measuring the physiological and psychological impact of enrichment by measuring hormonal concentration changes and/or endocrine responses (Moncek et al. 2004; Kempermann et al. 2010). However, the physiological aspect has received more attention, mainly because the entities studied were animals and humans with medical anomalies (e.g., autism). The techniques used have, however, been limited due to the difficulty in assessing the psychological well-being since the subjects in these studies have a limited ability to provide verbal or written responses for psychological well-being. EE studies have often assumed motivational changes, however, further investigation of this aspect is required (Watters 2009). Although we have attempted to bridge this gap in our study, we did not examine the physiological impact of social enrichments in gamified systems. IS researchers can, therefore, contribute to EE literature by demonstrating the effect of EE on

both aspects of wellbeing (psychological and physiological). They can also evaluate the threshold levels beyond which EE ceases to be beneficial.

In our study, we looked at the influence of social EE on an individual's motivation and behavior. However, we have only been able to cover a subset of the psychological aspects (i.e., motivation). Future research can look at expanding the model to understand how social EE affects the hedonic and eudaimonic wellbeing of individuals. The existing SDT literature suggests that both these types of wellbeing play an important role in achieving a desired physical outcome (Ryan and Deci 2000; Miquelon and Vallerand 2006).

Finally, our study has examined the influence of social EE within gamified systems on a user's motivation. This effect has been examined through a cross-sectional survey where the user is asked to think of a group within a gamified system (e.g., Fitbit). Our findings are limited to the influence of a single group on a user's motivation and behavioral adherence. Users of gamified systems can simultaneously be members of multiple groups. Future research can build on the findings of this research by examining the effects of groups on motivation and behavioral adherence when a user belongs to one group vs. multiple groups.

Conclusion

Although a growing stream of studies has emerged to examine the various factors and contexts associated with gamified systems, much of the prior research has tacitly assumed that integrating game elements in information technology can influence behavioral/attitudinal change in the system users. Little attention has been paid to the environmental factors that may aid with reconciling the differential effects observed in the gamification literature. In this study, we found that these internal and external environmental factors in socially-enriched gamified systems

strongly influenced a user's motivation towards a given behavior. We hope that this study will lead to additional research in this important stream of gamified system usage and success.

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Appendix A

Table A1. Item Loadings and Construct Measurement Properties

Construct	Items	Standardized Loading	Cronbach's Alpha	Average Variance Extracted	Variance Inflation Factor
Social Competition (SC)	Competition_1	0.781	0.89	0.56	2.1
	Competition_2	0.809			
	Competition_3	0.756			
	Competition_4	0.786			
	Competition_5	0.754			
	Competition_6	0.775			
	Competition_7	0.765			
Social Experience (SE)	Social_experience_1	0.688	0.91	0.57	3.6
	Social_experience_2	0.756			
	Social_experience_3	0.764			
	Social_experience_4	0.777			
	Social_experience_5	0.782			
	Social_experience_6	0.74			
	Social_experience_7	0.769			
	Social_experience_8	0.783			
Perceived acceptance/rejection (A/R)	Belonginess	0.901	0.84	0.64	1.8
	Control	0.797			
	Selfesteem	0.878			
Perceived Playfulness (PP)	Playfulness_1	0.653	0.91	0.54	3.3
	Playfulness_2	0.758			
	Playfulness_3	0.816			
	Playfulness_4	0.785			
	Playfulness_5	0.802			
	Playfulness_6	0.708			
	Playfulness_7	0.824			
	Playfulness_8	0.748			
	Playfulness_9	0.819			
Goal Difficulty	Task_Difficulty1	1	1	1	1.6
Have-to motivation (HM)	Amot1	0.829	0.94	0.66	2.1
	Amot2	0.835			
	Amot3	0.843			
	Amot4	0.858			
	ExtReg1	0.834			
	ExtReg2	0.855			
	ExtReg3	0.812			
	ExtReg4	0.841			

	InjReg1	0.618			
	InjReg2	0.525			
	InjReg3	0.539			
	InjReg4	0.49			
Want-to motivation (WM)	IdReg1	0.781	0.94	0.58	1.5
	IdReg2	0.727			
	IdReg3	0.776			
	IdReg4	0.692			
	IngReg1	0.798			
	IngReg2	0.768			
	IngReg3	0.746			
	IngReg4	0.797			
	IntReg1	0.797			
	IntReg2	0.787			
	IntReg3	0.786			
	IntReg4	0.819			
Behavioral Adherence	BA	1	1	1	1.2
Accomplishment (AC)	Accomplishment_1	0.767	0.94	0.69	5.8
	Accomplishment_2	0.835			
	Accomplishment_3	0.826			
	Accomplishment_4	0.766			
	Accomplishment_5	0.833			
	Accomplishment_6	0.868			
	Accomplishment_7	0.85			
	Accomplishment_8	0.841			
Guided (GD)	Guided_1	0.806	0.93	0.71	5.6
	Guided_2	0.786			
	Guided_3	0.819			
	Guided_4	0.826			
	Guided_5	0.845			
	Guided_6	0.801			
	Guided_7	0.808			
Immersion (IM)	Immersion_1	0.714	0.92	0.58	4.6
	Immersion_2	0.771			
	Immersion_3	0.805			
	Immersion_4	0.801			
	Immersion_5	0.777			
	Immersion_6	0.788			
	Immersion_7	0.787			
	Immersion_8	0.776			

	Immersion_9	0.785			
Challenge (CH)	Challenge_1	0.843	0.91	0.62	3.2
	Challenge_2	0.758			
	Challenge_3	0.815			
	Challenge_4	0.81			
	Challenge_5	0.831			
	Challenge_6	0.822			
	Challenge_7	0.8			
	Challenge_8	0.79			

Table A2. Item Loadings and Cross-Loadings

Indicators / Construct	SC	SE	SAR	HM	WM	BA	PP	GoalDiff	Gender	Age	Time_Use	AC	CH	GD	IM
Competition_1	**0.707**	-0.365	0.129	-0.091	-0.101	-0.06	0.135	0.114	0.104	0.159	-0.11	0.139	0.123	-0.122	-0.364
Competition_2	**0.825**	0.384	-0.118	-0.174	0.131	-0.012	-0.202	0.187	0.064	-0.119	0.005	-0.137	-0.406	0.241	0.281
Competition_3	**0.797**	-0.117	0.042	-0.064	0.107	0.023	0.216	0.019	-0.209	0.062	-0.095	0.084	0.131	-0.363	0.006
Competition_4	**0.799**	0.143	-0.079	0.204	-0.161	0.047	-0.271	-0.268	0.057	0.011	0.038	-0.084	-0.174	0.319	0.007
Competition_5	**0.67**	0.452	-0.095	-0.23	0.073	-0.011	-0.194	0.117	0.103	-0.341	0.062	-0.16	-0.045	0.069	0.124
Competition_6	**0.725**	-0.396	0.085	0.238	-0.113	-0.168	0.182	-0.225	-0.192	0.118	0.157	0.131	0.403	-0.072	-0.327
Competition_7	**0.705**	-0.136	0.055	0.111	0.057	0.178	0.162	0.071	0.091	0.1	-0.051	0.039	0.031	-0.103	0.239
Social_experience_1	0.138	**0.769**	-0.173	0.106	0.004	-0.14	-0.091	-0.055	-0.083	0.034	-0.205	0.305	-0.441	0.198	0.056
Social_experience_2	0.122	**0.732**	-0.119	-0.096	-0.03	0.01	0.234	-0.065	0.022	0.003	0.167	-0.008	0.151	0.014	-0.263
Social_experience_3	-0.193	**0.782**	-0.104	-0.079	0.085	0.171	-0.205	0.063	-0.017	-0.168	0.088	-0.184	0.169	-0.266	0.281
Social_experience_4	-0.107	**0.798**	0.163	0.034	-0.161	-0.027	-0.047	0.041	0.095	0.115	0.109	0.09	0.121	-0.184	0.052
Social_experience_5	0.089	**0.688**	0.035	-0.096	-0.018	-0.031	-0.112	0.154	0.082	0.099	-0.037	-0.395	-0.188	0.223	0.152
Social_experience_6	-0.071	**0.861**	-0.086	0.023	0.072	0.078	0.088	-0.086	-0.002	0.003	0.176	-0.202	0.237	-0.095	-0.057
Social_experience_7	-0.012	**0.638**	0.224	0.103	-0.026	-0.024	0.071	-0.054	-0.333	0.001	-0.207	-0.057	0.078	0.381	-0.2
Social_experience_8	0.063	**0.78**	0.1	0.006	0.061	-0.054	0.067	0.012	0.184	-0.078	-0.147	0.417	-0.16	-0.156	-0.05
Belonginess	-0.099	0.015	**0.88**	0.017	0.045	0.203	0.03	0.039	0.024	-0.047	-0.081	0.066	0.094	-0.131	0.003
Control	0.09	-0.145	**0.634**	-0.172	0.132	-0.302	-0.048	0.081	-0.074	0.101	0.079	0.022	0.188	-0.064	-0.009
Selfesteem	0.036	0.09	**0.865**	0.107	-0.142	0.016	0.005	-0.099	0.029	-0.027	0.025	-0.083	-0.234	0.181	0.004
Amot1	-0.147	-0.014	-0.076	**0.824**	-0.055	-0.146	-0.123	-0.259	-0.026	0.076	0.147	-0.002	-0.256	0.227	0.306
Amot2	-0.144	0.021	0.193	**0.797**	-0.146	0.023	0.032	0.193	0.125	0.039	0.047	-0.146	0.082	-0.185	0.26
Amot3	-0.041	-0.034	-0.022	**0.833**	-0.069	-0.234	-0.1	-0.141	0.066	0.191	0.043	0.182	0.018	-0.254	0.201
Amot4	-0.124	0.091	-0.019	**0.853**	0.027	-0.035	-0.077	0.075	-0.06	0.18	-0.034	0.144	0.164	-0.433	0.074
ExtReg1	0.115	-0.082	0.067	**0.804**	-0.06	-0.041	0.226	-0.056	0.079	-0.071	-0.111	0.291	0.062	-0.128	-0.276
ExtReg2	0.135	0.06	-0.016	**0.853**	0	0.128	-0.068	-0.023	-0.074	-0.057	-0.216	0.088	-0.18	0.243	-0.209
ExtReg3	0.184	-0.089	0.066	**0.719**	0.115	0.256	0.064	0.238	-0.077	-0.275	-0.03	-0.429	-0.252	0.559	-0.224
ExtReg4	-0.008	0.03	0.048	**0.824**	0.019	0.122	0.152	-0.039	-0.084	-0.136	0.024	-0.112	0.077	0.067	-0.069
InjReg1	0.038	0.044	-0.467	**0.145**	0.525	-0.075	-0.301	0.049	0.178	-0.118	0.417	-0.279	0.624	0.096	-0.277
IdReg1	0.035	-0.196	-0.063	-0.155	**0.793**	-0.149	-0.058	0.078	-0.076	-0.01	0.032	-0.116	-0.031	0.341	-0.171
IdReg2	-0.107	0.007	0.022	-0.016	**0.7**	0.261	0.064	0.121	-0.099	-0.156	-0.065	0.154	0.061	0.033	-0.38
IdReg3	0.018	0.111	-0.097	0.241	**0.731**	0.151	0.09	0.055	-0.187	0.114	-0.23	0.007	0.369	-0.053	-0.492
IdReg4	-0.059	-0.021	0.12	0.128	**0.619**	0.146	-0.272	0.113	-0.004	0.051	0.064	-0.415	-0.297	0.638	0.075
IngReg1	0.069	-0.255	-0.045	0.184	**0.833**	0.076	0.142	-0.167	0.033	0.142	-0.07	0.038	0.05	-0.012	-0.004
IngReg2	0.083	-0.166	0.01	0.066	**0.786**	0.048	0.239	0.081	0.075	0.152	-0.066	-0.07	0.27	-0.36	0.005
IngReg3	0.25	-0.01	-0.036	-0.099	**0.739**	0.005	-0.203	-0.039	0.039	0.366	-0.123	-0.188	0.266	-0.215	0.201
IngReg4	0.074	0.078	-0.016	-0.216	**0.809**	-0.108	-0.196	0.02	0.213	0.057	0.092	0.152	-0.006	-0.401	0.197
IntReg1	-0.01	-0.028	0.029	-0.114	**0.813**	-0.137	0.078	-0.248	-0.118	-0.161	0.036	0.017	-0.258	0.272	0.05

