Communications of the Association for Information Systems

11-13-2007

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AN EXPLORATORY STUDY OF SOCIAL FACTORS INFLUENCING VIRTUAL COMMUNITY MEMBERS' SATISFACTION WITH AVATARS

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ABSTRACT

Virtual communities that feature avatars are an emerging social software business model on the Internet. Avatars are Internet users' graphical representations of themselves in virtual environments. This study investigates how virtual community members' satisfaction with avatars is formed. We test a research model that proposes that social factors influence virtual community members' satisfaction with avatars. We draw upon social presence theory, social comparison theory, and self-identity theory. Data from a field experiment (N=134) is analyzed using Structural Equation Modeling (SEM). Our results provide empirical support for our proposed model. We report that social factors affect virtual community members' satisfaction with the use of avatars in virtual communities. Our intended contribution is to help both managers and academics understand aspects of customer behavior and customer satisfaction when using avatars in virtual communities. This study also presents suggestions for future research regarding the use of social software in business.

Keywords: avatar, social presence, social comparison, self-identity, user satisfaction, virtual community

I. INTRODUCTION

The growing ubiquity of technology has changed the way businesses interact with customers. The Internet and Web browsers enable businesses to distribute information and market their products online. The development of these technologies has enabled businesses to utilize creative means to attract and—more importantly—to *satisfy* their customers. The drive for customer satisfaction is understandable, given that customer satisfaction is essential to the success of any commercial venture. An understanding of how customer satisfaction can be developed in an online environment is crucial if e-commerce ventures are to succeed.

Many e-commerce firms are attempting to build customer satisfaction by creating virtual communities. Virtual communities are computer-mediated spaces where there is an integration

of content and communication with an emphasis on member-generated content [Hagel and Armstrong 1997; Lee et al. 2003a]. Creating virtual communities enables businesses to provide information both efficiently and in a timely manner as they bring offline customers online [Koh et al. 2007]. In virtual communities, avatars are often used to allow Internet users to interact with other users as they participate in the virtual community.

An avatar is an Internet user's graphical representation of himself or herself in a virtual environment; avatars convey identity, presence, and activities to others [Benford et al. 2001; Hemp 2006]. Avatars have been used in video games such as *The Sims* and in online virtual worlds such as *Second Life,* but now are increasingly being used by commercial Web sites to deliver product information in an attempt to generate revenue [Hemp 2006; Holzwarth 2006]. These commercial Web sites may sell avatars or may use avatars as guides in shopping, software demonstrations, and advertisement (see Appendix I for examples of avatars and Appendix II for details about their use in e-commerce). Despite the growing use of avatars in virtual communities, little knowledge exists regarding how businesses may influence virtual community members' satisfaction with avatars. Because avatars themselves improve customers' satisfaction and increase their purchase intention on e-commerce Web sites [Holzwarth 2006], it is important for both researchers as well as practitioners to understand how to ensure satisfaction with avatars. This paper attempts to address the existing knowledge gap by investigating the following research question: What are the important factors influencing virtual community members' satisfaction with avatars?

This paper explores whether theories of social interaction that have been developed in the physical world may explain virtual community members' satisfaction with avatars that exist in virtual worlds. Social interaction plays a role in shaping an individual's identity [Tajfel 1972]. When membership in a community is a component of an individual's self-identity, that individual may desire to actively participate in (or be present in) the community and compare himself or herself with other members of the community [Lee et al. 2003b]. When an individual has these desires, a means for presence and comparison may satisfy those desires. We argue that avatars provide a means for presence and comparison in a virtual community. If avatars indeed enable these desires to be fulfilled, virtual community members will be satisfied with avatar use. We believe that this research is among the first to employ theories of social interaction to the relatively new realm of virtual beings, known as avatars. Our intended contribution is to provide a basis for understanding customer satisfaction in virtual communities.

The remainder of the paper is organized in the following manner. In Section II, we present the theoretical background for our study. We draw on social presence theory, social comparison theory, and self-identity theory as we develop our hypotheses and research model. In Section III, we discuss our research methods, providing details about our sample, variables, and measurement of those variables. We describe the procedures we used to conduct a field experiment using student subjects. The empirical results of our experiment are analyzed using structural equation modeling (SEM) and presented in Section IV. We find support for our hypotheses and proposed model. The final section discusses our results, explaining that social factors may impact virtual community members' satisfaction with avatars. As we conclude our paper, we describe the implications of our findings for e-commerce firms, the implications for researchers, the limitations of our study, and ideas for future research.

II. THEORETICAL BACKGROUND AND RESEARCH MODEL

The Internet provides many opportunities to investigate human behavior and interpersonal communication [Kraut, 2004].   The rapid expansion of new means of Internet-enabled communication has a broad social impact [Kraut et al. 2002]. Different means of communication, such as e-mail, chat rooms, and bulletin boards, create a networked society and increase the number of interpersonal relationships an individual may potentially have [Cummings et al. 2002; Willman 2002]. These online forums for communication increase individuals' social involvement with others and introduce new factors that may impact the formation of those individuals'

identities. Interpersonal communication is aided by the presentation of visual information [Kraut et al. 2003]. Avatars are one way that visual information can be added to online communication and may be useful as virtual community members display aspects of their identity to other members.

The use of an avatar as an alternate persona is similar to the use of a personal Web page in a virtual community. Like Web pages, avatars demonstrate virtual community members' identities and preferences. The use of avatars in the context of computer-mediated communication is also similar to the use of "emoticons" such as smiley faces and identities like user IDs developed in virtual communities to support social interactions [Baym 1994]. However, the use of avatars is different from Web pages, emoticons, and identities because avatars are richer manifestations of the virtual community member. The effects of media richness on communication, organizational structure, and relations between members of organizations have been a focus of research for over 20 years [Daft and Lengel 1986]. While studies have investigated media richness and the establishment of interpersonal relationships in conjunction with different types of technology [Fulk et al. 1990; Short et al. 1976], few have investigated why people adopt visual and graphical representation in virtual communities. In particular, the growing use of avatars in virtual communities represents a new context, in which members of a virtual community can communicate their identity and self-image to other members. When avatars are viewed as a way for virtual community members to share rich information about themselves with others, it seems reasonable to investigate what impact avatars themselves might have on virtual community participation.

