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User behavior toward preventive technologies – cultural differences between the United States and South Korea

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USER BEHAVIOR TOWARD PROTECTIVE TECHNOLOGIES – CULTURAL DIFFERENCES BETWEEN THE UNITED STATES AND SOUTH KOREA

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Abstract

Protective technologies -- computer technologies that secure data and systems from viruses, unauthorized access, disruptions, spyware, and other threats -- have become increasingly important in the globally networked economy and society. Yet, little is known about user attitudes and behavior and their determinants, especially across cultures. This study examines cross-cultural differences between South Korea and the United States in user behavior toward protective technologies in the context of anti-spyware technologies. The theoretical model developed is based on the framework of the theory of planned behavior and Hofstede's cultural dimensions and indices. Several hypotheses about the moderating effect of culture on the strength of the model's relationships were developed. The model was then empirically tested using structural equation modeling techniques and multigroup analysis. Most of the hypothesized differences were found to be statistically significant between the two cultures. Theoretical and practical implications of the study are discussed. We believe that the findings of this study could offer some insights into designing effective information security policies, practices, and technologies for different cultures and improve our knowledge about user behavior in difference cultures.

Keywords: protective technologies, spyware, awareness, cross-cultural differences

1 INTRODUCTION

The expansion and globalization of computer and Internet usage have generated many unintended consequences. While individuals, organizations, and society have benefited tremendously from the widespread applications of information technology (IT), computer users have become increasingly vulnerable to the threats posed by the negative technologies designed to disrupt or harm systems, individuals, and organizations, such as hacking tools, computer viruses, and spyware. Unfortunately, the technologies designed to protect individual users and organizational systems from these negative technologies often lag behind both in terms of variety and complexity. What has made the situation even worse is the fact that many computer users are complacent about the potential danger of negative technologies and often avoid using protective technologies (Hu and Dinev, 2005). Thus combating the threats of negative technologies requires a balance between developing effective protective technologies and persuading users to adopt and use these technologies.

Unlike the technologies designed to enhance the productivity or experience of the users, protective technologies usually do not produce any measurable benefits to their users. In order to design effective policies and practices on corporate, social, and individual levels to successfully defend against the negative technologies, a thorough understanding of user attitudes, intentions and behavior toward the protective technologies is necessary. Although academic studies focusing on these issues are just beginning to emerge (Bagchi and Udo 2003, Stafford and Urbaczewski, 2004; Hu and Dinev, 2005), strong theoretical foundations and empirical validations are still lacking (Stafford and Urbaczewski 2004). What makes the matter even more complex is the fact that more and more users are connecting to the Internet from their homes or workplaces, controlling the inputs, processing, and outputs, choosing which technologies and applications to download, install and use. The security and privacy risks in this type of environment are both high and convoluted. It is necessary to understand how users perceive the threats and why they intend to use some, and ignore other, protective technologies.

Our research involves studying computer users' attitudes and behaviors in the following unique set of circumstances: 1) the users engage in various Internet activities voluntarily, not because of organizational demands and policies; 2) protective technologies are used for the sole purpose of countering the impact of negative technologies where the "use one IT to counter another IT" scenario is more complex than traditional technology usage; and 3) there is no measurable positive impact on user performance. This is because it is impossible to know for sure how much money or how many hours have been saved because of anti-virus, anti-spyware or fire-walls in use. At best, the original healthy state of computer systems is preserved and users can avoid disruption of their activities. We conduct our study based on the integrated model developed by Hu and Dinev (2005) with a focus of identifying the impact of cultural factors on user behavior. We recognize the importance of the global involvement in the fight against these negative technologies and the importance of building awareness among all Internet users about the consequences of the threats caused by viruses and spyware. Studying the cultural effects on user behavior will contribute to the global fight against negative technologies. For cross cultural comparison, we chose subjects from the United States and South Korea for several reasons. First, both countries are democracies with well developed economies. Second, historically, the ethos of both countries shaped different philosophies and values. Finally, the researchers have access to a large number of college students enrolled in similar undergraduate programs that makes the comparison more relevant.