IntReg2	-0.003	0.238	-0.189	-0.051	**0.782**	-0.081	-0.111	-0.015	0.083	-0.282	0.117	-0.243	-0.137	0.26	0.237
IntReg3	-0.299	0.053	0.213	0.08	**0.791**	-0.134	0.291	0.047	0.028	-0.028	0.141	0.196	0.031	-0.348	0.186
IntReg4	-0.064	0.209	0.072	-0.012	**0.784**	-0.004	-0.127	0.01	-0.012	-0.228	0.055	0.38	-0.327	-0.028	0.042
BA	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0
Playfulness_1	-0.031	0.394	-0.15	0.098	0.106	0.164	**0.577**	-0.046	-0.208	-0.059	0.025	0.35	-0.224	-0.054	0.111
Playfulness_2	0.13	0.09	0.047	-0.215	0.087	-0.097	**0.668**	0.064	0.231	0.116	0.002	-0.331	0.231	-0.095	0.106
Playfulness_3	-0.242	0.072	0.084	0.246	-0.026	0.002	**0.763**	-0.148	-0.195	-0.076	0.047	0.114	-0.214	0.053	0.21
Playfulness_4	-0.004	-0.029	-0.03	0.049	-0.023	0.075	**0.842**	-0.186	0.151	-0.005	0.055	0.161	-0.121	0.06	-0.054
Playfulness_5	0.315	-0.041	-0.204	0.019	-0.093	-0.021	**0.783**	0.133	-0.119	0.051	-0.086	0.047	0.046	0.191	-0.272
Playfulness_6	0.051	-0.096	0.03	0.077	-0.037	0.044	**0.685**	0.116	0.019	0.033	0.077	-0.223	-0.06	-0.088	0.357
Playfulness_7	0.016	-0.067	-0.026	0.063	0.06	-0.036	**0.788**	-0.213	-0.039	0.078	-0.194	0.005	0.232	0.006	-0.337
Playfulness_8	-0.244	0.037	0.014	-0.161	-0.045	-0.156	**0.71**	0.09	0.1	-0.064	0.15	0.015	-0.003	-0.035	0.016
Playfulness_9	-0.002	-0.239	0.203	-0.18	0.004	0.038	**0.808**	0.214	0.035	-0.074	-0.046	-0.127	0.08	-0.08	-0.033
Task_Difficulty1	-0.051	0.332	-0.256	0.239	-0.298	0.122	-0.068	**0.651**	0.112	0.115	-0.071	-0.064	0.12	-0.369	0.304
Task_Difficulty2	0.051	-0.332	0.256	-0.239	0.298	-0.122	0.068	**0.651**	-0.112	-0.115	0.071	0.064	-0.12	0.369	-0.304
Gender	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0
Age	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0
Time_use	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0
Accomplishment_1	0.397	-0.074	0.177	0.066	-0.092	0.255	-0.202	0.327	-0.068	0.121	-0.045	**0.628**	-0.155	-0.086	0.095
Accomplishment_2	0.012	0.146	-0.125	-0.122	0.026	0.024	-0.181	0.233	0.06	-0.094	0.027	**0.864**	-0.231	-0.045	0.243
Accomplishment_3	-0.123	-0.04	0.16	-0.113	-0.038	0.064	-0.024	0.149	-0.048	-0.063	-0.006	**0.857**	-0.079	0.175	-0.016
Accomplishment_4	-0.179	0.081	0.057	0.083	-0.02	0.041	-0.087	-0.147	-0.013	0.016	-0.003	**0.883**	-0.121	0.193	0.032
Accomplishment_5	0.059	-0.329	-0.097	-0.016	-0.001	-0.254	0.392	-0.288	-0.004	0.064	0.059	**0.86**	0.07	0.177	-0.261
Accomplishment_6	-0.025	-0.035	-0.058	-0.039	0.073	-0.157	0.26	0.006	0.105	0.018	0.032	**0.862**	0.256	-0.269	-0.05
Accomplishment_7	-0.095	-0.033	0.035	0.074	0.028	0.018	0.023	-0.216	0.044	0.036	-0.02	**0.859**	-0.015	0.001	-0.065
Accomplishment_8	0.066	0.269	-0.106	0.087	0	0.078	-0.241	0.029	-0.097	-0.067	-0.057	**0.836**	0.244	-0.178	0.046
Challenge_1	0.052	0.216	-0.166	0.002	0.078	-0.184	-0.132	-0.093	-0.075	-0.032	-0.078	0.204	**0.844**	0.015	0.073
Challenge_2	0.114	-0.124	-0.024	-0.026	0.037	-0.065	0.28	0.049	0.234	0.159	-0.207	0	**0.618**	-0.387	0.039
Challenge_3	-0.072	0.168	-0.092	0.035	0	0.038	-0.136	-0.033	-0.003	-0.138	-0.031	-0.176	**0.877**	0.197	-0.013
Challenge_4	0.066	0.097	-0.071	-0.05	-0.025	0.138	-0.23	0.149	0.184	-0.138	0.078	0.051	**0.812**	-0.052	-0.076
Challenge_5	0.034	-0.305	0.049	0.107	-0.099	-0.025	0.226	0.067	-0.203	0.087	-0.099	-0.154	**0.8**	0.076	-0.234
Challenge_6	-0.015	-0.124	-0.038	-0.002	-0.008	-0.103	0.144	-0.19	0.101	0.094	0.057	0.011	**0.772**	-0.196	-0.018
Challenge_7	0.222	-0.307	0.104	-0.009	-0.019	0.084	0.164	-0.154	-0.112	0.122	0.112	-0.162	**0.796**	0.405	-0.145
Challenge_8	-0.41	0.348	0.275	-0.072	0.045	0.115	-0.246	0.238	-0.074	-0.107	0.144	0.256	**0.724**	-0.188	0.421
Guided_1	-0.045	-0.033	0.015	0.067	-0.076	-0.007	0.099	-0.219	-0.073	-0.133	0.211	0.046	0.177	**0.874**	-0.181
Guided_2	0.026	-0.001	0.053	0.043	-0.009	0.009	0.061	0.097	0.107	0.03	0.038	0.059	0.2	**0.816**	-0.058
Guided_3	0.223	-0.042	-0.229	0.022	-0.028	-0.034	0.055	-0.167	-0.075	0.076	-0.089	0.044	-0.014	**0.86**	-0.187
Guided_4	0.032	-0.183	0.095	-0.06	-0.039	0.073	0.068	0.162	0.078	0.003	-0.356	0.166	-0.263	**0.793**	0.125
Guided_5	-0.125	0.089	0.034	-0.104	0.112	-0.028	-0.123	0.103	-0.06	-0.036	0.105	-0.426	0.057	**0.855**	0.254
Guided_6	-0.101	0.13	0.175	-0.057	0.061	0.143	-0.096	0.16	0.138	0.071	0.064	0.077	0.115	**0.829**	0.094
Guided_7	-0.009	0.031	-0.126	0.082	-0.02	-0.144	-0.062	-0.108	-0.098	-0.005	0	0.05	-0.28	**0.862**	-0.032

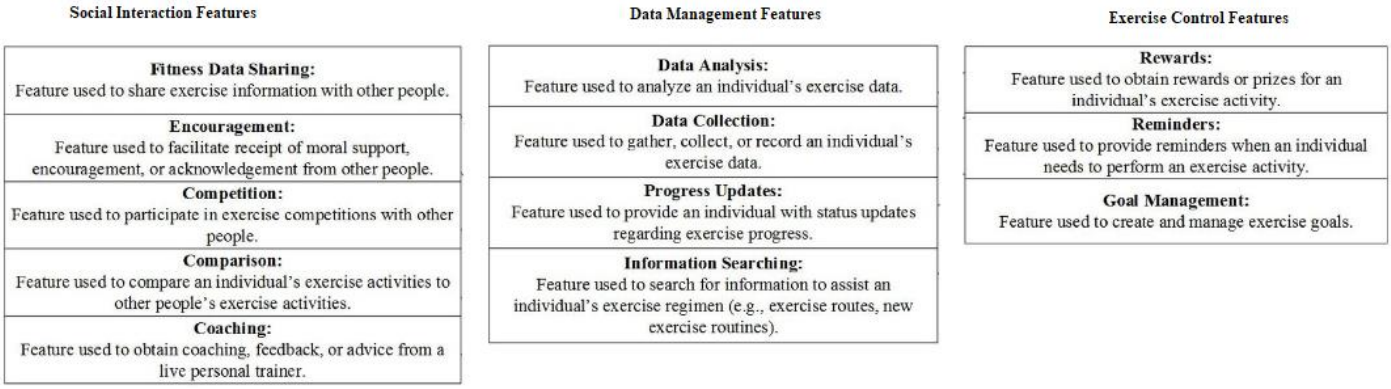
Immersion_1	-0.082	0.279	0.109	-0.072	0.041	-0.057	-0.223	0.08	-0.065	0.103	-0.021	-0.114	-0.199	0.361	**0.756**
Immersion_2	0.268	-0.497	0.177	0.049	-0.03	0.086	0.126	0.033	0.096	0.068	-0.084	0.499	-0.418	0.187	**0.786**
Immersion_3	0.012	-0.342	0.206	0.028	-0.005	-0.134	-0.056	-0.008	0.066	-0.015	-0.003	0.487	-0.442	0.04	**0.777**
Immersion_4	0.019	0.185	-0.104	0.076	-0.045	-0.006	0.229	-0.118	-0.092	0.047	-0.009	-0.215	-0.091	0.083	**0.715**
Immersion_5	-0.214	0.064	0.028	0.073	0.076	0.151	0.159	-0.078	-0.08	-0.048	0.09	-0.458	0.042	0.346	**0.722**
Immersion_6	0.126	0.058	-0.057	-0.059	-0.071	-0.06	-0.245	0.098	0.221	-0.057	0.168	0.016	0.02	-0.056	**0.787**
Immersion_7	-0.153	0.21	-0.148	-0.089	0.059	0.051	-0.197	-0.012	-0.013	0.044	-0.05	0.125	0.431	-0.463	**0.753**
Immersion_8	0.054	0.092	-0.031	-0.086	-0.076	-0.085	0.068	0.099	-0.099	-0.073	-0.048	-0.314	0.364	-0.342	**0.743**
Immersion_9	-0.051	-0.006	-0.182	0.08	0.051	0.059	0.154	-0.099	-0.054	-0.065	-0.041	-0.089	0.304	-0.139	**0.813**

Table A3. Correlations versus sq. root AVEs between Constructs*

	SC	SE	SAR	HM	WM	BA	PP	GoalDiff	Gender	Age	Time_Use	AC	CH	GD	IM
SC	**0.749**														
SE	0.599	**0.759**													
SAR	0.427	0.462	**0.801**												
HM	-0.055	-0.33	0.009	**0.816**											
WM	0.236	0.246	0.393	-0.121	**0.767**										
BA	0.138	0.122	-0.074	-0.333	-0.002	-									
PP	0.524	0.657	0.427	-0.157	0.199	0.121	**0.74**								
GoalDiff	-0.071	-0.102	-0.186	0.338	-0.391	-0.03	-0.05	-							
Gender	-0.072	-0.061	0.079	0.174	0.046	-0.041	0.043	0.008	-						
Age	-0.102	-0.041	0	-0.115	0.046	0	-0.216	-0.047	-0.056	-					
Time_Use	0.057	-0.035	-0.008	-0.187	0.08	0.192	-0.192	-0.067	-0.125	0.264	-				
AC	0.508	0.669	0.357	-0.474	0.359	0.179	0.533	-0.195	-0.146	-0.033	0.077	**0.835**			
CH	0.475	0.597	0.395	-0.269	0.306	0.07	0.537	-0.078	-0.024	-0.19	-0.115	0.815	**0.787**		
GD	0.437	0.591	0.358	-0.339	0.295	0.168	0.519	-0.145	-0.077	-0.023	-0.019	0.827	0.827	**0.844**	
IM	0.479	0.314	0.401	0.071	0.221	0.017	0.628	-0.034	0.047	-0.181	-0.17	0.474	0.634	0.579	**0.762**

* The square root of average variance is shown on the diagonal in bold; Inter-construct correlation is shown off the diagonal; -- not applicable for formative and single-item constructs.

Figure A1: Data Management Features and Exercise Control Features in Fitness Technologies (adopted from James et al. 2019)



CHAPTER 3

Research Essay 2

Does thinking abstractly improve (or reduce) trust in Online Patient Communities? Influential Proximity in HiT

*"**If You Build It, Will They Come? The Kaiser Permanente Model of Online Health Care**"*
– Silvestre, Sue, and Allen (Kaiser Permanente)

Abstract

Health information seekers encounter a plethora of web-based health information systems from a range of organizations and individuals, which are often of varying quality, accuracy, and reliability. This presents consumers with significant challenges in evaluating and selecting the sources to use, and more specifically, in assessing the credibility and trustworthiness of those sources. Prior research suggests that web-based health information-seeking behavior is influenced by website design features, information content features, the perceived reputation of the organization hosting the website, an individual's prior experience and propensity to trust, self-efficacy, and the consumer's computer. However, researchers have paid little attention to the influential role of electronic propinquity (i.e., the perception of psychological closeness with the artifact and its content) in modern-day IT artifacts. In this research, we identified the factors related to propinquity that influence a user's trust in online patient communities. We found that spatial, temporal, and hypothetical proximities with the online patient community can affect a user's trust in the community as well as the system. We also found that multiple dimensions can sometimes boost a user's trust. Under certain circumstances, the effect can diminish with multiple dimensions.

Keywords: Construal Level Theory, propinquity, trust in community, trust in system, online patient community, proximity, spatial proximity, temporal proximity, hypothetical proximity, knowledge sharing.

Introduction

The internet is an important source of health information and advice (Sbaffi and Rowley 2017). Health information seekers encounter a plethora of web-based information, as well as other sources of health information from a variety of organizations and individuals, and of varying quality, accuracy, and reliability (Sbaffi and Rowley 2017). This presents individuals with significant challenges in evaluating and selecting the sources to use, and more specifically, in assessing the credibility and trustworthiness of those sources (Sbaffi and Rowley 2017). Hence, research that enhances our understanding of the factors that influence the evaluation and selection processes associated with digital health information can inform the design of health information systems (Sbaffi and Rowley 2017).

Some health information systems (e.g., PatientsLikeMe) have been more successful than others in gaining users' trust, thereby attracting them to use the system, self-disclose intimate details (e.g., sexual orientation, smoking habits, and mental illnesses), and consume information within the system. The success of such systems contradicts past research on consumer behavior that suggests people are skeptical about providing information on the web in exchange for access to information due to the feeling of a loss of control and lack of clarity on how the data will be used (Hoffman, Novak, and Peralta 1999). In fact, Zahedi and Song (2008) point out that web consumers initiate and establish relationships with health infomediaries that may go beyond one encounter. Research suggests that web-based health information-seeking behavior is influenced by website design features (e.g., clear layout/design, contact details of owner, brand/logo, quality seal/endorsements, authority of owner, interactive features, etc.); information content features (e.g., perceived information quality, ease of use, readability, relevance, clarity/understandability, etc.); perceived reputation of the organization hosting the website; individual's prior experience;

individual's propensity to trust; self-efficacy; and consumer's computer skills (Sbaffi and Rowley 2017; Kim 2016; Or and Karsh 2009; Zahedi and Song 2008). There is evidence that various demographic variables (e.g., age, income, and gender) may influence web-based health information-seeking behaviors, however, there is scant evidence that these factors also impact a user's trust judgment (Sbaffi and Rowley 2017; Or and Karsh 2009).

Trust formation towards a web-based health information system, particularly when the consumer believes the website has attributes that are beneficial to the consumer, is important when the consumer does not have credible information or an affective bondage with the website (Yi et al. 2013). Pavlou et al. (2008) suggest that the text content in online websites can influence a user's trust in a given IT artifact because this information aids users with inferring signals of other's trustworthiness. Trust has been identified as "an important lubricant of the social system" (Arrow 1974, p. 23), while factors such as race/ethnicity and geographic proximity hold weight in explaining observed differences in trust in social networks (Bapna et al. 2017). So, are web-based health information systems that display information, such as geographic location, age, gender, and race more likely to be perceived as trustworthy by users?

Some of the modern-day IT artifacts (e.g., social media, online patient communities) are characterized by electronic propinquity, the perception of psychological closeness with the artifact, and its content, all of which will influence individuals' interaction with data-driven computer systems (Carr and Haynes 2015). For example, in Bernhardt and Felter's (2004) study on mothers seeking pediatric information, the participants provided evidence that they trusted websites if they included familiar source's name and picture. While structural features (e.g., website design, navigation, security) will influence consumers' trust in web-based health information (Kim 2016), we posit that the electronic propinquity characteristics of web-based

health information systems, such as online patient communities (OPC), can improve trust in the community and the system in general. This, in turn, can lead to more usage, self-disclosure of sensitive information (e.g., PHI), and consumption of information within these systems. However, further investigation of the evaluation psychology of consumers is essential in order to understand the factors that influence trust formation in a web-based health information system. Specifically, we need to identify the psychological factors (i.e., the factors related to propinquity) that will result in consumers trusting a specific web-based health information system (i.e., online patient communities), setting aside all other concerns they have, which thereby leads to an interest in joining as well as sharing and consuming information. Therefore, in this paper, the research question we seek to answer is: What are the propinquity-related factors that influence consumers' trust in online patient communities and, in turn, the intent to participate (i.e., attitude towards knowledge sharing and intent to consume)?