Events that simulate physical-world experiences have been suggested as a way to encourage online interaction [Andrews et al. 2002]. Avatars may influence virtual community participation in three ways. First, membership in one group or subculture rather than another shapes the experiences of the members and affects the quality of their electronic life [Hiltz 1984]. Avatars have the ability to enable virtual community members to feel that they are clearly linked to a particular electronic group or subculture, namely, the virtual community. When virtual community members see that their avatars share characteristics with other avatars, they may sense that they are members of a particular social group. Second, virtual community members' presence in the virtual society through their avatars may provide members with the feeling of living in close association with others. Virtual community members may be aware of avatars, consider them as virtual human beings, and want to interact with them [Reeves and Nass 1996]. Finally, virtual community members may compare their avatars to those of others, as humans compare themselves to others in the physical world, thus creating a social bond through comparison.

To investigate how the social aspects of avatar use in a virtual community influence satisfaction with the avatar, we draw on self-identity, social presence, and social comparison theories. The theories are briefly reviewed in the following subsections as we develop our hypotheses and research model.

SATISFACTION

In this study, we are interested in the role social factors play in explaining users' satisfaction with avatars. Although some information systems (IS) research indicates that social factors may influence users' behavior when utilizing information technology [Fulk et al. 1990; Short et al. 1976], few theories explain individuals' behavior from a social psychology or cybernetic perspective [Lamb and Kling 2003]. Recently, several IS studies have viewed information technologies in social settings that contextualize social effects. The concepts investigated include subjective norm, social presence, social information processing, and social influence [Igbaria and Tan 1997; Song and Zahedi 2005; Venkatesh and Brown 2001] (See Appendix III for a summary of social theories used in IS research). On the basis of this previous research, we argue that social factors may be drivers of satisfaction for members of virtual communities.

The dependent variable in this study is virtual community members' satisfaction with avatars. User satisfaction is defined as "the sum of one's feelings or attitudes toward a variety of factors

affecting that situation" [Galletta and Lederer 1989]. It also has been defined in information systems research as "felt need, system acceptance, perceived usefulness, feelings about the information system, and information systems appreciation" [Ives et al. 1983]. While these definitions are slightly different, they deliver a common notion that user satisfaction is an evaluative response or an outcome that is built upon users' perceptions of information systems [Khalifa and Liu 2002-3; Melone 1990]. Because virtual communities are designed with the intention that people join and participate, satisfaction with the community and its features is crucial. Therefore, we use virtual community members' satisfaction with avatars as the dependent variable in this study.

SOCIAL PRESENCE THEORY

Social presence theory discusses the social effects a medium of communication may generate [Short et al. 1976]. Social presence is the degree to which people establish close, interpersonal connections with each other during interaction in a communication setting [Fulk et al. 1990; Short et al. 1976]. Social presence theory posits that the match between a communication medium's capability to transmit social presence and the social need for a task is critical to the effectiveness of communication [Christie 1985]. This is because the presence of others affects the nature of intersubjective interpretation of meaning [Christie 1985]. More recently, this theory has been applied to explain that different types of media vary in the social presence they facilitate [Miranda and Saunders 2003]. Also, social presence has been shown to affect the effectiveness of communication [Miranda and Saunders 2003].

On this basis, we argue that virtual community members' desire for social presence—that is, their desire for close, interpersonal connections with others—will partially determine their satisfaction with the use of an avatar. Because avatars enrich online communication, avatars provide a useful tool with which community members can form interpersonal connections with others. Virtual community members who desire social presence will desire to use avatars to develop and increase that social presence. Thus, it may be inferred that a virtual community member's attitude toward social presence—that is, his or her attitude toward developing close, interpersonal connections with other virtual community participants—affects his or her satisfaction with the use of avatars. Such a relationship has been indicated in product purchase situations [Dahl et al. 2001]. Therefore, we hypothesize:

Hypothesis 1: Virtual community members' favorable attitude toward social presence will positively influence their satisfaction with the use of avatars.

SOCIAL COMPARISON THEORY

Social comparison theory postulates that people prefer to compare themselves with others who are similar in opinions, values, abilities, and other related attributes [Festinger 1954]. Social comparisons are especially salient when a group with whom one compares oneself is important to the individual [Festinger 1954].   Social comparison theory suggests that individuals' comparison behavior proceeds through three steps: (1) people assess how others feel and behave; (2) people select or seek information as a basis for comparison; and (3) people utilize the information they possess in order to improve their own performance [Suls 1977]. Social comparison can be defined as the process of assigning a value to one's self that is a joint function of one's own and referent others' performance [Dakin and Arrowood 1981].

Social comparison has been described as an antecedent of satisfaction in marketing research that explains the fairness consumers perceive [Szymanski and Henard 2001]. In social psychology, social comparison theory has been linked with equity theory [Conner 2003] because social comparison processes are associated with perceptions of fairness, justice, or equity in terms of comparison to others [Austin 1977]. In organizational psychology, researchers have found that comparisons that individuals make with others significantly influence their satisfaction [Sweeney and McFarlin 2004].

An individual who holds a strong tendency to compare himself or herself with others may find satisfaction using avatars in a virtual community because avatars allow virtual community members to present whatever image they choose to other members of the community. The form and characteristics of the avatar are largely the decision of the member.   Therefore, we hypothesize that:

Hypothesis 2:   Virtual community members' tendency to compare themselves with other members will positively influence their satisfaction with the use of avatars.

SELF-IDENTITY THEORY

Virtual communities that utilize avatars facilitate self expression. Given that individuals express their interests and identities to others in virtual communities [Benford et al. 2001; Hemp 2006], a natural question is, "What motivates people to express themselves in virtual environments" [Bargh et al. 2002]? Self-identity theory addresses this issue. Identity can be defined as an individual's answer to the question "Who am I?" [Stryker and Serpe 1994]. Individual identity is the highest of the hierarchical cognitive structures comprising the self [Stryker and Burke 2000] and self-identity theory posits that individuals form their self-identity based on the roles they fill [Stryker and Burke 2000]. How one identifies oneself is determined by how well one performs a certain role [Stryker and Burke 2000]. Thus, self-identity focuses on the self in terms of the roles an individual occupies, such as group member, friend, teammate, or employee. Self-identity can be also viewed as "the salient part of an actor's self which relates to a particular behavior that reflects the extent to which an actor sees him or herself as fulfilling the criteria for any societal role" [Conner and Armitage 1998, p. 1444].

Social identity is slightly different from self-identity.   Social identity theory explains the psychological bases of distinction between groups of individuals [Tajfel and Turner 1986]. Social identity is defined as "the individual's knowledge that he or she belongs to certain social groups together with some emotional and value significance to her/him of this group membership" [Tajfel 1972, p. 31]. Social identity explains an individual's self-concept from the perspective of social group membership. In other words, it is a self-developed conception of who the self is, a conception that is at least partially built on an understanding of what social groups the self belongs to. This differs from self-identity, which is derived solely from an individual's unique attributes [Hogg and Terry 2000].

