

# **“It Feels Right. Therefore, I Feel Present and Enjoy”: The Effects of Regulatory Fit and the Mediating Roles of Social Presence and Self-Presence in Avatar-Based 3D Virtual Environments**

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## **Abstract**

This research examined the effects of regulatory fit on media users' enjoyment of interactions with a virtual interlocutor and feelings of social presence and self-presence in the 3D virtual environments (VEs) of Second Life. Results from a two (regulatory focus state: promotion vs. prevention) × two (regulatory strategy: eagerness means vs. vigilance means) between-subjects full-factorial experiment demonstrated that the regulatory fit between regulatory focus state and means for goal pursuit in computer-mediated communication (CMC) within 3D VEs increases users' enjoyment, feelings of presence, and postexperimental healthy eating intentions. A path analysis further revealed the mediating roles of social presence and self-presence. Theoretical and methodological contributions as well as practical implications are discussed.

## **I Introduction**

Online virtual worlds have great potential as sites for research in the social and behavioral sciences generally as well as computer-mediated communication (CMC) and human-computer interaction (HCI) specifically. The creativity oriented environment Second Life (SL) and the massively multiplayer online role playing game (MMORPG) World of Warcraft encompass the diversity of current VEs (Bainbridge, 2007). SL is the largest and most popular 3D VE. According to the economic statistics collected and last updated by Linden Labs on July 12, 2010, the number of residents logged in during the prior 60 days was 1,379,892 (Second Life, 2010). In addition to being an entertainment medium for multi-user interfacing and social networking, SL provides social and behavioral researchers with rich possibilities to experiment with a variety of virtual objects and actors in various online settings. Within SL, participants create their own avatars and experience exposure to a wide variety of manipulation stimuli in real time. Immersive VE technology ensures high control over the experimental procedure, replications of virtual actors' behavior, and high realism, as well as the use of diverse samples in distal locations (Gillath, McCall, Shaver,

& Blascovich, 2008). Leveraging 3D VEs as interactive communication apparatuses for experimental research, this study tested regulatory focus theory (Higgins, 1997) inside SL. Validation and replication of a relevant theory in a novel context is a valuable addition to emerging research areas like CMC and HCI. Before introducing a regulatory focus approach, the following section provides a brief literature review about the extant theories imported to and replicated in the CMC research terrain that advance the theory-driven scientific study of presence and virtual environments.

## **1.1 The Extant Literature on CMC Theories**

### **1.1.1 Electronic Propinquity Theory.**

Electronic propinquity theory (EPT) is “a general theory of mediated communication” (Korzenny, 1978, p. 3). Electronic propinquity refers to “electronic proximity, or electronic nearness, or electronic presence” (Korzenny, 1978, p. 7). Propinquity is strongly correlated with satisfaction, communication effectiveness, and task accomplishment (Korzenny & Bauer, 1981). Although the theory did not originally consider the internet, e-mail, and real-time CMC, its conceptual definitions and basic propositions offer a broad and powerful approach to understanding the effects of electronic media (Walther & Bazarova, 2008). Recently, Nowak, Watt, and Walther (2009) replicated EPT and extended its scope to include text-based CMC and virtual groups beyond face-to-face (FtF) communication and voice-based or video conferencing communication systems.

**1.1.2 Social Identity Theory.** Social identity theory (SIT) has been applied to the social identity model of deindividuation effects (SIDE; Reicher, Spears, & Postmes, 1995) in CMC. SIT claims that in-group and out-group categorization exaggerates perceived similarity between the self and other in-group members and magnify perceived differences between the self and out-groups (Tajfel & Turner, 1986). The SIDE model applies SIT to a CMC context by focusing on how visual anonymity instigates social identification (Wang,

Walther, & Hancock, 2009). SIDE suggests that visual anonymity and subsequent deindividuation from CMC drive users to identify with a group identity that is salient to them (Wang et al., 2009). SIT is a useful framework that can be applied to computer mediated interpersonal communication and ethnically diverse online groups (see Walther, 2009) or interethnic communication via social networking sites (SNSs).

**1.1.3 Self-Presentation Theory.** A growing number of CMC scholars (Hancock & Toma, 2009; Toma, Hancock, & Ellison, 2008) have examined the formation of impressions via CMC, drawing from Goffman’s (1959) self-presentation theory (SPT). Walther’s (2007) hyperpersonal model of CMC posits that CMC users take advantage of the interface and channel characteristics that CMC offers to enhance their relational outcomes. This model has been applied to self-presentation in an online dating context (Ellison, Heino, & Gibbs, 2006). Walther, Slovacek, and Tidwell (2001) suggested that idealization and selective self-representation occur when no photographic images exist in CMC. Gonzales and Hancock’s (2008) identity shift model examines how computer-mediated self-presentation alters users’ identities. These CMC models provide a fresh outlook on SPT by investigating self-presentation in a variety of CMC contexts ranging from deceptive self-presentation in online dating to impression formation in SNSs.