Research has shown that different objective dimensions of psychological distance (time, space, social distance, and hypotheticality) with respect to an object/situation/action affects the mental construal (i.e., interpretation) of the object/situation/action (Trope et al. 2007). This construal, in turn, guides prediction, evaluation, and behavior (Trope et al. 2007). Construal Level Theory (CLT), which describes the relationship between various psychological distance dimensions and mental construal levels of an object/event/action, is an ideal candidate that can help researchers understand how consumers evaluate the trustworthiness of an online patient community based on propinquity-related information cues. The basic tenets of CLT are that abstract thinking is used to transcend the present and expand one's mental horizons by thinking farther into time and space and considering remote targets and unlikely possibilities (Van Lange et al. 2011). Further, abstract thinking based on informational cues will, in turn, influence the

consumer's perception of an object, event, or individual intentions to adopt or use an object and/or specific behaviors (Ho et al. 2015; Ahn 2015; Chiou et al. 2013; Wilson et al. 2013; Fujita and Carnevale 2012; Rim et al. 2009).

Our research contributes to the literature in two ways. First and foremost, we (re)conceptualize the concept of trust from the perspective of social psychology. As Li et al. (2008) suggest, "initial trust formation is particularly relevant in an IS context, as users must overcome perceptions of risk and uncertainty before using a novel (or existent) technology." Trust is a psychological state that comprises the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another (Rousseau et al. 1998). In our study, we explained that the mental construal mechanisms that help potential users of web-based health information systems transcend the perceived risks and uncertainty to trust certain web-based health information systems (e.g., *PatientsLikeMe.com*) with sensitive personal information. In the existing literature, it is clear that many researchers have looked at trust between people and technology (i.e., trust in systems, such as recommendation systems, decision-support systems, and websites) highlights the importance of the personalization of systems to increase trust in them (Söllner et al. 2016). However, researchers have paid little attention to the influence of electronic propinquity-related factors on trust in a system. Using Construal Level Theory (CLT), we have addressed this research gap by identifying the psychological proximity factors that can improve trust in health IT artifacts (e.g., online patient communities), which thereby leads to greater participation. Second, we contribute to the CLT literature by empirically validating the influence of one psychological dimension on the influence of another dimension. As Liberman et al. (2007) note, the general psychophysical principle of diminishing sensitivity with magnitude, together with CLT's assumption of

interchangeability of distance dimensions, suggest that the impact of distance on one dimension would be reduced when combined with the impact of distance on another dimension. For example, temporal distance would have a lesser impact on both the advice given to another person than on one's own decisions and on hypothetical events as compared to real events (Liberman et al. 2007). This proposition, however, requires empirical corroboration (Liberman et al. 2007). Our study examines this by comparing the combined effect of multiple dimensions vs. the effect of one dimension on trust in a system.

In the following sections, we discuss the relevant literatures and propose a theoretical model that explains the influence of psychological proximity on trust in an IT artifact (specifically online patient communities). We then proceed to describe the research methodology used for this study and discuss the implications of our research.

Relevant Literature

Trust

Mayer, Davis, and Schoorman (1995) define trust as the "willingness of a party to be vulnerable to the actions of another party based on the expectation that the other party will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party." Based upon this definition, Rousseau et al. (1998) identify three main components of a trusting relationship; namely:

1. The presence of least two entities (trustor and trustee) who mutually benefit from the relationship.
2. The presence of uncertainty and risk arising from the trustee failing to meet trustor's expectations.

3. The trustor's faith in the trustee's intentions that the trustee will not betray the trustor's risk-assuming behavior.

Trust is important in many ways as it enables cooperative behavior, promotes adaptive organizational forms, reduces harmful conflict, decreases transaction costs, and facilitates the rapid formulation of ad hoc work groups, etc. (Rousseau et al 1998). Trust is not a behavior (e.g., cooperation) or a choice (e.g., taking a risk); rather, it is an underlying psychological condition that can cause or result from such actions (Rousseau et al 1998). Trust, as a psychological state, comprises the intention to accept vulnerability based upon the positive expectations of the intentions or behaviors of another (Rousseau et al 1998). One of the most important characteristics of trust is that it can be subjective. For example, the level of trust may differ for different individuals for similar situations. The level of trust depends on how our perceived thoughts are affected by the context (i.e., situational factors or opportunities) (Vanneste et al. 2014), as well as the other person's characteristics (e.g., competence, expertise, honesty, integrity, ability, dependability) and actions (Rousseau et al. 1998). Rousseau et al. (1998) identify some common conditions under which trust exists in various situations; namely:

1. **Risk** – A condition considered essential in the psychological, sociological, and economic conceptualizations of trust. Risk is the perceived probability of loss, as interpreted by a decision maker. It has a reciprocal relationship with trust (i.e., when risk exists, an opportunity for trust exists, and positive experiences in uncertainty will reinforce trust).
2. **Interdependence** – A condition that requires the reliance upon another to achieve the interests of one party.

3. **Vulnerability** – trust is formed under uncertainty because the trustor can only guess the other's trustworthiness and is, therefore, vulnerable to the actions of the trustee. Without vulnerability, the role of trustworthiness (and trust) is limited.

Rousseau et al. (1998) suggest that both risk and interdependence are required for trust to emerge, and the nature of risk and trust changes as interdependence increases. They suggest that degrees of interdependence actually alter the form trust may take and is based on the context within which the need for trust exists. The different forms of trust identified by Rousseau et al. (1998) based on various situations are described below:

1. **Calculus-based trust** is based on rational choice (usually a characteristic of interactions in economic exchange). This form of trust emerges when the trustor perceives that the trustee intends to perform an action that is beneficial. The perceived positive intentions in calculus-based trust derive not only from the existence of deterrence (i.e., costly sanctions in place for breach of trust) but also because of credible information regarding the intentions or competence of another (e.g., consumer reviews). Exchanges based on calculus-based trust are likely to be terminated once violation occur.
2. **Relational trust** (or "**affective trust**" [McAllister 1995] or "**identity-based trust**") derives from repeated interactions between trustor and trustee. Information available to the trustor from within the relationship itself forms the basis of relational trust. Reliability and dependability in previous interactions with the trustor give rise to positive expectations about the trustee's intentions. Emotion enters into the relationship between the parties because frequent, longer term interaction leads to the formation of attachments based upon reciprocated interpersonal care and concern. Repeated cycles of exchange, risk taking, and the successful fulfillment of expectations strengthen the willingness of trusting parties to rely

upon each other and expand the resources brought into the exchange. Exchanges characterized by relational trust are often more resilient. Unmet expectations can survive when relational trust exists, particularly if parties make an effort to restore a sense of good faith and fair dealing to their interactions.

3. **Institution-based trust** is based on both calculus-based and relational trust. Ex ante deterrents may promote trust because one's confidence that reputation matters permits relationships to form in the first place. Institutional factors (e.g., teamwork culture, legal system, moderators in online communities) can provide broad support for the critical mass of trust that sustains further risk taking and trust behavior.

Conceptualizing trust in only one form in a given relationship risks missing the rich diversity of trust in a business setting (Rousseau et al. 1998). In any given relationship, trust may exist to different degrees between the parties, depending on the task or setting (Rousseau et al. 1998).

In a fluid work setting (e.g., open source software development), trust may be particularly important for the ability of users to participate such that it manifests itself in trust-related behaviors (e.g., cooperation, increase participation), which thus leads to higher trustworthiness (Rousseau et al. 1998). Similarly, in a knowledge-based economy (e.g., online patient community), a trustee's competence, ability, and expertise become increasingly important as an indicator of his or her ability to act as anticipated (Rousseau et al. 1998). In a social setting (e.g., online social networks), an individual's perception of a community influences the trust he/she has in it (Söllner et al. 2016).

Trust in Information Systems (IS)

Söllner et al. (2016) performed a curation of "Trust" studies within the IS domain (which included 33 papers with over 20,000 combined citations) and identified four clusters of studies:

(1) between people or between groups, (2) between people and organizations, (3) between organizations, and (4) between people and technology. The first cluster focused on trust within virtual teams and online marketplaces (buyer-seller). Trust was identified as an antecedent for team success, an increase in shared knowledge leading to increased performance, effective communication, etc. The second cluster focused on customer trust in internet businesses where trust was a factor in driving online businesses. The third cluster concentrated on inter-organizational trust particularly from an IT/IS outsourcing perspective. Trust was identified as the basis for a mutually beneficial outsourcing relationship across different types of outsourcing, such as open sourcing, IT outsourcing, and IS offshoring. Trust influenced the type of contract used in software development outsourcing and was an important antecedent of strategic information flows within inter-firm logistics relationships. Finally, the last cluster, where our research lies, focuses on trust relationships between people and technology. Trust in systems, such as recommendation systems or decision-support systems or websites, has been the main area of research in this cluster.

The "Computers are social actors" paradigm has clearly delineated the applicability of interpersonal trust theories to the domain of trust in IT artifacts (Pavlou et al. 2008). Pavlou et al. (2008) suggest that people consider recommendation agents and other technologies to be objects of trust, and that these trust perceptions can influence one's adoption of that artifact. The text content of online websites influences a user's trust in the IT artifact because this information signals others' trustworthiness (Pavlou et al. 2008). For example, Ridings et al. (2002) suggest that the decision to trust others in virtual communities is based on a knowledge of other people derived from their disclosure of personal information (e.g., gender, age), which, in turn, influences the development of integrity/benevolence such that knowing more about a person

makes it easier to shape beliefs regarding their standards and principles, which thus leads to increased trust in virtual communities. Pavlou et al. (2008), however, point out that future research could focus on the trust-building potential of textual information (e.g., personal information) in online environments and IT artifacts. Through such research, we can better understand the relationship between trust and IT artifacts (or systems) (Pavlou et al. 2008). Our study aims to address this research gap by developing a theoretical framework to explain the factors influencing trust formation in IT artifacts. We specifically investigate this phenomenon in online patient communities as individuals are willing to trust and share sensitive personal health information in these virtual settings.

Previous research argues that trust in the virtual settings can be divided into two forms based on the targets of trust: trust in system and trust in community members (Hsu et al. 2011). Trust in system is "a belief that the proper impersonal structures have been put into place to support likelihood of successful social exchange" (Hsu et al. 2011; Pavlou 2002). Leimeister et al. (2005) consider that trust in system is based on the perceived reliability or reliance of an information system. It reflects the willingness of the trustor to behaviorally depend on an information system to do a task (Hsu et al. 2011) based on the expectation that the digital artifact is designed to be secured (Yan and Holtmanns 2008). Privacy protection beliefs about the system (Zhang et al. 2017) and design features of the system (Khatri et al. 2018) contribute towards online health information exchange system adoption and the disclosure of information in these systems.

Trust in community members refers to "one party's willingness to depend on the other party (or parties) with a feeling of security, even when negative consequences are possible" (Pennington et al. 2003). Perceived informational and emotional support from the use of the

community-enabled online systems facilitates the disclosure of information within the system (Zhang et al. 2017; Eysenbach, 2008). Ridings et al. (2002) postulates that trust in virtual community members affects an individual's desire to share and access knowledge.

Ratnasingam (2005) further suggests that the two types of trust (i.e., trust in system and trust in community members) are important in any virtual setting because they can facilitate cooperation and information sharing among parties. Interactions with humans, as well as information in the system, is observed to play a significant role in health information exchanges (Ling and Chang 2018). Since knowledge sharing in virtual communities is a form of social interaction supported by information technologies, both forms of trust could be critical in shaping members' knowledge sharing in the context of virtual communities (Hsu et al. 2011).

Trust within any context (including virtual communities) is developed through at least four different mechanisms: initial bias correction, change in relationship value, identification, and trust-based selection (Vanneste et al. 2014). The initial bias correction stage occurs when entering any relationship. At the beginning, a trustor may be pessimistic, unbiased, or optimistic about the partner's (or system's) trustworthiness. This initial bias can influence the party's intent to use a given IT artifact and his/her attitude towards knowledge sharing, to the extent that an optimistic bias will increase both, while a pessimistic bias will decrease both. Engaging in a relationship, however, provides the trustor with first-hand evidence, which influences the trustor's estimate of its partner's (or system's) trustworthiness and thereby results in the correction of the initial perception (Vanneste et al. 2014). A positive bias correction can improve a party's intent to use the artifact, as well as his/her attitude towards sharing knowledge. Finally, given the possibility of exit, a trustor will continue to interact only with partners (or systems) that

are trusted, and untrustworthy individuals (or systems) are deselected over time (Vanneste et al. 2014).

Interestingly, Vanneste et al. (2014) point out that "the faster the trustee identifies with the trustor and the more the trustor recognizes this identification, the more rapidly trust increases." Social identity theory suggests that information originating from groups with which the individuals identify (same location or demographics) is viewed as more credible than information from members of outgroups (Metzger and Flanagin 2013). Therefore, we posit that certain psychological factors (influenced by the information in a given IT artifact), such as social proximity, temporal proximity, and spatial proximity are likely to act as information proxies when evaluating trust in virtual systems. Web-based health information systems (e.g., online patient communities) designed to provide information proxies (associated with proximity) are likely to be viewed as more trustworthy, however, such systems require empirical validation.

Construal Level Theory (factors influencing initial trust)

Construal level theory (CLT) is an account of how psychological distance influences individuals' thoughts and behavior (Trope et al. 2007). CLT assumes that people mentally construe (i.e., interpret) objects that are psychologically near in terms of low-level, detailed, and contextualized features, whereas when they are at a distance, they construe the same objects or events in terms of high-level, abstract, and stable characteristics (Trope et al. 2007). Research has shown that different dimensions of psychological distance (time, space, social distance, and hypotheticality) affect mental construal, and that these construals, in turn, guide prediction, evaluation, and behavior (Trope et al. 2007).

From a functional perspective, the mental construal of an event, object, or action can be high-level construal and low-level construal (Van Lange et al. 2011). High-level construal are

decontextualized representations that extract gist from available information with an emphasis on few superordinate core features of events (Van Lange et al. 2011). Low-level construal are relatively unstructured, contextualized representations that include subordinate and incidental features of events (Van Lange et al. 2011). Therefore, high-level construal can be said to be abstract (i.e., more conceptual or theoretical), while low-level construal is more concrete (i.e., grounded with minute details) (Van Lange et al. 2011).

Psychologically distant events are construed at the high level, whereas psychologically closer events are construed at the low level. For example, one could think about planning a vacation one year from now vs. next week. A person planning a trip in the following week will construe it at low levels. This would mean that the person has more realistic information to hand, such as the actual air ticket price, actual hotel rates, savings in the bank, weather at potential destination, local political conditions, vacation period available at workplace, etc. This contextualized information could, in turn, enable realistic decision-making, such as identifying the destination of travel, the duration of stay, items to pack, etc. On the other hand, when planning a vacation one year from now, the person planning the trip will construe it at high levels. That is, the person has high level (i.e., theoretical or abstract) information, such as the estimated air ticket price, estimated hotel rates, savings likely to be in the bank, etc. This decontextualized information can enable only a few travel-related decisions, such as the destination of travel, and can potentially result in unrealistic decision-making due to the lack of complete and accurate information. Therefore, temporal proximity when planning a trip can influence the quality and quantity of information (e.g., cost of hotel, air tickets) a person has to make decisions.