Identity, as described above, has been explained as having both an individually determined component as well as a socially determined one. In virtual communities, a community member's avatar reflects the member's self-identity as well as the member's social identity.   Thus, interaction among virtual community members helps define the member's identity.   Virtual community members who identify strongly with the community may enjoy the communication opportunities with virtual community members. This strong identification may foster a desire for social presence and fuel social comparison.   Previous studies found that self-identity has a significant impact on attitude [Debono and Snyder 1995; Terry et al. 1999].   Hence, we hypothesize:

Hypothesis 3a: Virtual community members' strong identification with their community positively influences their attitude toward social presence.

Hypothesis 3b: Virtual community members' strong identification with their community influences their attitude toward social comparison.

The hypothesized relationships we have described are depicted in Figure 1, our proposed research model.
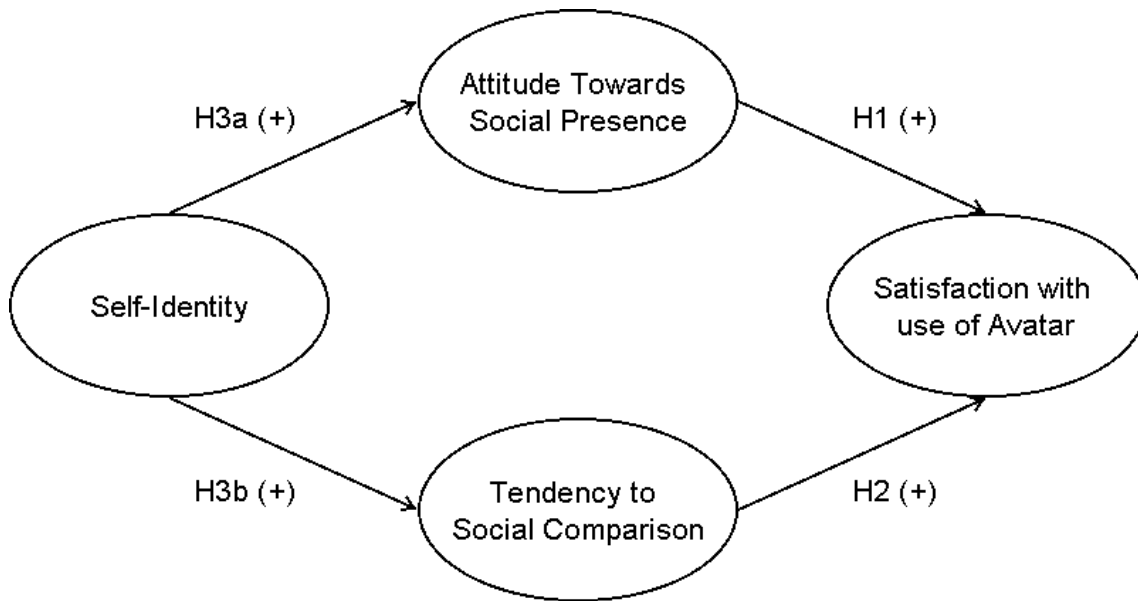
Figure 1. Proposed Research Model

III. METHODS

DATA COLLECTION

The research model was tested using a field experiment. The subjects in the experiment were students in a core course in Management Information Systems at a major North American university. Participation in the experiment was voluntary; students choosing not to participate were given an alternate assignment. Subjects were asked to choose one of three virtual communities, join that virtual community, and participate in that virtual community for two weeks (spending at least 30 minutes total on the virtual community Web site). Subjects were allowed to select which virtual community they wanted to join in the hopes that an element of choice would help increase their interest in exploring the use of avatars. The three virtual communities subjects were able to choose from were avatarity.com, thepalace.com, and tcz.org. Each of the three virtual communities allows members to create an avatar as well as engage in traditional virtual community activities such as chatting and instant messaging (IM)[2]. The subjects were asked to imagine that they were in one of the given virtual communities, and had enough money to customize their avatar. After the period of participation had passed, a survey was distributed to the subjects to gauge their perceptions (see Appendix IV for the survey instrument). To verify usage, subjects were required to submit screen shots of each visit to the virtual community Web site.

Out of 184 students in the course, 134 chose to become subjects in the experiment. The ages of the subjects ranged from 19-49 years old, and the average age was 21.1 years. Subjects aged 19-21 composed 85 percent of our population; 118 were upper-division undergraduates.

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[2] The virtual community "avatarity.com" allows a participant to create an avatar or use an avatar that was posted by another user. Avatars are used in online forums, Web pages, chat rooms, and/or instant messenger profiles. The virtual community "tcz.org" (The Chatting Zone) is a virtual community where participants can create avatars and build a virtual world in which they can interact with others. The virtual community "thepalace.com" allows users to create and use avatars. In this community, users can build their own chat server and make it a part of the community. Each virtual community is free to join, but customization of avatars requires a fee.

Approximately 50 percent of the subjects were male and 50 percent were female. Of the 134 subjects, 62 chose avatarity.com, 39 selected thepalace.com, and 33 picked tcz.org as their target virtual community.   ANOVA analysis indicated no significant differences among the avatarity.com group, the thepalace.com group, or the tcz.org group. Results of this ANOVA analysis appear in Appendix V in Table A. Respondents were asked to rate their experience with computers and with the World Wide Web in general. On a scale of 1 to 7, with 1 being a novice and 7 being an expert, this group of subjects considered themselves to be experienced users of computers (4.6) and near the middle of the scale on their use of the World Wide Web (4.0).

The use of undergraduate students in this study was an appropriate choice because college students and college graduates compose the vast majority of Internet users. To help develop an understanding of behavior regarding the use of virtual communities, college students seem to be a logical choice. It has been reported that major users of the Internet are individuals who have a college degree and are 16 to 44 years old [Hoffman et al. 1996]. The subject pool for this study has a very similar demographic makeup.

OPERATIONALIZATION OF RESEARCH CONSTRUCTS

In this study, the scales for measuring the research constructs were developed based on previous literature to ensure the content validity of the instrument. Constructs, operational definitions of those constructs, and the sources of those definitions are reported in Table 1. We performed a pilot test using 20 subjects as a preliminary validation of our measures.

RELIABILITY AND VALIDITY

We used *Mplus* software for the estimation of the measurement model. The reliability of first-order constructs was measured using Cronbach's alpha, composite factor reliability (CFR), and average variance extracted (AVE).   All Cronbach's alpha values are well above the recommended threshold of 0.70. Similarly, all CFR values are well above the cut-off value of 0.70 and all AVE values are well above the cut-off value of 0.50 [Segars, 1997]. The values for these measures (see Table 2) provide support for the reliability of the constructs.