Thus, existing theories and models can be tested, replicated, refined, and revised in a novel research domain. The CMC theories cited above touch upon the basic mechanism underlying people’s information processing, identity formation, and self-presentation in VE-based CMC. Relatively little attention has been paid, however, to the basic principles of *designing* effective, persuasive (cognitive and motivational dimension), and enjoyable (affective dimension) messages in CMC and virtual social interaction. What makes virtual social interaction in an avatar-based CMC contextualized within VEs persuasive and enjoyable? What are important mediating mechanisms that play a role in computer-mediated interpersonal communication in VEs? To address this research gap, the current experiment drew upon

Higgins's (1997) regulatory focus theory (RFT) and the existing literature on presence.

## **1.2 Regulatory Focus Theory and Regulatory Fit**

RFT (Higgins, 1997) proposes two distinct self-regulatory states: promotion focus and prevention focus. Promotion regulatory focus is concerned with hopes, aspirations, and positive outcomes. Individuals with a promotion orientation strive toward growth and accomplishments; they focus on achieving their goals and are sensitive to the presence of positive outcomes. In contrast, prevention regulatory focus is concerned with duties, obligations, and negative outcomes. Individuals with a prevention orientation strive toward safety and security; they focus on fulfilling their responsibilities and are sensitive to the absence of negative outcomes.

From a personality psychology perspective or motivational standpoint, individuals with strong promotion goals are strategically inclined to approach matches to their aspirations whereas individuals with strong prevention goals are inclined to avoid mismatches to their duties. In addition, people with a dominant promotion regulatory focus prefer to use eagerness-related strategies of goal pursuit (action plans they can use to make sure everything goes right and help them realize their aspirations), which fit their concern with accomplishment. In contrast, people with a dominant prevention regulatory focus prefer to use vigilance-related strategies of goal pursuit (action plans they can use to avoid anything going wrong and prevent them from realizing their obligations), which correspond to their concern with responsibility (Higgins & Spiegel, 2004). In this regard, regulatory focus can be understood as a chronic and relatively stable motivational orientation or personality trait.

From an experimental psychology perspective, regulatory focus can be experimentally manipulated and viewed as a temporarily activated state. For example, promotion regulatory focus can be induced when people are prompted to think about or enumerate their hopes and aspirations, whereas prevention regulatory focus can be induced when they are prompted to list their duties and obligations. In contrast to chronic regulatory focus as a

motivational orientation factor, situational regulatory focus is fluid and temporary. Leveraging the potential of VEs for manipulating a wide variety of stimuli in real time, the current study examined the effects of experimentally-induced, situational regulatory focus as a temporarily activated state on VE users' enjoyment, health behavioral intentions, and feelings of presence.

RFT has been one of the most prominent theories in current social psychology (Higgins, Roney, Crowe, & Hymes, 1994), experimental psychology (Uskul, Sherman, & Fitzgibbon, 2009), consumer psychology (Werth & Foerster, 2007), marketing research (Aaker & Lee, 2006), health communication (Keller, 2006), economic psychology (Halamish, Liberman, Higgins, & Idson, 2008), advertising (Florack, Ineichen, & Bieri, 2009), organizational studies (Moss, 2009), and brand communication (Jain, Lindsey, Agrawal, & Maheswaran, 2007) over the last decade. This paper argues for applying Higgins's RFT to the VE-based CMC arena with the hope of developing theories about avatar-based CMC in 3D VEs and providing practical implications for virtual social interaction. To this end, the present study addressed the integral role regulatory fit plays in message framing in VE-based CMC and its effects on enjoyment in avatar-based social interaction within 3D VEs, health behavioral intentions in e-health, and feelings of presence.