CLT has established that people describe more distant future activities in high-level terms (i.e., high-level construal) rather than lower-level terms (i.e., lower-level construal) (Van Lange et al. 2011). Similar effects have been established when actions take place in a spatially-distant location (Henderson et al. 2006), when the actions are framed as unlikely to take place (Wakslak et al. 2006), or when the actor is described to be dissimilar to the perceiver (Liviatan et al. 2008). Spatial distance, social distance, and reduced likelihood promote the use of abstract terms. In fact, all four dimensions of psychological distance (temporal, spatial, social, and hypothetical) are associated with high-level construal (Trope et al. 2007), while psychological proximity is associated with low-level construal. As psychological distance increases, construal becomes more abstract, and as level of abstraction increases, perceptions of psychological distance also increase. This supports the basic tenets of CLT that abstract thinking is used to transcend the present and expand one's mental horizons by thinking farther into time and space and considering remote targets and unlikely possibilities (Van Lange et al. 2011).

CLT has been used as a theoretical lens to study self-control, spontaneous trait inference formation, intentions (such as the adoption of new e-learning system or communication tools, or consuming soft drinks) and behaviors (such as procrastination or consumption), perceptions of group members in a virtual setting, evaluation, and predictions (Ho et al. 2015; Ahn 2015; Chiou et al. 2013; Wilson et al. 2013; Fujita and Carnevale 2012; Rim et al. 2009). However, the influence of mental construal levels on trust is understudied to the best of our understanding. In fact, Vanneste et al. (2014) studied trust over time in exchange relationships and suggested that there was an initial bias in trust formation that is corrected over time after a few exchanges. They state that, "Before entering any relationship, a trustor may be pessimistic, unbiased, or optimistic about the partner's trustworthiness… Optimism could be explained by an in-group bias by which

people ascribe better qualities to others from the same group. One such quality is trustworthiness." So, does the trustworthiness arise from the trustor construing a partner at low levels when he/she belongs to the same group? If yes, is this likely to arise in an online patient community where individuals of the same ethnicity (or from same location) are likely to be perceived as more trustworthy than others?

Prior IS research has already found that web content influences the trust in a website (or recommending agent) because the information from the website signals others' trustworthiness (Pavlou et al. 2008). Yet, the trust-building potential of textual information (e.g., personal information) in online environments and IT artifacts has received scant attention (Pavlou et al. 2008). In this study, we posit that the textual information in a website (such as race, gender, location details in a user's profile) can act as informational proxies that aids an individual's construal mechanism to transcend the present and expand one's mental horizons by thinking farther into time and space and considering remote targets, as well as unlikely possibilities. More specifically, we argue that the information in online patient communities influences a person's proximity dimension with the community, as well as the system, and, in turn, their mental construal of the website, thereby affecting the trust he/she places in it (see Figure 1). In light of this, our objective is to empirically validate that trust formation, which plays a critical role in both the acceptance and usage of technical systems (Yagoda and Gillan 2012), can be influenced by social proximity, as well as other forms of proximity dimensions. Figure 2 depicts our research model.

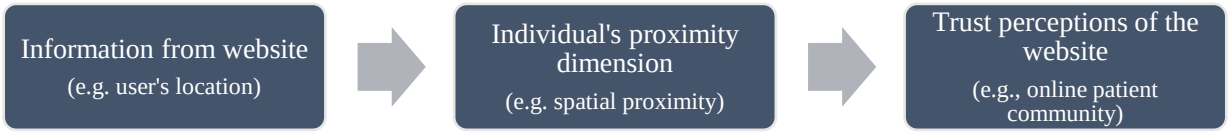


Figure 1: Construal mechanism overview in online systems

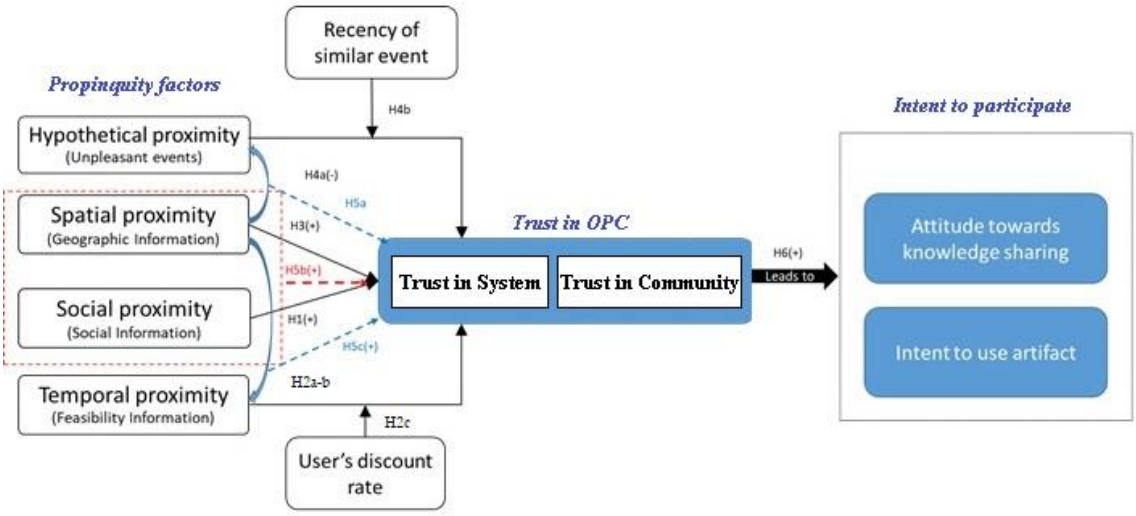


Figure 2: Research Model

Social proximity and trust in online patient communities

Social proximity is the perceived distance between self and other, which is different from physical distance between self and other (Williams and Bargh 2008). A special case of social proximity is homophily (McPherson, Smith-Lovin, and Cook 2001), which refers to the tendency for people to interact more with their own kind—whether by preference or induced by opportunity constraints (McPherson and Smith-Lovin 1987)—as defined by individual characteristics such as race, gender, educational class, organizational unit, etc. Therefore, social proximity, or homophily, refers to the degree to which pairs of individuals who interact are similar in background characteristics (Emmerik 2006). A greater degree of similarity implies the higher similarity of background expectations and greater level of shared understanding between people (Hsu et al. 2011). In this sense, similarity enables people to create a feeling of shared ethical and moral habits, and thus allows people to believe that others' behaviours are appropriate and ethical (Hsu et al. 2011). The proximity argument, therefore, suggests that people will benefit more from people with the same social and/or background characteristics

because interpersonal similarity fosters reciprocal relationships, which is one of the important components of an exchange relationship (Emmerik 2006).

Prior research on homophily and its effects on group and individual performance outcomes suggests that interacting exclusively with similar individuals is efficient to the extent that similarity (a) facilitates transmission of tacit knowledge, (b) simplifies coordination, and (c) avoids potential conflicts (Borgatti and Foster, 2003). Therefore, the faith a trustor places in an environment that enables relationship with similar individuals is likely to be high; that is, users are more likely to trust an online patient community that enables a relationship with similar individuals through the display of more personal information (e.g., race, gender, etc.). Corroborating this, we find that users tend to share intimate details (e.g., mental health issues/behaviors, sexual orientation) in online patient communities (such as *PatientsLikeMe.com*) with similar individuals.

Despite being spatially distant from others, some users are able to relate with others (Hamburger et al. 2013) who are socially similar to them (i.e., social proximity) in exchanges, which thus promotes more of a sense of belonging (Davis 2012) and trust than they would have had in the offline world. This social proximity with others comes as a result of construal of others at lower levels (i.e., subordinate features such as race), thereby considering others as their friends (Hamburger et al. 2013), which thus leads to self-disclosures (Rubin and Shenker 1978) and greater participation. Therefore, we hypothesize that:

H1a: The more socially proximal the user feels with the sociodemographic of other users of a given OPC, the more trust the user will have in the system.

Parks and Floyd (1996) concluded that socio-demographic characteristics have a relatively weaker influence on the socializing behavior of users in virtual communities. Disease-related factors, such as the type of cancer or the stage of disease, might also influence the

establishment of virtual relationships (Marco et al. 2008). People often turn to online patient communities (or virtual communities) for emotional and social support (Eysenbach 2008). The social support received from virtual communities about an illness (such as breast cancer), in turn, positively influence coping and post-adaptation behaviors (Marco et al. 2008). Virtual relationships are, therefore, established for reasons beyond informational support (Marco et al. 2008). The perceived social companionship support in online patient communities is more likely improve a user's confidence in the virtual community (Marco et al. 2008). Therefore, we hypothesize that:

H1b: ***The more socially proximal the user feels with other users' health-related condition in a given OPC, the more trust the user will have in the community.***

Temporal proximity and trust in online patient communities

Temporal distance from an object changes the way people mentally represent such objects, and when associated with an outcome, can affect judgement and choice with respect to the outcome (Van Lange et al. 2011). Many studies across disciplines have looked at how people make choices for their immediate future versus their distant future, and their findings include: time discounting, delay of gratification, shifts in level of aspiration, future planning, future optimism, overconfident prediction, regret, hindsight bias, and biased autographical memory (Van Lange et al. 2011). Planning fallacy (the tendency to overcommit oneself when making plans for the future) and time discounting (the tendency to attach greater value to immediate outcomes than delayed outcomes) are two phenomena that have been explained using CLT (Van Lange et al. 2011).

When planning, desirability concerns (the end state or "why" aspect of actions) are superordinate aspects of actions, while feasibility concerns (the means or "how" aspect of actions) are the subordinate aspects of actions (Van Lange et al. 2011). CLT predicts that

desirability concerns outweigh feasibility concerns as psychological distance increases (Van Lange et al. 2011). Therefore, when making future decisions, activities are represented in terms of their desirability aspects, however, when decisions are made in the near future, feasibility aspects becomes more prominent (Van Lange et al. 2011).

Temporally proximal behavior is a behavior that has just occurred or is just about to occur (Sheppard et al. 1996), such as workouts to reduce weight or quitting smoking. Prior research suggests that individuals are likely to abandon or even become pessimistic about their optimistic estimates on an end goal (or outcome) in the face of temporal proximity of self-relevant feedback (Sheppard et al. 1996). However, through the presentation of self-relevant feedback that make feasibility aspects more prominent (e.g., mystats in QuitNet or a cravings diary in Stop Smoking Center), OPC can aid with the temporal transition from optimism to accuracy in outcome predictions (i.e., goal set by the user). In the process, users are more likely to develop trust in the IT artifact's ability to help them achieve their goal, which can lead them to be involved more with the artifact. Therefore, we hypothesize that:

H2a: The more temporally proximal a user perceives goal attainment using the given OPC, the more trust the user will have in the system.

Festinger (1950, 1954), in his theory of social comparison, suggested that people affiliate with others because they are excellent sources of information about social reality. When people find themselves in ambiguous situations within a social context, and conventional sources of information do not provide enough information to erase their doubts and apprehensions, they join with other people to compare their personal viewpoint to those expressed by others to determine if they are "correct," "valid," or "proper" (Forsyth, 2000). In OPC, some users opt for using medical interventions (e.g. Chantix, e-cigarette) to break a bad habit such as smoking. However,

these users often turn to forums to get first-hand quality information from users in similar situations about the effectiveness, as well as the side effects of the various medical treatment options available in the market. Encouraging discussions in forums about medical options can improve the confidence in adopting that option as a potential solution. On the contrary, discouraging discussions in the forums about a medical option can reduce the confidence in adopting that option as a potential solution. The quality of information in a given OPC, when jointly synthesized by a user, can influence the selection of the best option available to them (Mpinganjira 2018).

Discouraging recommendations in communities (or forums) within OPC about a given solution could result in the transition from optimistic to pessimistic estimates of the end goal. That is, the community recommendations can be said to be subordinately influence a user's perception of goal attainment with a given solution. It can also influence the trust s/he places in the community as the recommendations fail to erase any doubts and apprehensions the user has. Hence, we hypothesize that:

H2b: The less temporally proximal a user perceives goal attainment based on the recommendations within a given OPC, the less trust the user will have in the community.

The tendency to construe distant actions in terms of their high-level construal (superordinate aspects) rather than low-level construal (subordinate features) also applies to time discounting; however, when the value associated with low-level construal is more positive than that of high-level construal, time delay will discount the attractiveness of the option (Van Lange et al. 2011). In such scenarios, the opportunity to achieve a given goal using an IT artifact seems to be a less attractive proposition. However, when the value associated with high-level construal

is more positive than that of low-level construal, time delay will augment the attractiveness of an option (Van Lange et al. 2011). In such scenarios, the opportunity to achieve a given goal using a IT artifact seems to be an attractive proposition. Prior studies have found that health maintenance habits are also associated with individual time preferences. Differences in underlying preferences for the present over the future may be a substantial barrier for people's propensity to adopt healthy lifestyles (Bradford 2010). A user's individual discount rate (i.e., the association of individuals' preferences with respect to time) may, therefore, moderate the relationship between an artifact's ability to transcend temporal distance and the user's trust in achieving the given objective. In the presence of feasibility information in IT artifacts, higher rates of discounting (i.e. stronger preferences for the present over the future) for an individual will lead him/her to more strongly engage in unhealthy behaviors relative to a person with lower rates of discounting because the present option of consumption is more appealing to them (Bradford 2010). Hence, we hypothesize that:

> ***H2c: The influence of temporal proximity on trust in system and community is moderated by a user's discount rate such that the trust a user has in a given OPC will be higher with a lower user discount rate. When a user's discount rate is high, the trust the user has in the same OPC will be lower.***

Spatial proximity and trust in online patient communities

The hypothesized relationship between psychological distance and abstraction may be a result of the association that exists between direct experience and event/object information (Van Lange et al. 2011). When something occurs "here and now" (or is in our immediate vicinity), we tend to have a lot of information about it, and thus, we think of it in concrete, low-level terms that make use of the rich and contextualized detail that is available (Van Lange et al. 2011). Typically, as an event (or object) is further removed from direct experience (i.e., is more distant),

we have less available and reliable information about it, which leads to the formation of a more abstract and schematic representation of the event (or object) (Van Lange et al. 2011).

Although the internet allows communication and sharing across geographic and temporal boundaries, previous studies suggest that many friendships are formed based on the degree of propinquity (Hamburger et al. 2013; McPherson et al. 2001). In online settings, younger adults tend to befriend and socialize with others within the same state (Mazur and Richards 2011). When connecting with individuals in the same state, these individuals can transcend any psychological distance (due to space) that exists between them and others. This arises mainly because the person has more concrete (low-level) information about local conditions. For example, Aral and Nicolaides (2017) found a strong correlation between weather (i.e. temperature and precipitation) and influence of peers on running behavior. Thus, the peer effect for health-related activities are influenced by more local factors than previously thought.

Geographic proximity in social networks is important for relational development (Baym and Ledbetter 2009), and self-disclosures plays a central role in development and maintenance of any form of relationships (Collins and Miller 1994). The presence of geographic propinquity-related information in a given OPC is likely to influence an individual's confidence in the artifact. The user may perceive the artifact as being competent in enabling secure and reliable connections with other individuals located at the same place when geographic propinquity-related information is provided in the artifact, thereby improving the trust an individual has in that artifact. Therefore, we hypothesize that:

H3: The more spatially proximate the user feels with other users in a given OPC, the more trust the user will have in the system and the community.