We also carried out confirmatory factor analysis (CFA) to establish convergent validity. The CFA factor loadings, t-values, and item R^2 values are reported in Table 3, which shows that most item factor loadings are significant and all exceed 0.70. The high values for factor loadings support convergent validity for the constructs. Furthermore, the t-values for factor loadings of manifest variables

Table 1. Construct Definition and Sources for Item Development

Constructs	Operational Definition	Sources
Self Identity (SEID)	An individual's perception that he or she is a member of the community in which he or she uses an avatar.	[Stryker and Burke 2000]
Social Presence (SP)	An individual's like or dislike of establishing close, interpersonal connections with other individuals	[Fulk et al. 1990; Short et al. 1976; Yoo and Alavi 2001]
Social Comparison (SC)	An individual's tendency to compare himself or herself with other people	[Dakin and Arrowood 1981; Oliver 1997]
Satisfaction (SATIS)	Degree of pleasurable fulfillment an individual derives from using an avatar	[McKinney et al. 2002]

Table 2. Reliability Measures for Model Constructs

Constructs	Alpha	Composite Factor Reliability	Average Variance Extracted
1. Self-identity (SEID)	0.89	0.87	0.63
2. Social presence (SP)	0.83	0.86	0.67
3. Social comparison (SC)	0.83	0.90	0.75
4. Satisfaction (SATIS)	0.92	0.91	0.72

were well above 2.0, supporting the statistical significance of factor loadings [Muthén and Muthén 2003]. The data presented in Tables 2 and 3 indicates that all conditions for convergent validity are met [Fornell and Larcker, 1981]. The correlation matrix for the items is reported in Appendix V, Table B.

Table 3. Confirmatory Factor Analysis: Measurement Model

Constructs	Items	Loading	t-value	R^2
Self identity	SEID1	0.97	10.64	0.68
	SEID2	0.97	14.08	0.76
	SEID3	1.00	0.00	0.68
	SEID4	0.86	11.79	0.59
Social presence	SP1	0.94	9.00	0.47
	SP2	0.97	10.50	0.72
	SP3	1.00	0.00	0.77
Social comparison	SC1	0.92	12.08	0.68
	SC2	0.85	12.38	0.73
	SC3	1.00	0.00	0.75
Satisfaction	SATIS1	0.76	14.14	0.64
	SATIS2	0.99	33.45	0.90
	SATIS3	1.00	0.00	0.94
	SATIS4	0.82	15.67	0.71

One guideline for discriminant validity is that the square root of AVE for each construct should be greater than correlation values of any construct with other constructs [Fornell and Larcker 1981; Segars 1997]. Table 4 shows that the square root of AVE of each construct is greater than its correlation with other constructs.

Table 4. Construct Correlation and Discriminant Validity

Constructs	Construct Correlation[a]			
	1	2	3	4
1. Self-identity (SEID)	(0.79)			
2. Social presence (SP)	0.50	(0.82)		
3. Social comparison (SC)	0.50	0.30	(0.87)	
4. Satisfaction (SATIS)	0.64	0.54	0.39	(0.85)

[a] Value on the diagonal represents the square root of AVE.

We further assessed discriminant validity by comparing the original measurement model with three latent variables against other measurement models with three constructs, which included every possible combination of collapsing two constructs into one [Gefen et al. 2003; Song and Zahedi 2005]. Table 5 shows that the chi-square of the original CFA is significantly smaller than the CFA of any alternative model. Since combining two latent variables adds three degrees of freedom to the model, the chi-square differences between the original CFA and any alternative model should be greater than 11.34 (p = 0.01). All differences are above the threshold. The chi-square value in the original CFA was significantly better than the reduced measurement models. Thus, the criteria for discriminant validity are met.

Table 5. Pair-wise Discriminant Analysis of Constructs

Models	χ^2_{df}	χ^2 difference from original
Original measurement model	$\chi^2_{38} = 48.61$	-
Satisfaction and social presence	$\chi^2_{41} = 114.37$	65.76
Satisfaction and social comparison	$\chi^2_{41} = 219.24$	170.63
Satisfaction and self identity	$\chi^2_{41} = 131.51$	82.90
Social presence and social comparison	$\chi^2_{41} = 144.42$	95.81
Social presence and self identity	$\chi^2_{41} = 119.54$	70.93
Social comparison and self identity	$\chi^2_{41} = 137.10$	88.49

Fit indices for the measurement model were calculated. The normed chi-square (χ^2 / degree of freedom) is 1.33, which is below the recommended cut-off value of 3 [Gefen et al. 2003]. Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) are both 0.98, above the cut-off value of 0.90 for the case of continuous outcomes [Bhattacherjee 2002; Hu and Bentler 1999]. The Goodness-of-Fit Index (GFI) is 0.93, and the Adjusted Goodness-of-Fit Index (AGFI) is 0.91; both of these are also above their recommended cut-off values [Gefen et al. 2000]. Furthermore, the Normed Fit Index (NFI) and the Non-normed Fit Index (NNFI) are 0.93 and 0.98, respectively, both above the cut-off value of 0.90. Root Mean Square Error of Approximation (RMSEA) is 0.050 below the 0.06 cut-off for continuous variables [Hu and Bentler 1999], indicating a

satisfactory model fit. In addition, we investigated the Standardized Root Mean Square Residual (SRMR) as an index for badness-of-fit [Muthén and Muthén 2003].   The SRMR for the measurement model was 0.055 which well below the suggested threshold of 0.10, providing further support for the model fit [Byrn 1998; Hu and Bentler 1999].   Overall, these results (summarized in Table 6) suggest that the measurement model adequately fits the data.

Table 6. Fit Indices for the Measurement Model

Goodness of Fit Indices	Measurement Model	Recommended Cut-off
Normed Chi-square (Chi-square / d.f.)	1.33	Below 3
CFI (Comparative Fit Index)	0.98	Above 0.90
TLI (Tucker-Lewis Index)	0.98	Above 0.90
GFI (Goodness of fit Index)	0.93	Above 0.90
AGFI (Adjusted Goodness of Fit Index)	0.91	Above 0.80
NFI (Normed Fit Index)	0.93	Above 0.90
NNFI (Non-normed Fit Index)	0.98	Above 0.90
RMSEA (Root Mean Square Error of Approximation)	0.050	Below 0.06
SRMR (Standardized Root Mean Square Residual)	0.055	Below 0.10

We also check for common method variance.   "Method variance refers variance that is attributable to the measurement method rather than the construct of interest" [Podsakoff et al. 2003, p. 879]. In many behavioral studies, the nature of self-reported data and the logical flow of items can cause common method variance. It has been noted that only a few published papers have addressed common method variance despite frequent use of self-report surveys [Woszczynski and Whitman 2001]. In this study, we carried out Harman's single factor test. This test involves an exploratory factor analysis to determine how much variance is explained by one general factor [Podsakoff et al. 2003].   This test compares the loading of all items on a latent factor to the loading of all items on their theoretical constructs.   Harman's test showed that the first factor accounts for 23.7 percent of variance. According to Podsakoff et al. [2003], there is no absolute guideline in determining a general factor. When 20 percent of variance is explained by the first factor, this is not necessarily indicative of common method bias [Igbaria and Tan 1997; Song and Zahedi 2005].   Therefore, we find little reason to suspect common method bias.