## **1.3 The Effects of Regulatory Fit on Enjoyment and Healthy Eating Intentions**

One source of feelings of rightness ("feeling right") or wrongness ("feeling wrong") is the sense of a good or poor fit between one's regulatory focus and goal-pursuit strategies (Lee & Higgins, 2009; Aaker & Lee, 2006). Regulatory fit makes people "feel right" about what they are doing and consequently encourages them to engage more deeply in what they are doing (Lee & Higgins, 2009). Generally, people enjoy performing actions that help them meet their goals (Carver & Scheier, 1999; Freitas & Higgins, 2002). People show greater satisfaction, in turn, when their goal-pursuit strategies help them achieve important long-term aims (Sheldon & Elliot, 1999). People experience regulatory

fit when their goal pursuit strategy fits and sustains their regulatory focus. Previous research testing the effects of regulatory fit on persuasion demonstrates the persuasive power of the “feeling right” experience (Avnet & Higgins, 2006). During actual or imagined goal pursuit, regulatory fit results in persuasive outcomes (Lee & Higgins, 2009) and increases people’s motivation (Spiegel, Grant-Pillow, & Higgins, 2004), feelings of importance (Higgins, Idson, Freitas, Spiegel, & Molden, 2003), and sense of enjoyableness and excitement (Freitas & Higgins, 2002).

The current experiment tested the role of regulatory fit in 3D VEs on people’s feelings of presence, enjoyment (affective outcomes), and health behavioral intentions (cognitive and motivational outcomes resulting from persuasion) by manipulating the fit between experimentally manipulated regulatory focus and means for goal pursuit. This study extended research on avatar-based CMC in VEs by (1) examining the effects of cognitive and motivational factors (i.e., regulatory focus and regulatory fit) on users’ enjoyment of virtual interfaces and postexperimental health behavioral intentions; and (2) exploring possible mediating mechanisms (i.e., social presence and self-presence) that explain the processional link between cognitive antecedents and enjoyment in avatar-based CMC. Thus, rationales for conducting the current experiment were: (1) as CMC researchers, we can gain insight into designing enjoyable virtual interfaces for computer-mediated interpersonal communication in VEs; (2) as presence researchers, we can investigate the mediating role of feelings of presence in avatar-based virtual social interaction, thus advancing theories of presence; and (3) as health practitioners in application spheres, we can benefit from the efficacy of regulatory fit induction in the design of persuasive health messages for e-health interventions.

Based on the theoretical proposition that regulatory fit (referring to the fit between the actor’s regulatory focus states and the action’s strategic orientation) influences persuasive outcomes and the amount of enjoyment the action provides, the first hypothesis (H1) proposed the effects of regulatory fit (versus regulatory nonfit) between an induced regulatory focus state and salient regulatory strategies on people’s enjoyment (affective

outcome) of avatar-based CMC within 3D VEs and health behavioral intentions (motivational outcome).

**HYPOTHESIS 1:** (a) Participants in the promotion regulatory state (hopes) and promotion strategy (eagerness means for goal pursuit) regulatory fit condition will enjoy the virtual social interaction more and demonstrate greater healthy eating intentions than those in the regulatory misfit condition (hopes and vigilance means for goal pursuit); (b) Participants in the prevention regulatory state (duties) and prevention strategy (vigilance means) regulatory fit condition will enjoy the virtual social interaction more and demonstrate greater healthy eating intentions than those in the regulatory misfit condition (duties and eagerness means).

#### **1.4 The Effects of Regulatory Fit on Feelings of Presence**

Beyond replicating previous findings about the effects of regulatory fit on enjoyment and persuasion, the current study examined the role of regulatory fit in inducing media users’ feelings of presence in the novel context of interactive e-health communication within 3D VEs. An enhanced sense of presence resides at the heart of virtual experience and is implicit in users’ evaluation and enjoyment of interactive media and VEs (Lombard & Ditton, 1997). Users employ avatars to represent themselves in computer-mediated virtual settings (Peña, Hancock, & Merola, 2009). Thus, in SL, where people interact with virtual actors through a personalized avatar in real time, users experience social presence via parasocial interaction with other users’ avatars (Jin, 2011, in press). In addition, SL users create their own avatars and navigate the environments using their customized characters, thus experiencing self-presence. Therefore, the study examined the effects of regulatory fit in increasing the feelings of two types of presence in SL: social presence and self-presence.

Lee (2004) defined social presence as “a psychological state in which virtual (para-authentic or artificial) social actors are experienced as actual social actors in either sensory or nonsensory ways” (Lee, 2004, p. 45). In 3D VEs where users interact with one another through personalized avatars, social presence plays a critical role in

social interaction among the users. Self-presence refers to “a psychological state in which virtual self/selves are experienced as the actual self in either sensory or nonsensory ways” (Lee, 2004, p. 46). In SL, self-presence occurs when users do not notice the virtuality of either the para-authentic representation of their own selves or the artificially constructed alter selves. Given the increase in visual representations of the self via avatars (Jin, 2010a) and the relevance of self-related processes in avatar-based CMC (Gonzales & Hancock, 2008) as well as avatars’ practical value for inducing immersive virtual experiences, it is imperative to understand the mechanism whereby self-presence occurs and measure self-presence in people’s experience in VEs. In this regard, the current experiment induced feelings of self-presence by prompting a participant to create his or her own avatar and use it in the VEs.