Hypothetical distance and trust in online patient communities

The basic premise of CLT is that the more psychologically distant an event is, the more it will be represented at higher levels of abstraction (Van Lange et al. 2011). Typically, the more removed we are from an event, the less available and reliable information we will have about it, which thus leads to the formation of a more abstract and schematic representation of the event (Van Lange et al. 2011). When something occurs closer to us, we tend to have more information about it, and therefore, think of it in concrete, low-level terms that make use of the rich and contextualized detail that is available (Van Lange et al. 2011).

An event is, in some manner, psychologically distant, whenever it is not part of one's direct experience (Trope et al. 2007). Events can be said to be more psychologically distant as they happen to people less and less like oneself, or occur in a setting that is removed from one's environment (Van Lange et al. 2011). Therefore, the greater the hypothetical distance from an event, the more distant it appears and the more abstractly we would expect it to be represented (Van Lange et al. 2011). For example, a data breach in a company we are not associated with (e.g., a cyber-attack in Deloitte) can be viewed as a distant event, while a data breach in a company we are associated with (e.g., a cybersecurity incident at Equifax or Anthem Healthcare) can be viewed as a closer event. For users of online patient communities, the occurrence of unpleasant events (e.g., cyber-attacks or cyber security incidents) in an environment that is removed from them can affect the trust the user places in the OPC. When the unpleasant event (e.g., a data breach) strikes closer to home (i.e., a close relative or even in another IT artifact used by the user), a user is more likely to view the event in concrete (low-level) terms, and, hence, place less trust in the IT artifact being evaluated. In such situations, they will be less willing to disclose sensitive information online.

Similarly, unpleasant experiences in another IT artifact can influence a user's perception of a given OPC. For example, an obese user experiences shaming or embarrassing comments after posting a picture of himself/herself on Facebook. The harsh response received can raise his/her psychological barrier with sharing personal information on the internet. When an unpleasant experience (e.g. shaming in Facebook) strikes closer to home (i.e., it occurs to self in another IT artifact), a user is more likely to view the experience in concrete (low-level) terms and hence, place less trust in the community that exists within any other IT artifact being evaluated. In such situations, they will be less willing to disclose sensitive information in other online groups or communities. Therefore, we hypothesize that:

H4a: ***The more hypothetically proximate the user perceives the occurrence of certain unpleasant events (such as a data breach or cyberbullying) in a given OPC, the less trust the user has in the system and the community.***

When people think of future episodes, their distance coordinates in time, probability of episode occurrence, space, and personal relationships are positively correlated (Fiedler et al. 2012). In fact, prior research has found that inducing high (or low) distance in one dimension can prime high (or low) distance in the other dimensions, thereby influencing judgement and decision-making. For example, a person experiencing unpleasant events in the recent past is less likely to trust the system than if he/she had experienced the unpleasant event long time ago. Therefore, we hypothesize that:

H4b: ***The more recently a user experienced an event similar to a hypothetical event (such as data breach or cyberbullying), the stronger will be the influence of hypothetical proximity on the trust the user has in the system and the community.***

Association between the psychological distance dimensions and trust in an artifact

CLT posits that differential knowledge about proximal and distant objects (or events) may be the origin of the association between psychological proximity and low construal level, as well as between psychological remoteness and high construal level (Bar-Anan et al. 2006). Bar-Anan et al. (2006) notes that the different dimensions of psychological distance are not identical in every aspect. That is, in the case of temporal distance, the distant future is usually evaluated as more positive than the near future, while in the case of spatial distance, distant people are usually evaluated as more negative than closer people (Bar-Anan et al. 2006). However, the authors suggest that the different dimensions of psychological distance dimensions (spatial distance, temporal distance, social distance, and hypothetical distance) are associated as they share one basic psychological meaning; namely, distance from the same starting point of one's own direct experience (Bar-Anan et al. 2006). In addition, all the distance dimensions share the same fundamental relationship with construal levels (Zhang and Wang 2009).

Recent research examined the interactive effect of temporal and spatial distance on consumer evaluations and found that each distance had a boosting effect on the other distance (Huang et al. 2016). Temporal and spatial distance, when experienced in tandem, would also boost construal levels (Huang et al. 2016). However, the authors suggest that future research should examine if "the effect of distance always receives a boost from another distance." Zhang and Wang (2009) note that a distal prime along the spatial dimension leads to a greater perceived distance along the other three dimensions, but not the other way around. Hence, our study seeks to understand the effect of multiple dimensions on trust by considering spatial distance as one of the distance components.

It is possible that people can experience multiple dimensions of psychological distance at the same time (Huang et al. 2016). A person who is spatially proximate with other users in an

OPC might also be hypothetically proximal to the occurrence of an unpleasant event. For example, a data breach in Deloitte might have occurred at a place farther away from the user's location, but the user or one of his/her close friend or acquaintance might have been impacted as part of the data breach. Despite the presence of other users from the same geographic location, his/her trust in OPC is likely to be reduced because of the direct experience with a data breach. Therefore, we hypothesize that:

H5a: ***The more spatially proximal the user feels with other users of a given OPC, and the less hypothetically proximal the user perceives the occurrence of a certain event in the system and the community, the more trust the user has in the OPC than they would have with only spatially proximate or hypothetically distant conditions.***

Similarly, cues of distance from events on one dimension may affect the perceived distance from those events along other dimensions. Zhang and Wang (2009) suggest that distal prime along the spatial dimension leads to a greater perceived distance along the other three dimensions, but not the other way around. This is because people understand temporal, social, and hypothetical distance in terms of spatial distance. Symmetric priming effects should, therefore, occur when similarities between the spatial dimension and other dimensions exist, which thus leads to distance boosting effects (Huang et al. 2016). Hence, we hypothesize that:

H5b: ***The more spatially and socially proximal the user feels with other users of a given OPC, the more trust the user will have in the system and the community than they would have with only socially proximate or spatially proximate conditions.***

Whereas spatial distance reduces positivity (i.e., distant people are usually evaluated more negatively than closer people) (Bar-Anan et al. 2006), temporal distance typically enhances positivity (people are more positive about the more distant future) (Liberman et al. 2007). However, Huang et al. (2016) found evidence of a distance boosting effect when spatial distance

and temporal distance jointly amplified an individual's high-level construal, thereby increasing the effect on evaluation. Extrapolating this finding to the context of trust in OPC, we hypothesize that:

> ***H5c: The more spatially proximal the user feels with other users of a given OPC and the more temporally proximal the user feels by achieving his/her goal using a given OPC, the more trust the user will have in the system and the community than they would have with only spatially proximate or temporally proximate conditions.***

Trust in online patient communities and intent to participate

Trust has been identified as "an important lubricant of a social system" (Arrow 1974, p. 23). Prior research suggests that trust plays a crucial role in the establishment and sustenance of exchange-based relationships (Vannesta et al. 2014). Trust is a psychological step taken by a party based on the perceived ability, integrity, and benevolence of the other party to rule out any undesirable opportunistic behavior in the face of uncertainty in the environment (Gefen et al. 2003; Rousseau et al 1998). Norms of reciprocity that is influenced by trust (Kankanhalli et al. 2005) are often essential to sustaining online communities (Faraj et al. 2015; Wasko et al. 2005). Along with anticipated extrinsic rewards and sense of self-worth, anticipated reciprocity has been found to influence attitude towards knowledge sharing (Bock et al. 2005). In addition, Ridings et al. (2002) reported that the trust in members is significantly linked to the motivation to participate in the conversation in virtual communities. Chiu et al. (2006) indicate that trust in members is associated with quality of knowledge sharing.

Institutional structures and norms within a setting provide a sense of security that may encourage one's confidence in another party's trustworthy behavior and goodwill (Hsu et al. 2011). Trust in system has been found to be a significant antecedent of use of an IT system due to the social complexity of online interactions (Hsu et al. 2011; Gefen et al. 2003, Pavlov et al.

2008). Gefen et al. (2003) suggest that higher levels of trust in an IT artifact (e.g. ecommerce portal) will positively impact the intent to use the artifact; therefore, in an online patient community setting, we hypothesize that

H6: Trust in the system and the community will positively impact attitude towards knowledge sharing and the intent to use the given OPC.

Research Methodology

We conducted experiments using a randomized experimental design with primes to induce high or low mental construal levels. We followed up each experiment by asking questions to evaluate both trust in system and intent to participate. Our primes were designed to ensure that the high (or low) level construal would occur for social, spatial, temporal, and hypothetical scenarios (see Appendix C). We adapted scales from prior literature to measure trust in OPC and intent to participate (see Appendix B).

We collected the data via Amazon Mechanical Turk (AMT). One of the main advantages of using the AMT population is that it improves the generalizability of inferences, while there are also several other advantages as compared to traditional data collection methods (Buhrmester et al. 2011; Lowry et al. 2016; Peer et al. 2014). IS scholars are increasingly adopting AMT to study the effects of IT design features (e.g., identifiability, social presence awareness, timing of warning messages, connecting individual through network ties, providing reputation signals, etc.) on cyberbullying behaviors or task performance (e.g., Havakhor et al. 2018; Lowry et al. 2017; Jenkins et al. 2016). Our study is similar to these studies as our aim was to understand the effects of the various information elements embedded in an IT artifact design on trust and behavioral intent; hence, the use of AMT seems appropriate. The AMT workers would receive a small monetary reward for participation.

Procedure

We chose the *PatientsLikeMe.com* (OPC) website to identify realistic intentions and behavior. Appendix A (Table A1) depicts the sequence of tasks involved in the experiment and Appendix A (Table A3) presents the entire experimental design. At the beginning, participants were asked to provide some personal details and health-related information. A randomized experiment design was adopted for the experiments with 2 levels for each of the proximity dimensions (i.e., space, temporal, social, and hypothetical). Half of the participants were procedurally primed to use high-level construal by viewing screenshots of the *PatientsLikeMe.com* webpage (or news articles in the case of hypothetical proximity) that induces abstract thinking (i.e., superordinate features) using appropriate primes (see section on priming). The others were procedurally primed to use low-level construal by viewing screenshots of the *PatientsLikeMe.com* webpage (or news article in case of hypothetical proximity) that induce detailed thinking (i.e., subordinate features). A control group was also added to the design to validate if the primes were working as expected. The participants in all groups were asked to judge the trust worthiness of the online patient community like *PatientsLikeMe.com* and their intent to join and participate in these communities. They responded to four scales adapted from prior literature: trust in system (Kim et al. 2016; Anderson and Agarwal 2011); trust in community (Veenstra 2000); intent to use the system (Kim et al. 2016); and attitude towards knowledge sharing (Bock et al. 2005) (See Appendix B Table B1). Next, participants were asked proximity assessment questions as a manipulation check to identify their construal level (see Appendix A Table A2). This was essential to ensure that the primes worked by inducing the appropriate construal level. Finally, the participants were debriefed.

Priming

The participants were given external stimuli to trigger high or low mental construal levels on each dimension (i.e., spatial, social, temporal, and hypothetical). The participants were provided with a screenshot of the statistics on an online patient community for the spatial, temporal, and social dimensions (see Appendix C). This approach is similar to Liberman et al's (2012) approach of using pictorial primes for studying influence of spatial distance on children's creativity. A randomized experiment design was adopted for the experiments, with two levels for each of the proximity dimensions (i.e., space, temporal, and social). Participants in the spatially proximal condition would see approx. two times more users from a given country (i.e., United States) than those in spatially distal condition. Participants in the socially proximal condition would see a greater number of users of their own race and gender (or medical condition) than those in the socially distal condition. Participants in the temporally proximal condition would see feasibility statistics relevant to them (i.e., physical exercise statistics related to daily exercising) than those in the distal condition. For the hypothetical scenario, participants were shown news articles about data breaches at either Deloitte (a consulting firm) or Anthem (a health insurance service provider) (see Appendix C). Participants in the hypothetical proximal condition viewed the Anthem breach article, while those in the distal condition viewed the Deloitte data breach article. To measure the combined effect of multiple dimensions (i.e., spatial and social proximities as well as temporal and social proximities), we showed the participants combined screenshots of each of the dimensions assessed. For example, the participants were shown the geographic statistics and Deloitte data breach article for inducing spatially proximal and hypothetically distal conditions.

Sample Characteristics

We restricted the sample to AMT workers who had obesity, diabetes, or both since the objective of the study was to examine the influence of proximity dimensions on the evaluation of an online health infomediary (i.e., *PatientsLikeMe.com*). A total of 2050 AMT workers participated in the experiments. The participants were asked an attention check question designed to reflect very low difficulty such that answering incorrectly would reflect negligence by the participant. A total of 401 participants failed the attention check question. In addition, a total of 455 participants failed to complete the survey. These responses were excluded from further analysis. A total of 1194 usable responses were used for analysis after excluding those who failed the attention check, as well as those who did not complete the survey. The demographic statistics of our sample are presented in Table 1.

Table 1: Sample Descriptive Statistics (N=1194)

	n	Percent		n	Percent		n	Percent
Country			**Race**			**Medical Condition**		
U.S.	914	*76.8%*	White	752	*63.1%*	Diabetes	303	*25.4%*
Non-US	276	*23.2%*	American Indian or Alaska Native	34	*2.9%*	Obesity	752	*63.0%*
			Asian	233	*19.5%*	Both	139	*11.6%*
			Black or African American	131	*11.0%*			
Gender			Native Hawaiian or Pacific Islander	3	*0.3%*	**Physical Fitness Frequency**		
Female	625	*52.6%*	Other	39	*3.3%*	Daily	241	*26.6%*
Male	564	*47.4%*				4-6 times a week	229	*25.3%*
			Military Status			2-3 times a week	296	*32.7%*
			Currently serving	106	*9.0%*	Once a week	111	*12.3%*
Age			Previously served	271	*23.0%*	Never	18	*2.0%*
Under 18	2	*0.2%*	Not served	801	*68.0%*	Other	11	*1.2%*
18 - 24	189	*15.9%*						
25 - 34	546	*46.0%*	**Smoking Status**			**Exercising Duration**		
35 - 44	275	*23.2%*	Non-smoker	814	*68.2%*	6 months - 1 year	231	*19.7%*
45 - 54	96	*8.1%*	Smoker	379	*31.8%*	1 - 2 years	163	*13.9%*
55 - 64	58	*4.9%*				1 - 6 months	509	*43.3%*
65 - 74	18	*1.5%*				10 years or more	102	*8.7%*
75 - 84	3	*0.3%*				2 - 5 years	106	*9.0%*
						5 - 10 years	64	*5.4%*

Manipulation Check

First, we assessed whether the manipulation was successful. Participants were asked to rate questions related to each propinquity dimension. For example, to assess spatial proximity, participants were asked to rate "*How far is United States is from you*?" (*1 very close … 7 very far*) (see Appendix A Table A2 for the entire list). The mean scores were computed (see Table 2). A t-test indicated a significant mean difference between the high construal and low construal conditions, indicating that the manipulation was successful (see Table 2).