IV. RESULTS

The estimated model has a normed chi-square (chi-square/d.f.) of 1.33, which is below the recommended threshold of 3 [Gefen et al., 2003] As Table 7 shows, the CFI and TLI are 0.98. Both are above the cut-off value of 0.90 that is recommended for continuous outcomes case [Bhattacherjee 2002; Hu and Bentler 1999]. The GFI and AGFI are 0.93 and 0.90, respectively. Both are above their respective recommended cutoff values of 0.90 [Gefen et al. 2000]. Furthermore, the NFI and NNFI are 0.93 and 0.98, respectively.   Again, both are above their recommended cut-off values of 0.90. The RMSEA and SRMR are 0.050 and 0.054, respectively. These final two badness-of-fit indices are both below the recommended cut-off values of 0.10 and 0.06, respectively.   In sum, these fit indices provide support for model fit.

Hypothesis 1 posits that a virtual community member's attitude toward social presence influences the member's satisfaction with an avatar. This hypothesis was supported with a t-value of 6.17.

Hypothesis 2 (H1 and H2) posits that social comparison influences virtual community members' satisfaction with the use of an avatar. This hypothesis was supported with a t-value of 3.36. The R^2 for the final dependent variable, "Satisfaction with use of avatar" is 0.38. Hypotheses 3a and 3b posit that social presence and social comparison are formed by self-identity. Both of these hypotheses were supported as well. The t-value for H3a is 6.11; the t-value for H3b is 5.73. The t-values for all hypotheses were significant at the $p < 0.05$ level (H1: $p < 0.0001$, H2: $p < 0.0012$, H3a: $p < 0.0001$, H3b: $p < 0.0001$; these values were computed manually using the t-value and the degrees of freedom). The R^2 for "Attitude Toward Social Presence" is 0.29 and the R^2 for "Tendency to Social Comparison" is 0.26. These results indicate that people who identify themselves as members of a virtual community desire to be present in that community and tend to compare themselves with other members of the community (H3a and H3b). Furthermore, those who desire to be present in a virtual community and who compare themselves with other members of the virtual community are likely to be satisfied with the use of an avatar in a virtual community (H1 and H2). These results are depicted in Figure 2.

Table 7. Fit Indices for Estimated Model

	Estimated Model	Recommended Cut-off
Normed Chi-square (Chi-square / d.f.)	1.33	Below 3
CFI (Comparative Fit Index)	0.98	Above 0.90
TLI (Tucker-Lewis Index)	0.98	Above 0.90
GFI (Goodness of fit Index)	0.93	Above 0.90
AGFI (Adjusted Goodness of Fit Index)	0.90	Above 0.80
NFI (Normed Fit Index)	0.93	Above 0.90
NNFI (Non-normed Fit Index)	0.98	Above 0.90
RMSEA (Root Mean Square Error of Approximation)	0.050	Below 0.06
SRMR (Standardized Root Mean Square Residual)	0.054	Below 0.10

V. DISCUSSION AND CONCLUSION

This study has proposed a model of social factors that influence virtual community members' satisfaction with the use of avatars and conducted an initial test of the model. The results of the analysis lend support to the proposed model. In general, virtual community members that have a strong identification with a virtual community have relatively strong desires for social presence and social comparison. Desires for social presence and social comparison in turn influence virtual community members' satisfaction with the use of an avatar in a virtual community. People who have an interest in social comparison thus may be satisfied with avatars and with virtual communities that provide various tools for comparing one's avatar to others'. In this study, we presuppose that social presence and social comparison are primary desires of virtual community members and have provided support for the idea that the satisfaction of those desires facilitates satisfaction.
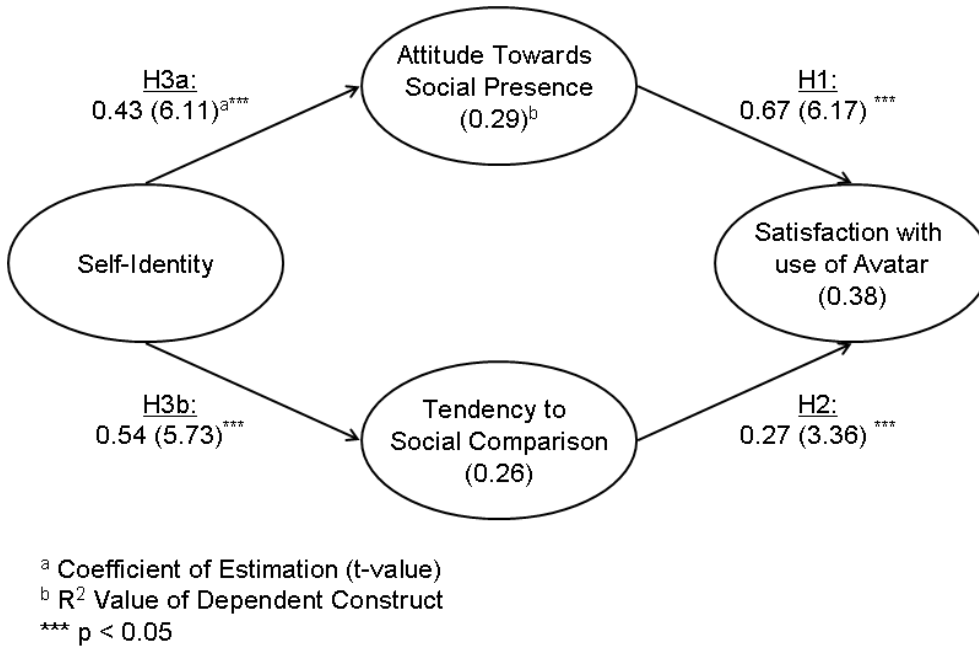
a Coefficient of Estimation (t-value)
b R^2 Value of Dependent Construct
*** p < 0.05

Figure 2. Estimated Model

IMPORTANCE OF FINDINGS AND IMPLICATIONS

Theoretical Implications

The theoretical implications of this study center on the understanding of the use of social software including avatars, virtual communities, and social networking Web sites. This study identifies factors (including self-identity, social presence, and social comparison) that can be used to examine the use of software that facilitates or enables social interaction. Hence, the proposed research model could be used to explain the use of other types of social software.