A considerable amount of research has examined the effects of sensory stimuli appealing to a broad range of human senses (audio, video, tactile stimuli), including machine-generated voices (Lee & Nass, 2005), visualization technologies in augmented reality (Botella et al., 2005), technological advancements in video games (Jin & Park, 2009), and haptic feedback (Jin, 2010b), on feelings of presence. We know very little about the influence of nonsensory or motivational factors, such as regulatory focus and cognitive goal processing, on feelings of presence. Therefore, the current study proposed that the regulatory fit that media users experience in SL increases their feelings of presence when they interact with a virtual interlocutor. The theoretical thinking and rationale driving this assumption are explicated below.

Presence phenomena are highly relevant to media users’ mediated interactions with engrossing and immersive VEs (Lee, 2004). The sense of a good fit (feeling right) versus poor fit (feeling wrong) between regulatory focus and goal pursuit strategies (regulatory fit versus regulatory misfit) can influence participants’ feelings of presence. These feelings of rightness, good fit, and consequent immersion can help participants feel, via the mechanism called perceptual illusion of nonmediation (Lombard & Ditton, 1997), as if the virtual interlocutor they interact with were a real social actor (social presence) and the avatar they are role-playing were their real

self (self-presence). For example, Lee and Nass (2005) empirically demonstrated that users feel stronger social presence when they hear a computer synthesized voice manifesting a personality that is similar to the user and consistent with the text’s personality. This finding suggests that the sense of good fit and similarity (as opposed to a sense of misfit and dissimilarity) induced by manipulating a sensory factor (computer synthesized voices appealing to the aural sense) is a significant predictor of strong feelings of social presence. However, as mentioned above, the emphasis in presence research has been on sensory modalities or technological factors. Although there is available scholarship that examines the correlation between nonsensory, purely cognitive antecedents (e.g., human factors including empathy, absorption, creative imagination, willingness to suspend disbelief) and presence (Sas & O’Hare, 2003), to the best of our knowledge, not much research has addressed the causal effects of experimentally manipulated cognitive factors such as regulatory fit and corresponding goal processing on feelings of presence, with very few exceptions (e.g., Schneider, Lang, Shin, & Bradley, 2004). In an attempt to fill this gap in the presence literature, the present study tested the causal effects of the sense of good fit via manipulating a nonsensory, cognitive factor on feelings of presence. Regulatory fit can increase participants’ (1) social presence through inducing a sense of rightness during interaction with other avatars and (2) self-presence through inducing self-congruity. This theoretical discussion guided the formation of the following hypothesis (H2) about the effects of regulatory fit between regulatory focus and goal pursuit strategies on feelings of presence.

**HYPOTHESIS 2:** (a) Participants in the promotion regulatory state (hopes) and promotion strategy (eagerness means for goal pursuit) regulatory fit condition will feel greater social presence and self-presence than those in the regulatory misfit condition (hopes and vigilance means for goal pursuit); (b) Participants in the prevention regulatory state (duties) and prevention strategy (vigilance means) regulatory fit condition will feel greater social presence and self-presence than those in the regulatory misfit condition (duties and eagerness means).

### 1.5 The Mediating Roles of Presence

A burgeoning body of research has reported the mediating roles of different types of presence in a wide range of interactive media environments, including social presence in a text-to-speech (TTS) interface (Lee & Nass, 2005), social presence in human-robot interaction (Lee, Peng, Jin, & Yan, 2006), self-presence in avatar-based video game playing (Jin & Park, 2009), and physical presence in virtual experiences (Jin, 2010b). As a mediator, feelings of presence explain the processional link between various exogenous factors (e.g., computer-synthesized voice, socially interactive robots, avatar-based games, virtual reality) and important endogenous variables in new, interactive media environments (e.g., evaluations of interfaces, parasocial interaction with social robots and video game avatars, enjoyment of virtual experiences). As discussed above, however, the extant literature on feelings of presence has been dominated by testing the mediation mechanism in light of technological advancements and sensory factors to the exclusion of nonsensory or cognitive factors. An additional theoretical hole in regulatory focus research is the lack of speculation on possible mediating variables. It is important to extend prior theory and research by investigating novel mediating variables. Based on these rationales as well as the aforementioned theoretical foundations and prior empirical findings surrounding the mediating role of presence, this study proposed the following hypothesis (H3) about the mediating effects of presence on participants' enjoyment of CMC with a virtual interlocutor in the VEs of SL.