2 THEORETICAL FRAMEWORK

2.1 User Behavior and Cultural Dimensions

For the purpose of cross cultural comparison, we adopted the theoretical model developed by Hu and Dinev (2005) for understanding computer user behavior towards protective technologies (Figure 1). This model drew upon the theory of planned behavior (TPB) (Ajzen, 1988, 2002) as well as the integrated model of user acceptance of e-commerce developed by Pavlou and Fygenson (2005). TPB contends that a person's behavior (B) is determined by his or her intention to perform the behavior of interest. This behavioral intention (BI) is in turn determined by three factors: attitude toward the behavior (ATB), subjective norm (SN), and perceived behavioral control (PBC). ATB refers to a person's judgment on whether it is good or bad to perform a behavior of interest. SN is a person's perception of the social pressure to perform or not perform the behavior in question. SN thus reflects the individual's perceptions of whether the behavior is accepted and encouraged by influential people in the individual's social circles. Finally, PBC refers to the perceived ease or difficulty of performing the behavior and is an antecedent to both intention and behavior (Ajzen 1988). Pavlou and Fygenson (2005) used two subconstructs as underlying dimensions of PBC – self-efficacy (SE) and controllability (C). Self-efficacy is defined as the individual's judgment of one's skills and capabilities to perform the behavior (Bandura 1986). Controllability is defined as the individual's judgment about the availability of resources and opportunities for performing the behavior (Ajzen 2002, Pavlou and Fygenson, 2005). Additionally, two key constructs, perceived ease of use (PEOU) and perceived

usefulness (PU) influence user attitudes toward the technology (Davis, 1989), with PEOU also influencing PBC (Pavlou and Fygenson, 2005).

Hu and Dinev's (2005) model described the formation of user behavioral intentions and actual behavior in response to negative technologies such as cyber attacks, viruses, and spyware. The study investigated the determinants of individual usage of technologies that clean, eliminate, or protect personal computer systems from intrusions of negative technologies. They showed that a new construct, namely technology awareness, emerged as crucial and strong predictor of user behavioral intention, actual behavior, subjective norm, and user attitudes. Following Dinev and Hart (2005) who defined social awareness as a predictor of privacy concerns, Hu and Dinev (2005) adopted the term and defined *technology awareness* as the user's following and being interested in, and knowledgeable about, technological issues, problems and techniques to solve them. They also found that PEOU and SE were no longer strong predictors of the attitudes toward behavior in the context of protective technologies as they are in the context of utilitarian technologies. Nevertheless, we include these constructs in this study for consistency as well as the consideration that cultural factors may change the nature of the relationships.

Individuals are conditioned by their culture. In order to understand the mechanisms and explain the variations of technology use between nations, cultural factors and dimensions need to be integrated into user behavior models. Several notable studies have discovered the moderating effects of culture on the relationships within the TPB models (Pavlou and Chai, 2002; Kacen and Lee, 2002; Tan et al., 2004) or the technology acceptance model (TAM) (Straub et al. 1997; Zakour, 2004). In general, however, studies about cultural effects on user behavior are few and often conflicting, with only selective dimensions studied. Recently Karahana et al. (2005) published a comprehensive and integrative perspective regarding the influence of culture on individual behavior based on the TPB. The authors concluded that behaviors involving different values and practices are influenced by different levels of culture such as professional and organizational.

Although several definitions of culture have been proposed within cultural anthropology, in the context of information systems research, the more symbolic views of culture are adopted. In that sense, culture is defined as "the collective programming of the mind which distinguishes the members of one group or category of people from another" (Hofstede, 1993, p.89). In this study we use probably the most influential dimensional approach - the cultural theory developed by Hofstede (1993) who generated and validated his framework from a compiled database of over 116,000 responses in 72 nationalities and over 20 languages. The framework clustered cultures based on five distinct dimensions: 1) Power Distance Index (PDI), 2) Individualism-Collectivism (IND), 3) Uncertainty Avoidance Index (UAI), 4) Masculinity-Femininity (MAS), and 5) Long-Term Time Orientation. PDI refers to the extent of adherence to formal authority. IND focuses on the basic level of behavior regulation of individual's relationships with respect to others. In a collectivist society individuals regard as more important to look after the interest of their group before themselves. UAI measures the importance of rules and standards and how much people feel threatened by high levels of uncertainty and ambiguity in the environment. MAS measures the degree the society reinforces the traditional masculine work role model of male achievement, assertiveness, control, and power.