In addition, the model can be extended to include a variety of aspects that are related to the fulfillment of virtual community members' needs. For example, future research can add technical characteristics of avatars and personal belief systems to the model to explain satisfaction with avatars. Furthermore, our conceptual model could provide a basis for investigating the feedback effect of continuous use of avatars over time through which the dynamics of customer satisfaction and re-visit intention may be investigated.

Managerial Implications

This study also has significant implications for practitioners. Because avatars improve customers' satisfaction as well as increase their purchase intention [Holzwarth 2006], the findings of this study may help managers understand what features their e-commerce site should have. Because social comparisons and opportunities to build relationships positively influence satisfaction with avatars, businesses may want to develop virtual communities that allow clear comparisons of virtual community members' characteristics. Our findings support the notion that features such as instant messaging and chat rooms may be more than simply a diversion for community members; they may serve to facilitate satisfaction with aspects of the virtual community.   The opportunity to personalize an avatar with clothing, hairstyles, or other accessories may also serve to improve community members' satisfaction with their avatars. Thus, avatars may be viewed as facilitators of business rather than simply as intriguing diversions for virtual community members.

Additionally, e-businesses may develop methods to enhance customer satisfaction and loyalty using avatars. Imagine that a shoe company provides avatars to its customers. The avatar may include specific information about a customer's appearance and act as a model to try on various types of shoes. The shoes could be modeled with various clothes, and perhaps discounts could be granted to customers who have visited the Web site and "tried on" shoes. Such an approach could increase customers' willingness to purchase shoes online. Even if those customers chose to purchase in a physical store, they would have already collected a significant amount of information about the shoes and thus, the salesperson would be able to interact more efficiently with the customer. Examples of avatar use can be imagined for other lines of business as well. Avatar-enabled shopping could act as a catalyst for e-commerce.

LIMITATIONS AND FUTURE RESEARCH

As do all social science studies, this study has limitations and could be improved upon in the future. First, students were our study subjects, which may cause some to question the external validity of our results. We contend, however, that students are an appropriate population from which to draw our subjects, particularly because the descriptive statistics for our sample closely approximate those of the general population of Internet users (as we noted in Section III). Future research may replicate our work with a different population. A closely related limitation is the absence of a control group in this experiment. Future research may include such a group to buttress our findings.

Second, few participants had experience with avatars in virtual communities. To examine the effect of satisfaction on intention to revisit a virtual community site, future studies may collect data at several points in time to develop a more comprehensive picture of virtual community member behavior. Such an approach would provide more comprehensive information about satisfaction with avatar use. It is conceivable that new virtual community members may display a recency effect where members who have an initial negative or positive experience using an avatar may over-react at the time their perceptions are measured. A better measure of actual satisfaction is when someone returns at a later date, rather than simply expresses a promise to return.

Third, there are factors other than social factors that may influence virtual community members' satisfaction with avatars. These may include community members' perceptions of the ease of use and usefulness of the avatar, the accessibility of the avatar, and the trust between the virtual community member and others in the community. While our model does explain 38 percent of the variation in satisfaction with avatars, the remaining variation may be explained by these additional factors. Future studies should thus investigate additional factors that may also be relevant to satisfaction with avatars.

Fourth, we note that approximately 27 percent of the students in the course from which subjects were drawn chose not to participate. This may indicate that some individuals may not want to use avatars. If such a group of individuals does exist, marketers may want to know how to distinguish between individuals that are willing to use avatars and those who are unwilling. Identifying individuals who do not want to use avatars therefore represents a possible area for future research.

Finally, additional relationships between our constructs could be investigated. Post-hoc analysis (not included here in the interest of space) revealed a potential relationship between self-identity and satisfaction. To our knowledge, no literature exists to support such a relationship, so this potential relationship should be viewed with great caution and subjected to intense scrutiny in future work.

CONCLUSION

Given that avatars improve satisfaction and increase purchase intention [Holzwarth 2006], the knowledge of how to increase satisfaction with avatars should prove valuable to businesses with an online presence. Taken in sum, our results indicate that there are specific features that might

be incorporated into e-commerce sites to facilitate customer satisfaction. As the ubiquity of Internet technology continues to increase, businesses may be able to leverage the results of this research to attract customers and increase revenue.

Editor's Note: This article was received on August 31, 2006. It was with the authors seven months for two revisions.

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APPENDIX I: EXAMPLES OF AVATARS

The avatar depicted in Figure I-A is from the virtual community "The Palace," a virtual community used in this study. The figure depicts the avatar itself and the menus available when creating the avatar. Clothing, hairstyles, and other accessories may be customized by the virtual community member. Avatars created in other virtual communities may have slightly different options, but generally allow customizations similar to the one shown here.
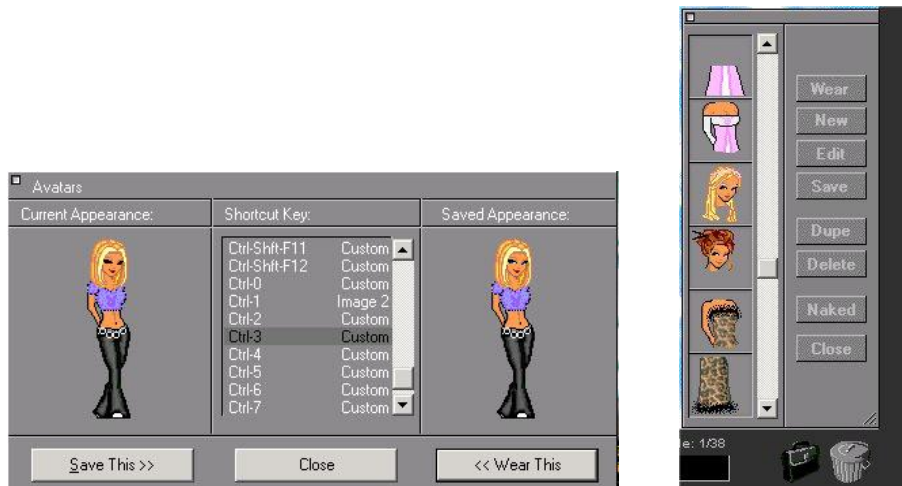
Figure I-A. "The Palace" Avatar

APPENDIX II: USE OF AVATARS IN E-COMMERCE

Avatars have been used in chatting, gaming, and online shopping. They are considered to directly affect companies' profits. The uses of avatars can be categorized into seven types: the sale of the avatar and related accessories, avatar advertising, avatar chatting, two-way communication, avatars in Internet shopping malls, public communication tools, and as tools to boost customer satisfaction. Table II-A shows the details of each of these types of avatar use.