**HYPOTHESIS 3:** Feelings of social presence and self-presence will mediate the effects of regulatory fit on enjoyment.

## 2 Method

### 2.1 Participants and Design

The experiment employed a two (regulatory focus state: hopes versus duties)  $\times$  two (regulatory strategy: eagerness means versus vigilance means) between-subjects full-factorial design. Participants were randomly assigned to one of the four conditions using a random number generator. Participants ( $M_{Age} = 19.80$ ,  $SD_{Age} = 1.01$ )

were recruited from a university in the United States. The study generally replicated the experimental procedure from a number of previous regulatory focus experiments (Freitas & Higgins, 2002; Hong & Lee, 2008; Keller, 2006) in the novel context of a VE-based interface, SL. The experiment utilized two key features of SL: its avatar creating function and role-playing feature. Participants were exposed to various manipulation stimuli in experimental settings within the VE. The specialist avatar delivered an individual health consulting session and induced a certain regulatory focus and means for goal pursuit in the interactive health communication environment. The HealthInfo Island within SL was the site for conducting the experiments (the user interface for interaction between a participant avatar and the virtual consultant avatar).

### 2.2 Experimental Procedure

Data collection began by inviting students to a lab equipped with computers on which SL was preinstalled and running. Using SL's avatar customization feature, each participant created a personalized avatar. After the avatar creation process, participants interacted with a virtual health consultant avatar using SL's instant messaging (IM) function. The health consultant avatar delivered manipulation stimuli in an individual health consulting session. After experiencing the virtual social interaction in SL, participants filled out a posttest questionnaire.

Participants were asked to create an avatar that reflected their physical appearance using the avatar customization function. The researchers played the role of the health consultant avatar in the interactive health consulting sessions, observed participants' avatar-creating behavior within the VEs, and measured total time spent on each participant's avatar creation. Furthermore, the researchers kept track of every participant's snapshot capturing his or her avatar appearance and log file records containing chat contents and time. The experimenters used a standardized script for every participant to ensure exact replication of the experimental protocol and manipulation stimuli, especially for regulatory focus and means of goal pursuit manipulations. At the same time, the experimenters controlled the script and interaction.

For example, if a participant did not seem to understand the experimental procedure within the 3D virtual environment (e.g., when a participant did not know how to proceed, or when a participant did not know exactly how to create his or her own avatar even after instruction by the health consultant avatar), the experimenter gave additional instruction. When a participant significantly deviated from most of the participants (e.g., when a participant spent too much time in the environment, when a participant did not create his or her avatar, when a participant withdrew, or when there was an unexpected interruption such as nonscripted, irrelevant, distracting conversation with other SL avatars), the participant was excluded from data analysis.

After avatar creation, participants continued interacting with the health consultant avatar by using the text-based chatting (IM) function in SL. With regard to regulatory focus state and the means for goal pursuit manipulations, the experiment generally replicated the manipulation procedure validated by Freitas and Higgins (2002). Freitas and Higgins's (2002) method has been tested and validated in previous marketing and consumer behavior research (Hong & Lee, 2008; Keller, 2006). The author of the current study added several phrases (health-related) where appropriate and modified the stimuli to fit the e-health context. The health recommendation avatar performed regulatory fit manipulations by prompting participants to describe the regulatory focus state and the means for goal pursuit.

### 2.3 Measures

Enjoyment was measured using a 7-point Likert scale ranging from "strongly disagree (1)" to "strongly agree (7)" following the instruction "Please select the number that best reflects your Second Life experience (interaction with the virtual health consultant avatar)." The three items modified from Lee et al. (2006) were: "I find Second Life entertaining"; "I find Second Life enjoyable"; "I had fun while playing Second Life" (Cronbach's  $\alpha = .95$ ). Healthy eating intention was measured using three items with a 7-point Likert scale: "I will pay close attention to nutrition information"; "Calorie levels will influence what I eat"; "I will pay

attention to calorie information" ( $\alpha = .90$ ). Social presence was measured by a 7-point scale ranging from "not at all (1)" to "very much (7)." The four items modified from Lee et al.'s (2006) human-robot interaction study were: "How much did you feel as if..." "you were interacting with an intelligent being?"; "you were with an intelligent being?"; "the health consultant avatar was real?"; "How compelling was your sense of the other avatar being present?" ( $\alpha = .84$ ). Self-presence was measured by three items from Jin and Park's (2009) study: "How much did you feel as if..." "you were your own avatar?"; "you were walking when your own avatar walked?"; "the line between your actual identity and virtual identity blurred?" ( $\alpha = .74$ ).