Table 2: Mean score and t-test for induced proximity conditions

Experimental Condition	Construal Level	N	Mean	SD	t-test
Spatial proximity	Proximal (low)	63	4.78	1.10	t=3.19 p<0.01
	Distal (high)	18	4.16	1.68	
Social proximity (Race and Gender)	Proximal (low)	36	5.8	2.92	t=-0.45n/s
	Distal (high)	34	6.26	1.94	
Social proximity (Medical Condition)	Proximal (low)	57	5.7	2.4	t=1.42n/s
	Distal (high)	24	5.83	1.9	
Temporal proximity	Proximal (low)	24	4.5	0.722	t=2.84 p<0.01
	Distal (high)	47	4	1	
Hypothetical proximity	Proximal (low)	42	3.57	0.73	t=4.91 p<0.001
	Distal (high)	31	2.9	1.25	
Spatial & Social proximity	Proximal (low)	24	4.58	0.565	t=6.96 p<0.001
	Distal (high)	49	3.15	1.13	
Spatial & Temporal proximity	Proximal (low)	15	4.67	0.408	t=3.56 p<0.001
	Distal (high)	51	4.08	0.796	
Spatial proximity & Hypothetical distance	Proximal (low-low)	62	2.6	0883	
	Proximal-Distal (low-high)	33	4.12	0.613	t=4.21 p< 0.001
	Distal-Distal (high-high)	16	3.12	0.922	

n/s non-significant

Results

Partial Least Squares Analyses

Partial Least Squares (PLS) analysis using WarpPLS was used to validate the psychometric properties of our measures and to test the paths hypothesized in Figure 2. We chose PLS because it permits the modeling of latent variables and the simultaneous assessment

of the measurement and structural models while placing minimal demands on sample size and distributional assumptions (Chin 1998; Hair et al. 2013). Additionally, we chose PLS to accommodate the moderating relationships in our research model. We first examined the psychometric properties of our measures through the measurement model and then tested our hypotheses through the structural model.

Measurement Model

Our main predictors are the proximity-related dimensions. Each dimension was dummy coded (high level = 1 and low level = 0). The trust in system, trust in community, intent to use artifact, and attitude towards knowledge sharing variables were measured based on items adapted from prior literature (see Appendix B) with a 7-point Likert scale and a mean score was computed. For constructs that were assessed using multiple items, exploratory factor analysis (EFA) with maximum likelihood extraction and varimax rotation was conducted to verify convergent and discriminant validity along with reliability tests.

We examined standardized loadings to assess the convergent validity of our reflective constructs. To ensure that the variance between each item and the associated construct exceeds the error variance, it is suggested that the standardized loadings (shown in Appendix D) should exceed 0.707 (Chin 1998). However, it is still acceptable for a measure to have a loading of 0.6 or higher if all other measures associated to the same construct have high loadings (Chin 1998).

In order to assess the internal consistency of our measures for each construct, we examined Cronbach's alpha, composite reliability, and average variance extracted for each construct. For Cronbach's alpha and composite reliability, it is suggested that values of 0.7 or higher are adequate (Nunnally 1994). All Cronbach's α are well above the .70 threshold (see Appendix D). With regard to AVE, Fornell and Larcker (1981) suggest that values should exceed

0.50 to ensure that more variance is captured by the measures relative to measurement error. AVEs for all constructs were above the recommended 0.5 threshold. Given the assessment of convergent validity, all measures were retained for subsequent analysis.

To assess discriminant validity, we first examined the item loadings and cross-loadings on each construct. All measures had higher loadings for the intended construct than other constructs, providing there was evidence of discriminant validity (see Appendix D). Additionally, we calculated the squared correlation of all construct pairs and compared it with the AVE of each construct to ensure that more variance associated with each construct is captured by its indicators, rather than the indicators of other constructs (Fornell and Larcker 1981). The AVE for each construct exceeded the squared correlation of all construct pairs, thus providing further evidence of discriminant validity (see Appendix D).

The results show strong support for convergent and discriminant validity. Based on the assessment of convergent and discriminant validity, we concluded that the measurement model was sufficiently robust to allow us to proceed to evaluation of the structural model.

Common Method Bias Analyses

Because trust in system, trust in community, intent to use artifact, and attitude towards knowledge sharing were obtained using the same experimental instrument, we conducted a separate test to examine common method bias in our data. The test we conducted was Harmon's single factor test (Podsakoff et al. 2003), which involved an exploratory factor analysis with all items used to measure the main variables in our study. The propinquity-related constructs (i.e., social proximity, spatial proximity, temporal proximity, and hypothetical proximity) are not susceptible to common method bias because they were experimentally manipulated in this study. Therefore, the propinquity-related constructs were excluded from the tests of common method

bias. The unrotated factor solution produced four factors with eigenvalues greater than 1, and with a total of 77.5% (spatial condition); 78.1% (social condition); 78.1% (temporal condition); and 81.7% (hypothetical condition) of the variance accounted for. The first extracted factor accounted for 23.5% (spatial condition); 23.9% (social condition); 26.3% (temporal condition); and 26.5% (hypothetical condition) of the variance in the data. These results suggest that common method bias is unlikely to be a significant problem in our data given that more than one factor emerged from the factor analysis, as well as the fact that the first factor did not account for the majority of the variance in our data.

Structural Model

To test H1-H4, we assessed the structural model by examining the path coefficients and their significance levels. First, we computed the path coefficients using the samples for the single proximity conditions. Next, to obtain the significance associated with each path, we applied the bootstrapping method with 999 resamples (results shown in Figure 3). The path coefficients, standard error, and effect size are provided in Table 3. As seen in Table 3, spatial proximity influenced both trust in community and trust in system, thereby providing marginal support for H3. Individuals who perceived closeness with the community spatially were more willing to trust the system and the community. Social proximity was not observed to influence trust in community and trust in system, thereby providing no support for H1a and H1b. The insignificant results can be attributed to the inability of the primes to induce high vs. low construal. Temporal proximity was observed to negatively influence trust in the community, thereby providing support for H2b. Individuals who saw discouraging statistics with respect to daily exercising were less willing to trust the community. On the contrary, the influence of temporal proximity on trust in system was not significant. Hence, no support was observed for H2a. Hypothetical

proximity was observed to reduce trust in community, thereby providing partial support for H4a. Individuals who perceived more risk with using the OPC were less willing to trust the community.

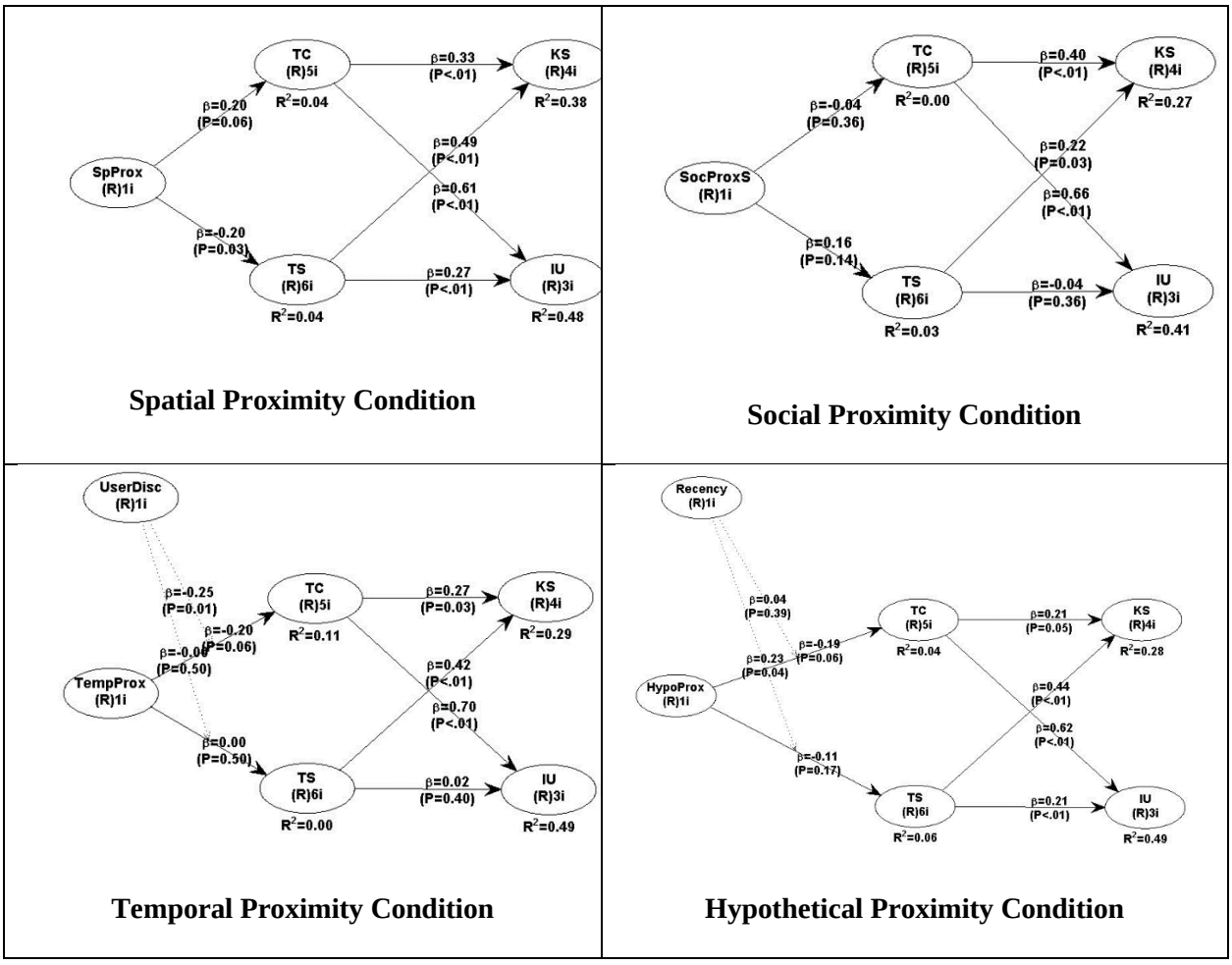


Figure 3: Bootstrapped path estimates (influence of single proximity dimension)

Table 3: Bootstrapped Path Estimates and Effect Size (Single Dimension)

	Spatial alone		Social alone		Temporal alone		Hypothetical alone	
	Std. Estimate	Effect Size	Std. Estimate	Effect Size	Std. Estimate	Effect Size	Std. Estimate	Effect Size
Proximity --> TC	0.2 † (0.125)	0.039	-0.04 n/s (0.125)	0.002	-0.20 † (0.132)	0.043	-0.19 †[a] (0.117)	0.034
Proximity --> TS	-0.20 ** (0.102)	0.04	0.16 n/s (0.148)	0.026	0 n/s (0.120)	0	-0.11 n/s [a] (0.120)	0.013
TC --> KS	0.33 * (0.085)	0.125	0.40 * (0.167)	0.189	0.27 ** (0.140)	0.09	0.21 † (0.124)	0.063
TC --> IU	0.61 * (0.083)	0.385	0.66 * (0.097)	0.421	0.70 * (0.093)	0.488	0.62 * (0.086)	0.42
TS --> KS	0.49 * (0.087)	0.253	0.22 ** (0.118)	0.079	0.42 * (0.132)	0.196	0.44 * (0.096)	0.213
TS --> IU	0.27 * (0.090)	0.091	0.04 n/s (0.115)	0.007	0.02 n/s (0.085)	0.003	0.21 * (0.086)	0.074
User discount rate * Proximity --> TC					-0.25** (0.110)	0.065		
User discount rate * Proximity --> TS					0 n/s (0.104)	0		
Proximity * BreachRecency --> TC							0.04 n/s (0.150)	0.002
Proximity * BreachRecency --> TS							0.023 n/s (0.123)	0.051
Average R-squared (ARS)	0.234		0.178		0.221		0.217	
Average adjusted R-squared (AARS)	0.220		0.155		0.199		0.195	

* p<0.01; ** p<0.05; † p<0.10; n/s non-significant; standard errors reported in brackets;
[a] sign reverses for hypothetical distance

H2c concerned the moderating role of user discount rate on the relationship between temporal proximity and trust in community/system. We found that the interaction term between user discount rate and trust in community was significant, thus providing partial support for H2b. Figure 4 illustrates the moderating effects of user discount rate on the relationship between temporal proximity and trust in community. Following the approach suggested by Aiken and West (1991), we tested whether the simple slopes differed from zero. The results (as shown in Table 4) indicated that the user's discount rate significantly influenced the negative relationship between temporal proximity and trust in community. The findings suggest that when the user's discount rate is high (i.e., s/he prefers present consumption), a higher effect of temporal proximity on trust in community will be observed. In other words, temporal proximity is more

influential on the user's trust in community when preference for present consumption increases. Finally, H4b concerned the moderating role of recency of similar events on the relationship between hypothetical distance and trust in community/system. The interaction effect was insignificant, thereby providing no support for H4b.

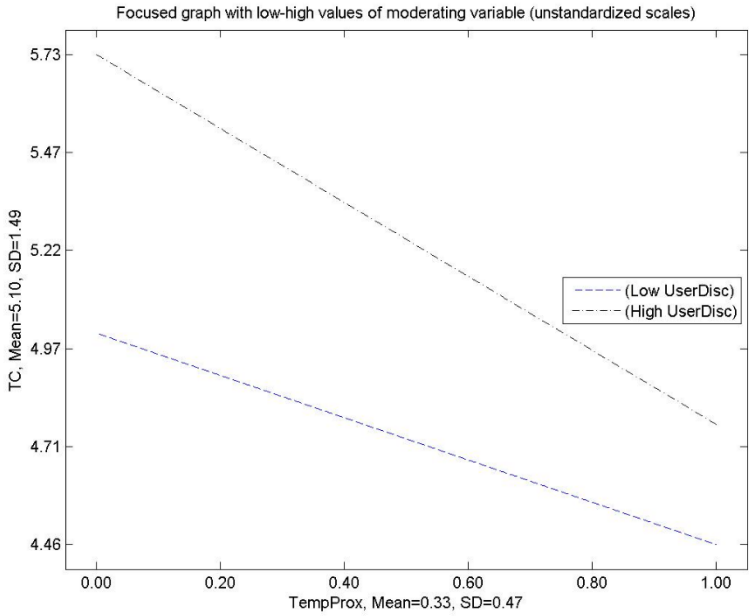


Figure 4: Interaction plot showing the moderating effect of user discount rate on the relationship between temporal proximity and trust in community

Table 4: CI test for Moderation

Interaction	**95% Confidence Interval**		**Zero included?**	**Support?**
	Lower	**Upper**		
User discount rate * Proximity --> TC	-0.466	-0.034	No	Yes

To test H5a-c, we assessed the structural model by examining the path coefficients and their significance levels. First, we computed the path coefficients using the samples for the multiple proximity conditions. Next, to obtain the significance associated with each path, we applied the bootstrapping method with 999 resamples (results shown in Figure 5). The path coefficients, standard error, and effect size are provided in Table 5. As seen in Table 5, the

influence of temporal proximity on trust in community became insignificant when spatial proximity was included. On the contrary, trust in system became significant such that users where more willing to trust the system. When acting alone, spatial proximity influenced trust in system negatively, but when combined with temporal proximity, the trust in system was positively influenced. Hence, we observed partial support for H5c. Individuals who perceived spatial and temporal closeness were more willing to trust the system.