Table II-A. The Types of Avatar Use

Type	Examples
Sale of Avatars and Accessories	Online communities such as Freechal and Neowiz sell various accessories for avatars such as clothes, hats, sunglasses, and wigs. Currently, the price range of avatar accessories is between $0.10 to $300, while the accessories raging from $1.00 to $5.00 are most common. (Source: Digital Chosun.com).
Avatar Advertising	SK Communication, one of the largest Korean telecommunications companies, provided customers with free text message service through which they downloaded avatars wearing branded clothing. (Source: digital times).
Avatar Chatting	Freecal and Neowiz are the leading companies for avatar-enabled chatting. In particular, Neowiz's profits are strongly related to avatar sales. (Source: Digital Chosun.com).
Two-Way Communication	Quiny, a cable TV program in Korea, makes people feel that they are in the cable TV program by showing their avatars on the T.V. In the program, avatars can sing songs, run, or even fly through the air (Source: Digital Times).
Avatars in Internet Shopping Malls	Daum internet shopping, an on-line company using 3-D avatars, sold luxury sunglasses by allowing customers to first select the most similar 3-D avatar face and to try on the luxury sun-glasses. The 360^0 rotation of the 3-D avatar helps shoppers see what the sunglasses will look like if they choose to purchase them (Source: digital times).
Avatars as Tools to Boost Customer Satisfaction	Miclub uses avatars to develop customer loyalty. The more often customers use the company, the more advanced and specialized are the avatar accessories that are provided to them (Source: Edaily.com).

APPENDIX III. SUMMARY OF SELECTED SOCIAL THEORIES USED IN IS RESEARCH

In Appendix III, we have summarized the social theories that have been used in IS research. We also present the contexts for these studies, the constructs used in the studies, and a condensation of the findings from these studies. This summary may represent a valuable contribution to researchers working in this area.

Table III-A. Summary of Selected Social Theories in IS studies

Theories	Authors	Study Context	Constructs	Findings
Social Exchange Theory/ Social Capital	[Gefen and Ridings 2002]	CRM	Perceived Responsiveness (PR), Cooperative intentions (CI), Configuration correctness (CC), User approval (UA)	PR → CI and CC CI → CC CC → UA
	[Kankanhalli et al. 2005]	Electronic Knowledge Repositories (EKR)	*Cost* (Loss of knowledge power (LKP), Codification Effort –Trust (CET), Codification Effort – Norms (CEN), Codification Effort – Identification (CEI) *Extrinsic Benefits* (ORG reward (ORG-RE), identification (ORG- ID), Image (IM), Reciprocity (RP)) *Intrinsic Benefits* (Self efficacy (SE), Enjoyment (ENJ) EKR Usage	CET, ORG-RE, ORG-ID, RP, SE, ENJ → EKR Usage
	[Wasko and Faraj 2005]	Electronic Knowledge Management	Individual Motivations: Reputation (RE), Enjoy Helping (ENJ) Structural Capital: Centrality (CEN) Cognitive Capital: Self-rated expertise (EXP), Tenure in the filed (TEN) Rational Capital: Commitment (COM), reciprocity (RP) Knowledge Contribution (KC)	*Helpfulness of Contribution*: RE, ENJ, CEN, COM → KC *Volume of Contribution*: RE, CEN, TEN, RP → KC
Social	[Malhotra and	Volitional	Perceived Usefulness (PU), Perceived Ease of Use	PU → A; PU → BI

Theories	Authors	Study Context	Constructs	Findings
Influence Theory/ Social Information Processing	Galletta 2005]	Systems Adoption	(PEOU), Attitude (A), Behavioral Intention (BI), Commitment to System Use (Internationalization based (INT), Identification based (IDN), Compliance based (COMP))	INT and IDN → PU INT, IDN, COMP → PEOU INT, IDN, COMP → BI
	[Gallivan et al. 2005]	IT Training (IT Usage)	Amount of User Training (AUT), Quality of User Training (QT), Computer Self Efficacy (SE), Coworkers' Quality of User Training (CQT), Coworkers' Computer Self Efficacy (CSE), Coworkers' IT Usage (CITU), Coworkers' Perceived Usefulness (CPU), Amount of IT Usage (ITU)	QT → ITU CQT → ITU CITU → ITU CSE → CITU CSE → CQT
Social	[Compeau et al. 1999]	General IT	SE, Expected Performance Outcome (PerfOut), Expected Personal Outcome (PersOut), Affect, Anxiety, Usage	SE → PerfOut, PersOut SE, PerfOut → Affect SE → Anxiety SE, PerfOut, PersOut → Usage
Theory of Reasoned Action / Theory of Planned Behavior	[Taylor and Todd 1995]	IT Computing Service	*Attitude*: PEOU, PU, Compatibility (COM) *Subjective Norm* (SN): Peer influence (PI), superior's influence (SI) *Perceived Behavioral Control* (PBC): SE, Resource Facilitating Condition (RFC), Technology Facilitating Condition (TFC) Behavioral Intention	PU → A PI, SI → SN SE, RFC → PBC A, SN, PBC → BI
	[Song et al. 2005]	E-Commerce Web Site	*Attitude* (A): (Perceived Price (PP), Perceived Service (PS) *External Subjective Norm* (ESN): External Normative Belief (ENB) *Perceived Behavioral Control* (PBC): SE, Resource Facilitating (RF)	PP, PS → A ENB → ESN SE, RF → PBC A, ESN, PBC → BI

Theories	Authors	Study Context	Constructs	Findings
			Behavioral Intention	
	[Pavlou and Fygenson 2006]	E-Commerce	*Attitude*: PEOU, PU, Trust Subjective Norm *Perceived Behavioral Control* (PBC): SE, Controllability Behavioral Intention (BI)	*Getting Information*: Trust, PU, PEOU → Attitude Trust, Download delay, Time, Navigation → Controllability Navigation, Skills → SE Attitude. PBC → BI PBC, BI → Getting Info Behavior *Purchasing:* PU, PEOU, Trust, Monetary Resource, Product value, Product diagonosticity → Attitude Monetary Resource, Product value, Product diagonosticity, Information protection → Controllability Product diagonosticity, Skills → SE Attitude. PBC → BI PBC, BI → Purchasing Behavior
Social Presence	[Yoo and Alavi 2001]		Media Condition (MC), Group cohesion (GC), Social presence (SP), Task Participation (TP), Consensus	*Zero History Group*: MC → SP, MC → TP *Established Group*: MC, GC → SP GC → TP TP → Consensus
Self/Social	[Gefen and	CRM	Perceived Responsiveness (PR), Perceived Group	PR → PGB