### 3 Results

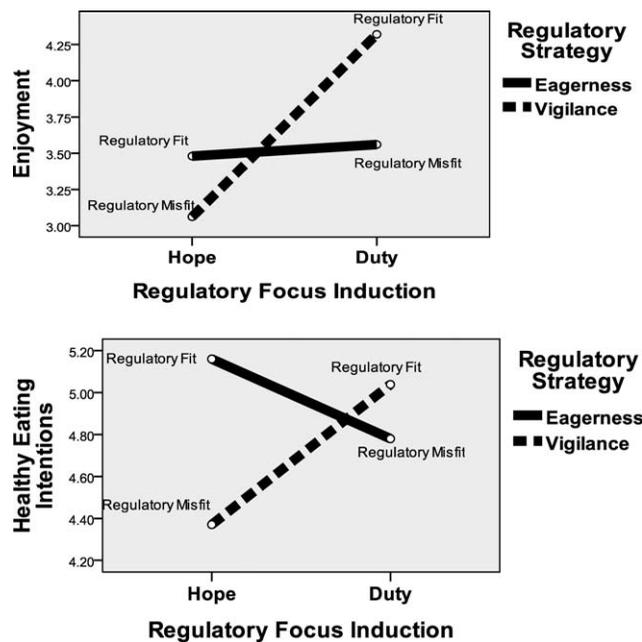
The results demonstrated a significant two-way interaction effect on enjoyment,  $F(1,99) = 4.81, p < .05$ , partial  $\eta^2 = .05$ , and on health behavioral intentions,  $F(1,99) = 3.66, p = .059$  (approaching significance), partial  $\eta^2 = .04$ . H1a and H1b were supported, as plotted in Figure 1.

The results demonstrated a significant two-way interaction effect between regulatory focus and means for goal pursuit on feelings of social presence,  $F(1,99) = 6.11, p < .05$ , partial  $\eta^2 = .06$ , and on feelings of self-presence,  $F(1,99) = 15.07, p < .001$ , partial  $\eta^2 = .13$ . H2a and H2b were supported, as plotted in Figure 2.

A path analysis was conducted to test the mediating roles of social presence and self-presence in determining the effects of regulatory fit on enjoyment (H3). Figure 3 shows the significant mediating roles of social presence and self-presence. H3 was supported.

### 4 Discussion

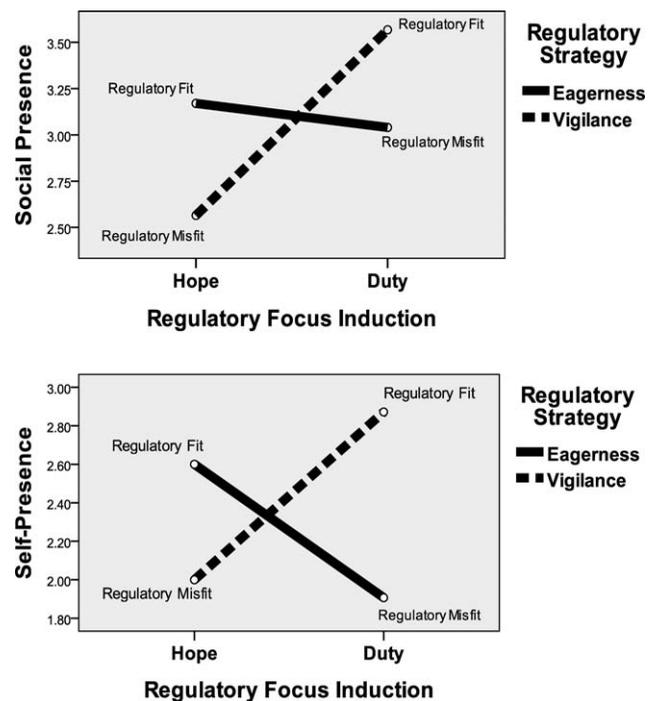
This research explored the roles of regulatory fit in the domain of SL's 3D virtual worlds and found that regulatory fit is an important antecedent of enjoyment, persuasive outcomes (healthy eating intentions), and feelings of presence in immersive 3D VE-based CMC. The results indicated that regulatory fit significantly increases users' enjoyment of virtual social interaction