Table 5: Path Estimates and Effect Size (Multiple Dimensions)

	With Social Proximity		With Temporal Proximity		With Hypothetical Distance	
	Std. Estimate	Effect Size	Std. Estimate	Effect Size	Std. Estimate	Effect Size
Spatial Proximity --> TC	0.06 n/s (0.115)	0.004	-0.01 n/s (0.180)	0	0.32 * (0.110)	0.106
Spatial Proximity --> TS	-0.02 n/s (0.120)	0	0.23 ** (0.130)	0.052	-0.12 n/s (0.151)	0.016
TC --> KS	0.40 * (0.113)	0.175	0.17 n/s (0.163)	0.047	0.34 ** (0.157)	0.117
TC --> IU	0.65 * (0.084)	0.432	0.70 * (0.069)	0.508	0.80 * (0.061)	0.647
TS --> KS	0.35 * (0.105)	0.145	0.43 * (0.106)	0.207	0.64 * (0.130)	0.418
TS --> IU	0.15 *** (0.092)	0.033	0.06 n/s (0.110)	0.017	0.14 *** (0.093)	0.021
User discount rate * Proximity --> TC			0.04 n/s (0.167)	0.002		
User discount rate * Proximity --> TS			0.08 n/s (0.092)	0.004		
Proximity * BreachRecency --> TC					0.21 ** (0.108)	0.046
Proximity * BreachRecency --> TS					-0.39 *** (0.236)	0.152
Average R-squared (ARS)	0.198		0.209		0.380	
Average adjusted R-squared (AARS)	0.182		0.184		0.354	
Srmr	0.116		0.115		0.115	

* p<0.01; ** p<0.05; *** p<0.10; n/s non-significant; standard errors reported in brackets

The influence of hypothetical distance on trust in community was positive in the presence of spatial proximity. The effect was higher than that observed in cases where hypothetical distance and spatial proximity acted alone, thereby providing partial support for H5a. The less a user perceives risk using the OPC and the more spatially proximate the user is with the community, the more trust s/he had in the community. This effect was, however, observed to

reduce when the user had encountered a similar unpleasant event recently (since the interaction term is significant in Table 5). The influence of hypothetical distance and spatial proximity on trust in system was insignificant. As for the combination of spatial proximity and social proximity, no significant results were observed. Hence, no support for H5b was found.

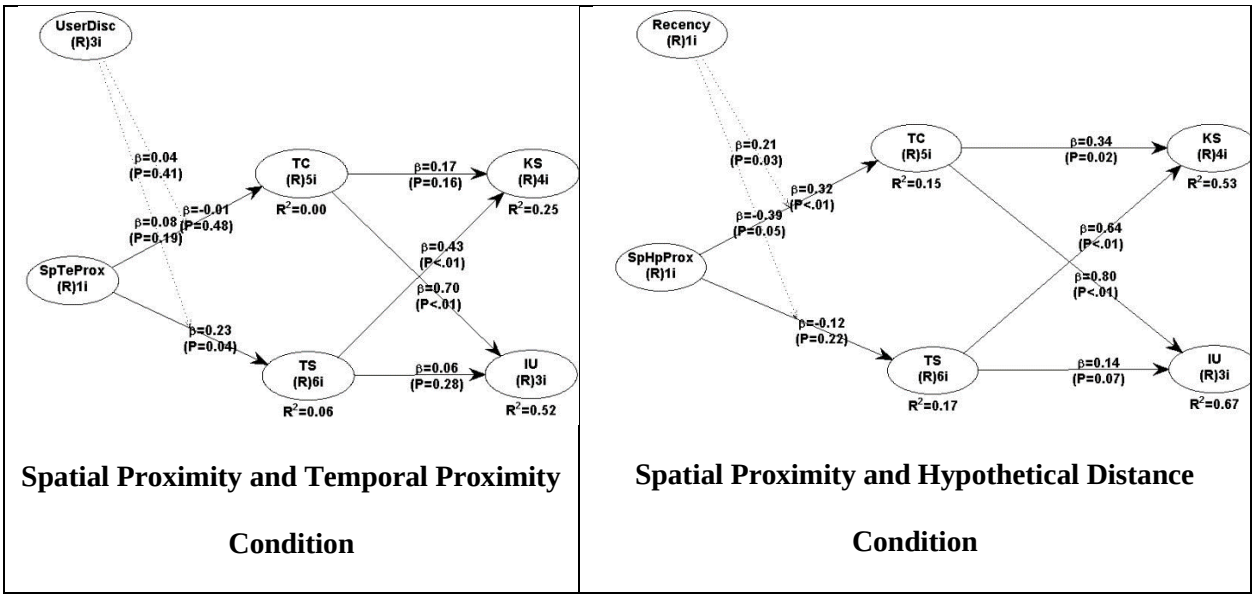


Figure 5: Bootstrapped path estimates (influence of multiple proximity dimensions)

Discussion

Having presented the results of our analysis, we now consider implications for research and for practice. We also discuss some limitations of this study and how they might also inform future research initiatives.

Implications for Research

Prior research suggests that web-based health information-seeking behavior is influenced by website design features (e.g., clear layout/design, contact details of owner, brand/logo, quality seal/endorsements, authority of owner, interactive features, etc.); information content features (e.g., perceived information quality, ease of use, readability, relevance, clarity/understandability, etc.); perceived reputation of organization hosting the website; individual's prior experience,

individual's propensity to trust; self-efficacy; and the consumer's computer skills (Sbaffi and Rowley 2017; Kim 2016; Or and Karsh 2009; Zahedi and Song 2008). However, there is evidence that various demographic variables (e.g., age, income, and gender) may influence web-based health information-seeking behaviors, but the evidence that these factors also impact a user's trust judgments is scant (Sbaffi and Rowley 2017; Or and Karsh 2009). While structural features (such as the design of a website, navigation, security, etc.) will influence the trust in web-based health information (Kim 2016), we posit that the informational proxies due to electronic propinquity (i.e., perceived closeness with an IT artifact and its content) of web-based health information systems like online patient communities (OPC) can improve trust in the community and the system in general. This, in turn, can lead to more usage, self-disclosure of sensitive information (e.g., PHI) and consumption of information within these systems. To the best of our knowledge, our study is the first to examine the influential role of electronic propinquity on a user's trust in web-based health infomediaries.

Through this study, we offer two major contributions to research: (1) we explain how informational proxies aid users by transcending the perceived risks and uncertainty to trust web-based health infomediaries (i.e., online patient groups/communities) with sensitive personal information; and (2) our study empirically validates the influence of multiple propinquity dimensions on the user's evaluation of an IT artifact.

First, we observed that trust in online patient community (a virtual community) improved when users felt psychologically close with other users within these communities. We found that information in these systems (e.g., health related statistics, geographical statistics) influenced a user's trust in OPC. Prior studies have pointed out the presence of an initial bias in trust formation before using a novel (or existent) technology, which, in turn, can influence the user's

behavior in relation-based trust situations. These studies have suggested that users are more likely to trust others who are similar to them, which could potentially explain why many users disclose personal health information to strangers in open communities such as *PatientsLikeMe.com*. Our study tries to explain this phenomenon by considering the influential role of propinquity-related factors arising from the textual content within online patient communities. In our study, we identified four objective dimensions (social, spatial, temporal, and hypothetical) that can influence a user's evaluation of a given OPC (i.e., the information system and the community within it). We find that spatial, temporal, and hypothetical-related information proxies influence a user's trust in the community more than the trust in the system. Spatial proxies, when combined with temporal proxies, however, influence trust in system more that trust in community. Temporal and hypothetical proximities influence the trust in community negatively. Hence, through this research, we explain how informational proxies associated with space, time or experience aid users by transcending the perceived risks and uncertainty to trust certain IT artifacts (i.e., online patient groups/communities) with sensitive personal information.

Second, this research contributes to the construal level theory literature by empirically validating the influence of multiple propinquity dimensions on the user's evaluation of an IT artifact. Prior research has suggested a distance boosting effect for spatial and temporal distances on outcomes (Huang et al. 2016). However, the effect of spatial and hypothetically distances on outcomes, as well as the effect of spatial and social distances on outcomes, have not been examined. Our study examines the effects in both situations. We observed a diminishing effect for the former case when a user has encountered a recent similar unpleasant event. We observed a boosting effect when a user is present with spatial and temporal proximity dimensions, thereby confirming prior research findings. Through this research, we have extended the understanding

of how multiple informational proxies aid user's with transcending the perceived risks and uncertainty to trust certain IT artifacts (i.e., online patient groups/communities) with sensitive personal information. More specifically, we found that a user is more willing to give sensitive information when spatial proximity and temporal proximity is induced. The user's willingness is also high when spatial proximity and hypothetical distance of a user is induced. However, the effect depends on the recency of when the user encountered a similar unpleasant event, such that the trust in community diminishes when the user had experienced a similar unpleasant event recently. Our findings answer Huang et al.'s (2016) call for future research to examine if "the effect of distance always receives a boost from another distance."

Implications for Practice

The findings of our study suggest several implications for online patient community users as well as organizations building these systems. The key concept for both of these entities is that of awareness of the importance of various propinquity-related factors that influences the trust and intent to adopt/use a given OPC.

Private organizations and governmental agencies often built online patient communities with the aim of enabling population outreach services (e.g., QuitNow). The success of these systems, however, lies in the adoption and use by patients. Patients have a plethora of online health infomediaries of varying quality, accuracy, and reliability (Sbaffi and Rowley 2017). This presents individuals with significant challenges in evaluating and selecting the sources to use, and more specifically, in assessing the credibility and trustworthiness of those sources (Sbaffi and Rowley 2017). Our study finds that providing informational proxies that induce psychological proximity in users can improve trust, and in turn, system adoption and use. Inducing spatial proximity can improve the trust a user has in the OPC, while inducing temporal

proximity can reduce the trust a user places in the OPC. Inducing multiple dimensions (e.g., spatial and temporal proximity) can sometimes boost the trust of a user. However, in view of the recent data breach news reports, managers, and system designers should be cognizant of the diminishing effect that can arise as a result of these reports. Therefore, designing web-based health infomediaries with information proxies that provide aid through gaining the user's trust is critical for its success, particularly in times of cyber-attacks.

OPC designs that display user statistics can obviously attract participants. However, many of the OPCs are designed and developed with a one-size-fits-all strategy. Our findings suggest that in-group biases (e.g., preference for users located in a certain places) can influence the trust a user places in a given OPC. Individuals who do not belong to the group are, therefore, less willing to trust, adopt, and use the system. Developing a universal system that caters to the needs of the diverse patient population is challenging, and, more likely, a waste of resources (e.g., cost of systems development). To build effective and efficient OPCs, practitioners need to limit the scope of the design to cater to a specific subset of the patient population. For example, practitioners can consider tailoring the message within a given OPC to address a specific group of patients (such as PTSD and veterans).

Finally, patients join OPCs to gain emotional and informational support. They are willing to be vulnerable to the risk of sharing personal health information (e.g., sexual orientation) within these OPCs. Our findings suggest that unpleasant experiences in other systems can influence their trust in the OPC. Extrapolating this finding, we believe that unpleasant experiences in the OPC can also influence the trust a user places in other systems. Users should be cognizant of the implications of sharing sensitive information within these systems, mainly because unpleasant experiences in these systems can influence their trust with using the OPC, as

well as other systems in future. On the other hand, users can derive the informational and emotional support from similar others by joining an OPC that fosters it while controlling for unwanted effects.

Limitations and Future Research

We believe that informational proxies within a system can aid users transcend any perceived risk of using the system and disclosing sensitive personal information. Inducing spatial, temporal, and hypothetical proximity influences the trust a user has in the community, while spatial alone, or when combined with temporal proximity, influence the trust of a user in the system. We were unable to empirically validate the influence of social proximity on a user's trust in OPC, mainly because the primes failed to induce high vs. low construal in the participants. We believe social proximity can positively influence the trust in community, as well as trust in system. Future research can, therefore, examine the effect of social proximity on a user's trust in OPC, as well as in other recommending systems.

Another limitation of this study is the consideration of unpleasant events for examining the influence of hypothetical proximity on trust in OPCs. Based on our findings, we suggest that unpleasant events can reduce trust. However, we call for IS researchers to examine the effect of pleasant experiences on a user's trust in OPC. A user who gains emotional and/or informational support when using social media is likely to be more optimistic about trusting and using an OPC. The influence of positive and negative experiences may, therefore, act in opposite directions resulting in a net zero effect.

Our study examines the effect of a single proximity dimension (i.e., spatial, social, temporal, or hypothetical) and multiple dimensions (i.e., spatial proximity and hypothetical distance, spatial, and temporal proximity) on trust in OPCs. We have not examined the holistic

effect created by all the four dimensions on trust in a given OPC. Future research can build on the findings of this research by examining the combined effects of all four proximity dimensions on trust in a given OPC.

Finally, we have measured trust in a given OPC using trust in community and trust in system. Our assumption lies in that these two trusts coexists simultaneously. However, it is possible for users to develop trust in a system due to its popularity, thereby leading to adoption of the system. Initially, although the user might not be an active participant in any community, based on their interaction with the system over time, they might begin to develop trust in the community that exist within the system. Trust in system can, therefore, influence the trust a user has in a community. On the contrary, a user might choose to trust and adopt a system mainly because of the community that exists within that system. In such scenarios, trust in system and trust in community may be independent of each other. Hence, future research needs to examine whether the trust in system can mediate the influence of proximity dimensions on the trust in community.

Conclusion

Prior research suggests that website design features, perceived reputation of organization hosting the website, individual's prior experience, individual's propensity to trust, self-efficacy, and consumer's computer skills can influence web-based health information-seeking behavior. Little attention has been paid to the influence of electronic propinquity in aiding users with transcending any perceived risk associated with using a given OPC. In this study, we found that information proxies within a given OPC can induce a user's psychological closeness with the OPC and, in turn, the trust s/he places in it. We hope that this study will lead to additional research in this important stream of online health infomediaries and their success.

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Appendix A

Table A1: Randomized experiment steps

1. Randomly assign participants to various groups
2. Collect demographics (e.g. race, gender, country, etc.)
3. Collect health-related information (e.g. chronic illness – obesity/diabetes, medications, etc.)
4. Introduce PatientsLikeMe website (home page, conditions page, treatment page)
5. Induce high-level construal (distal) or low-level construal (proximate) • **Social dimension:** Display user demographic statistics (e.g. race, gender) • **Spatial dimension:** Display user demographic statistics (e.g. country) • **Hypothetical dimension:** Display Anthem or Deloitte data breach report news report * • **Temporal dimension:** Display feasibility information (duration, dosage, stoppage reasons)
6. Measure trust in OPC (community vs. system)
7. Measure intention to participate in OPC
8. Assess proximity levels of participants

* Displayed before step 4

Table A2: Priming questions adapted from Zhang and Wang (2009)

Priming Dimension	**Manipulation check question**
Spatial	How far do you think United States is to you?
Temporal	How likely will you do physical exercise for 30 mins daily?
Social	How close do you think a Caucasian female Amazon Mechanical Turk (AMT) worker is to you?
Hypothetical	How likely is it for you to have being affected by Anthem's data breach?
	How likely is it for you to have being affected by Deloitte's data breach?