Theories	Authors	Study Context	Constructs	Findings
Identity	Ridings 2003]		Boundary (PGB), Perceived Shared Value (PSV), Software Correctness (SC)	PR → PSV PGB, PSV → SC

	[Lee et al. 2003b]	WebCT	Self Identity (SI), PEOU, SN, PU, Behavioral Intention (BI), Behavior (B)	*Voluntary and Mandatory*:
				
				Experienced and Inexperienced user
				
				  SN → PU
				
				  SI → PU, PEOU
				
				  PEOU → PU
				
				  PEOU, PU → BI
				
				  BI → B

Social Comparison	[Ang and Slaughter 2001]	Software Development	Attitude (Organization Support (OS), Distributive justice (DJ), Alienation (AL)), Behavior (In-role behavior (IB), Extra-role behavior (EB)), Performance (Loyalty, Obedience, Trustworthiness, performance)	*Different between Contractors (C) and Permanent Professionals (PP):* OS: C > PP IB & EB: C < PP Loyalty & Performance: C < PP
	[Shepherd et al. 1996]	Brainstroming	Number of Unique idea, Social Comparison (SC)	One has social comparison generated more unique ideas than one has no social comparison

APPENDIX IV. SURVEY INSTRUMENT

All items were measured on a seven-point Likert scale [1: Strongly disagree, 7: Strongly agree]

Self identity

SEID1   I am a person who considers the community in which I use Avatar important.

SEID2   I am a person who sees myself as belonging to the community in which I use Avatar.

SEID3   I believe that I fit very well into the member of the community in which I use Avatar.

SEID4   I am a person who criticizes the community in which I use Avatar.

Social Presence

SP1   Having a social interaction with other people in the community is extremely beneficial.

SP2   Making a friendly interaction with other people in the community is extremely pleasant.

SP3   Establishing interpersonal connections with other people during online communication is extremely wise.

Social Comparison

SC1   I always compare my Avatar to that of other members to check which is more attractive.

SC2   I always evaluate the efforts I put in my Avatar relative to those of other.

SC3   I usually judge the attractiveness of my Avatar against that of others.

Satisfaction

Satis1   I am satisfied with my decision to use Avatar.

Satis2   I am happy that I am using Avatar.

Satis3   I am sure it is the right thing to use Avatar.

Satis4   I have truly enjoyed Avatar.

APPENDIX V: SUPPORTING TABLES

To demonstrate that there were no significant differences among the three groups of participants (those who chose avatarity.com, those who chose thepalace.com, and those who chose tcz.org), we have performed one-way ANOVA analysis. These results indicate that there were no significant differences among the three groups on any of the survey items.

Table V-A. One-Way ANOVA Analysis

		Sum of Squares	df	Mean Square	F	Sig.
SEID1	Between Groups	.712	2	.356	.129	.879
	Within Groups	318.076	115	2.766		
	Total	318.788	117			

		Sum of Squares	df	Mean Square	F	Sig.
SEID2	Between Groups	.099	2	.050	.020	.981
	Within Groups	290.240	115	2.524		
	Total	290.339	117			
SEID3	Between Groups	1.664	2	.832	.265	.768
	Within Groups	360.989	115	3.139		
	Total	362.653	117			
SEID4	Between Groups	3.963	2	1.981	.797	.453
	Within Groups	285.741	115	2.485		
	Total	289.703	117			
SP1	Between Groups	2.223	2	1.112	.415	.661
	Within Groups	307.718	115	2.676		
	Total	309.941	117			
SP2	Between Groups	.682	2	.341	.191	.826
	Within Groups	204.810	115	1.781		
	Total	205.492	117			
SP3	Between Groups	2.801	2	1.400	.806	.449
	Within Groups	199.810	115	1.737		
	Total	202.610	117			
SC1	Between Groups	.091	2	.046	.016	.984
	Within Groups	333.197	115	2.897		
	Total	333.288	117			
SC2	Between Groups	1.113	2	.557	.248	.781
	Within Groups	258.590	115	2.249		
	Total	259.703	117			
SC3	Between Groups	1.112	2	.556	.187	.830
	Within Groups	341.939	115	2.973		
	Total	343.051	117			
SATIS1	Between Groups	3.904	2	1.952	.901	.409
	Within Groups	249.248	115	2.167		
	Total	253.153	117			
SATIS2	Between Groups	9.336	2	4.668	1.818	.167
	Within Groups	295.215	115	2.567		
	Total	304.551	117			
SATIS3	Between Groups	11.640	2	5.820	2.394	.096

		Sum of Squares	df	Mean Square	F	Sig.
	Within Groups	279.614	115	2.431		
	Total	291.254	117			
SATIS4	Between Groups	10.005	2	5.003	2.218	.113
	Within Groups	259.351	115	2.255		
	Total	269.356	117			

Table V-B. Item Correlation

	Mean	Std	1	2	3	4	5	6	7	8	9	10	11	12	13
1. SEID1	2.98	1.67	1.00												
2. SEID2	3.13	1.58	0.73	1.00											
3. SEID3	2.60	1.73	0.65	0.72	1.00										
4. SEID4	3.22	1.59	0.63	0.66	0.65	1.00									
5. SP1	3.86	1.57	0.45	0.42	0.50	0.30	1.00								
6. SP2	4.49	1.31	0.30	0.28	0.33	0.28	0.60	1.00							
7. SP3	4.81	1.31	0.34	0.38	0.38	0.33	0.57	0.76	1.00						
8. SC1	3.50	1.69	0.50	0.37	0.39	0.38	0.29	0.23	0.25	1.00					
9. SC2	3.28	1.50	0.36	0.35	0.42	0.42	0.26	0.20	0.23	0.68	1.00				
10. SC3	3.47	1.74	0.34	0.25	0.31	0.23	0.25	0.17	0.16	0.72	0.75	1.00			
11. SATIS1	4.10	1.48	0.45	0.51	0.45	0.40	0.40	0.39	0.47	0.28	0.25	0.17	1.00		
12. SATIS2	3.81	1.64	0.51	0.51	0.51	0.45	0.38	0.36	0.47	0.41	0.35	0.31	0.76	1.00	
13. SATIS3	3.81	1.61	0.50	0.53	0.50	0.45	0.42	0.38	0.47	0.39	0.28	0.26	0.77	0.92	1.00
14. SATIS4	3.77	1.54	0.46	0.52	0.51	0.42	0.42	0.31	0.46	0.37	0.29	0.24	0.72	0.77	0.82

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