**Figure 1.** The effects of regulatory fit on enjoyment (top) and healthy eating intentions (bottom).

and postexperimental health behavioral intentions as well as feelings of social presence and self-presence during their interactions with a virtual interlocutor in 3D VEs. Participants who were prompted to consider their hopes and aspirations and then list eagerness means for goal pursuit (regulatory fit between promotion regulatory focus and eagerness goal pursuit strategy) felt stronger social presence and self-presence than those who were prompted to think about hopes and aspirations and then enumerate vigilance means for goal pursuit. A similar pattern was found for the prevention regulatory focus condition. The experiment successfully replicated the efficacy of regulatory fit previously found across disciplines in the innovative domain of avatar-based e-health communication within interactive 3D VEs, thus extending the realm of regulatory focus research beyond the traditional, noninteractive, thought-task paradigm.

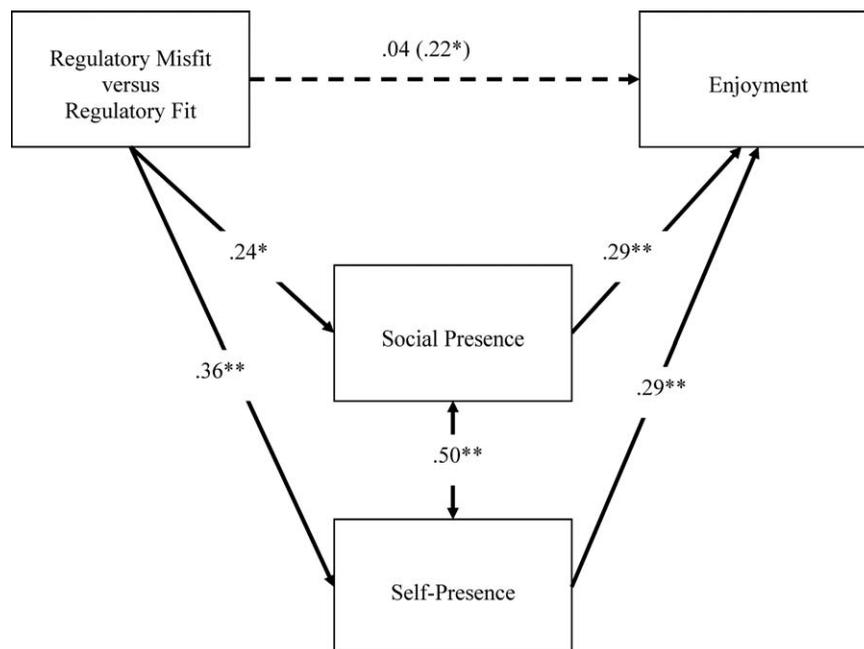
This study is the first to provide empirical evidence about the positive effects of regulatory fit on feelings of social presence and self-presence during an interactive media experience, a novel contribution to the body of regulatory fit literature. In addition, presence literature has mainly investigated the effects of perceptual factors,



**Figure 2.** The effects of regulatory fit on social presence (top) and self-presence (bottom).

sensory stimuli, or technological factors. This study expanded the scope of presence research to include motivational and cognitive factors such as regulatory focus induction and goal processing. One of the most valuable contributions was its extension of cognitive factors that promote perceptions of presence. All in all, this study enriched both bodies of research by linking regulatory fit and feelings of presence. Another theoretical contribution of this research was its endeavor to discover mediating variables in testing the effects of regulatory fit. Despite the prominence of RFT across various disciplines and burgeoning empirical findings about regulatory focus over the last decade, no prior research has tested the mediating roles of presence in the regulatory fit mechanism. Social presence and self-presence play a significant mediating role in explaining the path from regulatory fit to enjoyment in VEs.

This study experimented with SL as an innovative apparatus for testing a social psychological theory in the novel context of 3D VE-based e-health. Prior research induced regulatory focus mainly by thought task or an



**Figure 3.** Path diagram of mediation analysis: The mediating roles of social presence and self-presence.

\* $p < .05$ .

\*\* $p < .01$ .

Note 1. The number inside the parentheses is a standardized coefficient when the dependent variable (enjoyment) is regressed on the independent variable (regulatory fit) alone without including the mediating variables (social presence and self-presence) in the regression equation.