Table A3: Experiment Design

Group\Proximity		Social	Spatial	Temporal	Hypothetical
Control group	Social	C			
	Spatial		C		
	Temporal			C	
	Hypothetical				C
Treatment group (Single dimensions)	Social	X			
	Spatial		X		
	Temporal			X	
	Hypothetical				X
Treatment group (Multiple dimensions)	Spatial + Social	X	X		
	Spatial + Temporal		X	X	
	Spatial + Hypothetical		X		X

Appendix B

Table B1: Survey Instrument

Construct		Scale Items
Trust in OPC	**Trust in Community (TC) *** (Adapted from Veenstra 2000)	1. Most participants in online patient community can be trusted 2. Participants in online patient community seem to be willing to help if you need assistance 3. It is safe to communicate with participants in online patient communities 4. When it comes down to needing emotional support, you can always trust the people in online patient communities to provide that support 5. When it comes down to needing social support, you can always trust the people in online patient communities to provide that support
	Trust in System (TS) * (Adapted from Kim et al. 2016; Anderson and Agarwal 2011)	1. In general, I believe that this website is secure for communicating with other participants. 2. In general, the website is trustworthy. 3. In general, the website gives the impression that it will keep commitments about security and privacy. 4. The electronic/digital storage format of health information in this system presents a safe environment in which to exchange health information with others. 5. The digital storage format of this system presents a reliable environment in which to conduct health related transactions. 6. Organization in charge of this system seems to handle personal health information submitted by patients in an electronic format in a competent fashion.
Intent to participate	**Attitude towards knowledge sharing (KS) *** (Adapted from Bock et al. 2005)	1. My knowledge sharing with others in online patient communities is good for me. 2. My knowledge sharing with others in online patient communities is an enjoyable experience. 3. My knowledge sharing with others in online patient communities is valuable to me. 4. My knowledge sharing with others in online patient communities is a wise move for me.
	Intent to use artifact (IU) * (Adapted from Kim et al. 2016)	1. I will probably setup a profile and share personal conditions on online patient communities in the near future. 2. I am willing to share personal health issues online rather than offline (e.g. with friends or in a doctor's office). 3. I am likely to recommend online patient communities to my family and friends who do not know about this channel.
Individual's discount rate (UserDiscountRate)		''Suppose that you won a prize that is worth $1000 if you take it today. Or you could wait one year to claim the prize and be guaranteed to receive $1100. Would you claim the $1000 dollars today, or would you wait one year for $1100?'' (Follow-up questions were posed that asked respondents to compare $1000 today v. $1200 and $1050 in one year)
Recency of event (BreachRecency)		When was the last time you were affected by a data breach? o 1 - 6 months o 6 months - 1 year o 1 - 2 years

	○ 2 - 5 years ○ 5 - 10 years ○ 10 years or more

* Likert scale was used (*1 Strongly agree … 7 Strongly disagree*)

Appendix C

Spatial proximity primes

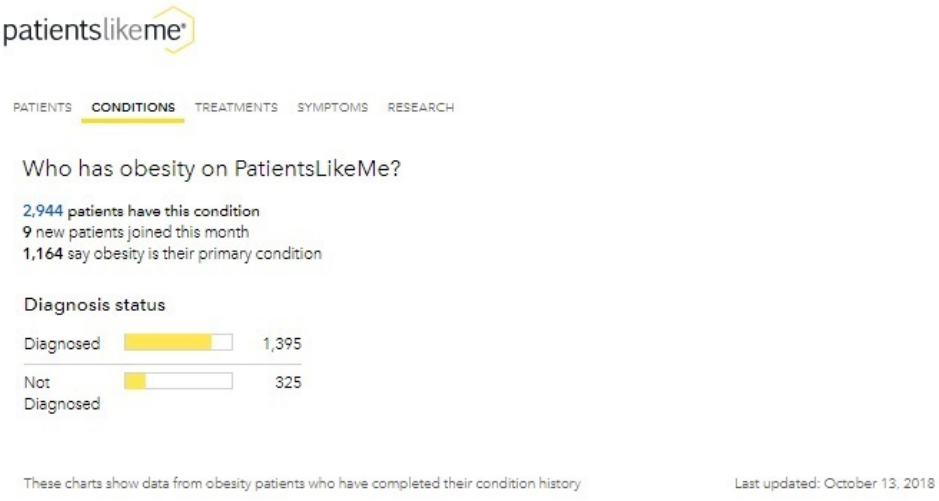
Hypothetical primes

Proximal prime

Distal prime

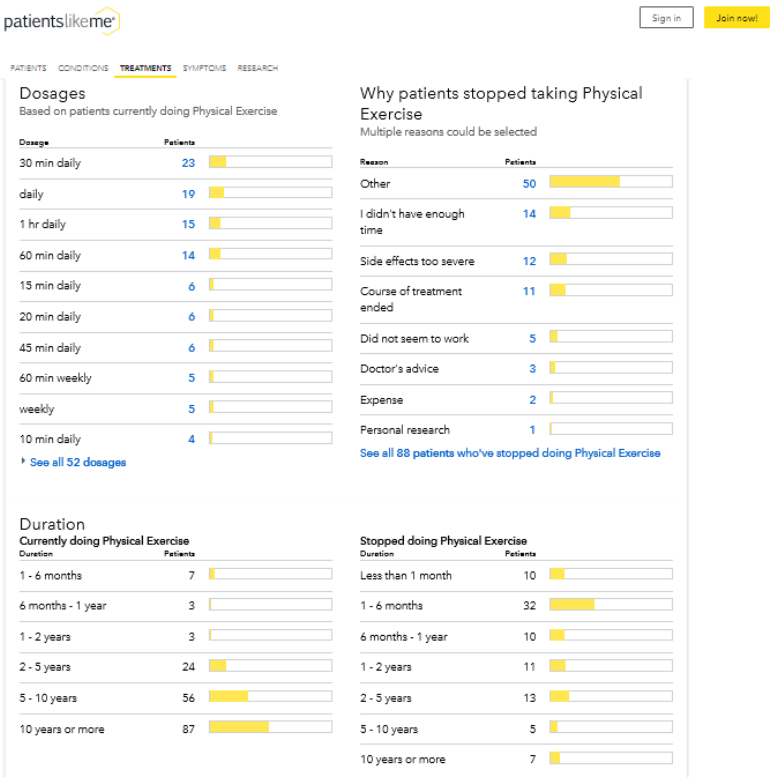
Social proximity primes

Sociodemographic prime



Medical condition prime

Temporal proximity primes



Appendix D

Spatial Measure Validation

Table D1: Item loadings and cross loadings

	Spatial Proximity	TC	TS	KS	IU
Country	**1**	0	0	0	0
TC_trusted	0.039	**0.865**	0.066	0.049	-0.008
TC_helpful	-0.091	**0.85**	-0.143	0.051	-0.044
TC_safe	0.044	**0.846**	-0.053	-0.005	0.145
TC_emotional_support	-0.073	**0.853**	0.063	-0.096	0.059
TC_social_support	0.083	**0.838**	0.067	0	-0.154
TOPC_secure	0.01	0.217	**0.766**	0.004	-0.331
TOPC_trustworthy	0.055	0.134	**0.827**	-0.006	-0.106
TOPC_keep_commitments	0.115	0.113	**0.799**	0.069	-0.115
TOPC_safe_environment	-0.02	-0.147	**0.898**	0	0.18
TOPC_reliable_environment	0.024	-0.119	**0.872**	-0.093	0.156
TOPC_competent_organization	-0.175	-0.155	**0.849**	0.034	0.16
KS_good	0.168	0.04	-0.032	**0.791**	-0.181
KS_enjoyable_experience	-0.03	0.002	-0.014	**0.779**	0.069
KS_valuable_to_me	-0.011	-0.061	-0.088	**0.864**	0.109
KS_wise_move	-0.12	0.023	0.135	**0.837**	-0.005
Intent_OPC_profile_setup	0.116	-0.084	-0.121	0.149	**0.927**
Intent_OPC_share_details	-0.124	0.111	0.079	-0.079	**0.841**
Intent_OPC_recommend_to_others	-0.003	-0.017	0.049	-0.079	**0.912**

Table D2: Correlations vs. sq. root of AVE and Cronbach alpha

	Spatial Proximity	TC	TOPC	KS	IU
Spatial Proximity	1				
TC	0.198	0.85			
TOPC	-0.2	0.104	0.836		
KS	-0.164	0.38	0.521	0.819	
IU	-0.135	0.635	0.336	0.54	0.894
Comp. reliabilities	1	0.929	0.933	0.89	0.923
Cronbach alpha	1	0.904	0.913	0.835	0.874

Social Measure Validation

Table D3: Item loadings and cross loadings

	SocProxS	TC	TS	KS	IU
Socialproximity	**1**	0	0	0	0
TC_trusted	-0.049	**0.804**	0.037	0.096	0.124
TC_helpful	-0.003	**0.848**	-0.164	0.07	-0.244
TC_safe	0.099	**0.787**	0.175	-0.194	0.393
TC_emotional_support	-0.089	**0.91**	0.025	0.07	-0.232
TC_social_support	0.051	**0.878**	-0.059	-0.054	0.009
TOPC_secure	0.184	-0.012	**0.788**	-0.181	0.169
TOPC_trustworthy	0.083	-0.231	**0.85**	-0.101	0.238
TOPC_keep_commitments	0.046	-0.073	**0.866**	-0.02	0.126
TOPC_safe_environment	-0.132	0.33	**0.876**	-0.041	-0.177
TOPC_reliable_environment	-0.325	0.039	**0.691**	0.247	-0.272
TOPC_competent_organization	0.102	-0.055	**0.839**	0.132	-0.121
KS_good	0.06	-0.12	0.051	**0.759**	0.235
KS_enjoyable_experience	0.083	0.11	0.058	**0.868**	-0.065
KS_valuable_to_me	0.016	0.158	-0.092	**0.883**	-0.135
KS_wise_move	-0.146	-0.159	-0.009	**0.905**	-0.003
Intent_OPC_profile_setup	-0.136	0.011	-0.017	-0.013	**0.92**
Intent_OPC_share_details	-0.015	0.021	-0.032	0.061	**0.904**
Intent_OPC_recommend_to_others	0.163	-0.035	0.053	-0.05	**0.853**

Table D4: Correlations vs. sq. root of AVE and Cronbach alpha

	Social Proximity	TC	TOPC	KS	IU
Social Proximity	**1**				
TC	-0.044	**0.847**			
TOPC	0.162	0.317	**0.821**		
KS	0.011	0.472	0.351	**0.855**	
IU	-0.313	0.643	0.167	0.395	**0.893**
Comp. reliabilities	1	0.917	0.932	0.939	0.939
Cronbach alpha	1	0.887	0.912	0.913	0.902

Temporal Measure Validation

Table D5: Item loadings and cross loadings

	Temporal Proximity	TC	TS	KS	IU
Physical fitness frequency	**1**	0	0	0	0
TC_trusted	0.07	**0.898**	0.023	-0.121	-0.071
TC_helpful	-0.078	**0.88**	0.006	-0.126	0.163
TC_safe	-0.012	**0.885**	0.051	0.074	-0.102
TC_emotional_support	-0.072	**0.82**	0.053	0.101	-0.078
TC_social_support	0.084	**0.893**	-0.128	0.081	0.083
TOPC_secure	0.124	0.005	**0.896**	0.063	-0.044
TOPC_trustworthy	-0.108	-0.287	**0.892**	0.04	0.125
TOPC_keep_commitments	-0.06	0.051	**0.858**	-0.132	-0.082
TOPC_safe_environment	0.021	0.093	**0.881**	0.042	-0.08
TOPC_reliable_environment	0.085	0.115	**0.813**	-0.08	0.188
TOPC_competent_organization	-0.057	0.037	**0.891**	0.055	-0.095
KS_good	-0.059	0.166	0.006	**0.884**	-0.215
KS_enjoyable_experience	0.109	0.179	-0.078	**0.858**	-0.082
KS_valuable_to_me	-0.002	-0.221	-0.03	**0.944**	0.21
KS_wise_move	-0.043	-0.098	0.097	**0.938**	0.066
Intent_OPC_profile_setup	0.026	-0.083	-0.076	0.125	**0.908**
Intent_OPC_share_details	-0.191	0.027	0.172	-0.149	**0.831**
Intent_OPC_recommend_to_others	0.146	0.058	-0.08	0.011	**0.92**

Table D6: Correlations vs. sq. root of AVE and Cronbach alpha

	Temporal Proximity	TC	IU	TOPC	KS
Temporal Proximity	**1**				
TC	-0.212	**0.876**			
IU	-0.19	0.701	**0.887**		
TOPC	0.001	0.158	0.133	**0.872**	
KS	-0.21	0.336	0.23	0.465	**0.907**
Comp. reliabilities	1	0.943	0.95	0.949	0.917
Cronbach alpha	1	0.924	0.937	0.927	0.864

Hypothetical Measure Validation

Table D7: Factor loadings

	Hypothetical	TC	TS	KS	IU
Type	**1**	0	0	0	0
TC_trusted	-0.048	**0.89**	-0.038	0.132	-0.111
TC_helpful	-0.013	**0.892**	-0.133	-0.097	-0.005
TC_safe	0.025	**0.901**	-0.042	0.007	0.015
TC_emotional_support	-0.041	**0.894**	0.135	-0.073	0.077
TC_social_support	0.078	**0.878**	0.079	0.031	0.024
TOPC_secure	0.005	0.06	**0.891**	-0.05	0.043
TOPC_trustworthy	0.045	0.164	**0.84**	-0.002	-0.293
TOPC_keep_commitments	0.149	0.044	**0.884**	-0.037	-0.099
TOPC_safe_environment	-0.106	-0.058	**0.859**	-0.01	0.095
TOPC_reliable_environment	0.029	-0.116	**0.914**	0	0.094
TOPC_competent_organization	-0.124	-0.084	**0.887**	0.098	0.144
KS_good	0.073	-0.103	0.032	**0.878**	-0.118
KS_enjoyable_experience	-0.118	-0.011	-0.031	**0.925**	0.026
KS_valuable_to_me	0.071	-0.034	0.103	**0.915**	0.079
KS_wise_move	-0.022	0.149	-0.107	**0.882**	0.009
Intent_OPC_profile_setup	-0.024	0.1	0.085	0.02	**0.932**
Intent_OPC_share_details	0.093	-0.297	-0.001	-0.061	**0.879**
Intent_OPC_recommend_to_others	-0.063	0.178	-0.083	0.037	**0.944**

Table D8: Correlations vs. sq. root of AVE and Cronbach alpha

	Hypothetical Proximity	TC	TOPC	KS	IU
Hypothetical Proximity	**1**				
TC	0.186	**0.891**			
TOPC	0.114	0.233	**0.879**		
KS	0.118	0.308	0.486	**0.9**	
IU	0.162	0.673	0.355	0.534	**0.918**
Comp. reliabilities	1	0.951	0.953	0.945	0.942
Cronbach alpha	1	0.935	0.941	0.922	0.907