Note 2. Regulatory fit was dummy coded (0: Regulatory Misfit versus 1: Regulatory Fit).

essay writing-based manipulation procedure using a paper and pencil questionnaire. Methodological modification of the manipulation process by deploying an interactive virtual interlocutor (health consultant avatar) who exposes participants to distinct regulatory focus and goal pursuit strategies constituted a notable departure from the traditional regulatory focus induction paradigm. The main dependent variables, feelings of presence, enjoyment (affective dimension), and healthy eating intentions (motivational dimension), are central to understanding the user experience in interactive 3D VE-based e-health. Postexperimental health behavioral intention (healthy eating intention) was measured since participants were manipulated with health-related regulatory focus and action strategies.

The use of interactive medical recommendation agents or health consultant avatars that provide health consum-

ers or patients with instant feedback and customized medical advice (Jin, 2010c,d) enables health researchers and practitioners to conduct tailored e-health interventions (Gorini, Gaggioli, Vigna, & Riva, 2008). Jin (2010d) examined the influence of regulatory focus and medical recommendation avatars' trustworthiness in avatar-based e-health within 3D VEs and found that VE users' evaluation of a medical recommendation avatar's trustworthiness mediated the effects of regulatory focus on their perceived informational and educational values of the health messages. A key difference between Jin's (2010c) study and the current research is that the former manipulated "regulatory focus of health messages about Human Papillomavirus (HPV) (benefits-framed *messages* emphasizing promotion regulatory focus versus costs-framed *messages* emphasizing prevention regulatory focus)" driven by regulatory focus theory. In contrast,

the latter manipulated “regulatory focus *states* of participants (hopes versus duties) and corresponding means of goal pursuit (eager means versus vigilant means) as well as the subsequent regulatory fit versus regulatory misfit” driven by the literature on the efficacy of regulatory fit. In light of practical and managerial implications, therefore, this line of research provides helpful insights for health professionals with regard to the utilization of avatars and development of intervention tools and the design (i.e., framing) of persuasive and enjoyable e-health messages. For example, interactive medical recommendation avatars can take advantage of the regulatory fit between the health messages and the message recipient’s regulatory focus to increase consumers’ health behavioral intentions, feelings of presence, and enjoyment of the e-health intervention. In the realm of e-commerce, avatars are being increasingly used as sophisticated artificial intelligence programs in the form of anthropomorphic information agents (AIAs) to provide product information in real time (Jin, 2009; Sivaramakrishnan, Wan, & Tang, 2007). In the e-education domain, SL presents an immersive online education environment (Boulos, Hetherington, & Wheeler, 2007). Educators are increasingly using SL to extend and expose their classrooms to a global audience. This study’s experimental apparatus and protocol can serve as a useful methodological framework for future research in e-health, e-commerce, and e-learning in 3D VEs since the study reveals a cognitive antecedent to several outcome variables (persuasion, presence, and enjoyment of the virtual experience) crucial in the design of effective and entertaining virtual interfaces.

This study has several limitations. First, the main modality of interaction between the participant avatar and the health consultant avatar was text-based instant messaging (IM). Adding voice-chatting modality in follow-up studies would shed some light on the effects of different modalities (unimodal stimuli appealing to a single sense versus multimodal stimuli appealing to multiple senses; Jin, 2009) in the regulatory fit induction process.

Second, participants were homogenous undergraduate students. Replication of the experimental apparatus across diverse populations recruited from real SL users would amplify the study’s external validity and social impact. SL has the potential to reach a wide variety of

populations with diverse cultural, ethnic, and educational backgrounds. Measuring diverse populations’ regulatory focus as a chronic trait factor and examining the moderating role of an individual’s chronic regulatory focus would elucidate the key difference between regulatory focus as a chronic motivational orientation versus a temporarily manipulated state.

Third, this study focused on the short-term effects of virtual social interaction leveraging medical recommendation avatars for e-health interventions. Further measuring health-related decision-making (e.g., food menu selection) and long-term behavioral change (e.g., change in dietary habits or physical exercise pattern) as post-experimental outcome variables would provide deeper insights into the more direct or longer-term impact of interactive avatar-based e-health in VEs. In addition, measurement of the perceived source credibility of the health consultant avatar and the perceived informational or educational value of the individual e-health consulting session would advance our understanding of key mediators in e-health (Jin, 2010c).

Last, in the current experiment, nonscripted, irrelevant, and distracting conversation with other users had to be removed to rule out the effects of other extraneous variables (interaction with multiple SL users, extra time spent on the virtual social interaction, or other visual stimuli that may interfere with the intended regulatory fit induction). Nonscripted conversation, however, could provide deeper insight into the way people interact with one another in VEs. Replication of the current research in a field experiment by including interactions with real SL users and the content analysis of nonscripted conversation would provide deeper insights into VE-based CMC.

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