2.2 Research Hypotheses on Moderating Effect of Culture

In this study, we contrast the cultural differences between South Korea and the U. S. and their impact on user behavior toward the use of protective technologies. These two countries measured quite differently on Hofstede's dimension indices. South Korea's high UAI at 85 (versus U.S. at 46) indicates the society's low level of tolerance for uncertainty. Such societies adopt strict rules and laws in an effort to minimize levels of uncertainty. They control almost everything in order to avoid the unexpected. As a result of the high UAI, the society is risk adverse and reluctant to change (Hofstede 1993). South Korea has a low IND rank of 18, which indicates a collectivist society. This contrasts with the highest IND index of the United States (91). Thus, loyalty to the group in South Korea will be

paramount, and may override other societal rules and regulations. Strong relationships are fostered where taking responsibility for group fellow members is everyone's duty (Hofstede 1993). PDI is also higher for South Korea (60) than for the U.S. (40). This implies that the South Koreans are relatively more accepting of unequal power distributions and more concerned with in-group interest rather than self-interest. They tend to be more formal, collectivistic, cooperative, and stability-oriented, as shown by their long-term orientation index of 75, versus 29 for U.S. Finally, MAS for the Korean society is 39 in contrast with U.S. with 62. The cumulative cultural characteristics show that individuals in the U.S. tend to be informal, individualistic, and achievement oriented. They value punctuality, voluntary associations, progress, and innovation. The U.S. ranking of first among individualistic societies has been confirmed by other empirical studies (e.g., Triandis, 1995).

The propositions of our study relate to the moderating effects of cultural dimensions on the relationships posited in Hu and Dinev (2005) model of protective technology usage (Figure 1). In order to empirically test their model, Hu and Dinev (2005) chose anti-spyware as the protective technology that is designed to counter the relatively new, but rapidly expanding, negative technology category of spyware. Spyware has become an epidemic security threat in recent years. It is surreptitiously installed on computers to invisibly track user activities such as web browsing and in some cases record key strokes (Taylor, 2002; Stafford and Urbaczewski, 2004). Under the category of spyware several varieties exist, such as adware, key loggers and Trojan horses. Recent media attention to spyware (Cha, 2004) has revealed the hidden cost of free access to Internet sites, freeware and shareware. The danger related to spyware, mainly identity theft, has prompted the U.S. government to take action (McGuire 2004) with Congress passing two bills: "Internet Spyware Protection Act," (H.R. 744), and "Securely Protect Yourself Against Cyber Trespass Act," (H.R. 2929), where installing spyware to break into someone's computer is a federal crime and hefty civil penalties could be levied. In the context of spyware, the model depicted in Figure 1 predicts user behavior of using anti-spyware technologies (e.g. spyware blockers, cleaners, Internet and browser settings) to prevent installation of spyware on users' computer or to clean already installed ones.

We argue that the strength of an individual's behavior intention leads to actual behavior, a relationship established in TPB, will depend on that individual's culture, in particular, its masculinity index and individualism. Indeed, in a highly collectivist society such as South Korea, the actual behavior of each member would most probably be moderated by group norms and the decision by peers to perform a certain task or enact a behavior. The masculinity index influences the actual behavior in the same direction – being a society with less pronounced masculinity, individual's behavior will be shaped not only by his or her personal goals and intentions, but also by the group's goals and opinions and how his or her behavior will affect them. Therefore:

H1: Being members of a more collectivist and more feminine culture, individuals in South Korea will exhibit a weaker relationship between behavioral intention and the actual behavior than their U.S. counterparts.

As members of a highly collectivist society, South Koreans will also exhibit greater influence of the subjective norm on the behavioral intention, since the group's needs and norms are of higher priorities (Pavlou and Chai, 2002; Tan et al., 2004). In addition to the individualism index, power distance will also moderate the relationship between the subjective norm and the behavioral intention. In higher power distance cultures, individuals' reliance upon the opinions of superiors will be more influential when assessing a behavior. This argument is supported by studies of cultural effects on TPB (Pavlou and Chai, 2002; Tan et al., 2004; Zakour, 2004). The higher power distance index in South Korea means that it accepts higher level of social inequality. The third factor that affects the relationship between behavioral intention and subjective norm is the uncertainty avoidance index. In order to avoid uncertainty and ambiguity, the ultimate goal of individuals in stronger uncertainty avoidance cultures is to attempt to minimize risk by following established rules and norms. The subjective norms thus will be even more important as guidance to behavior than for individuals in cultures where people rely more on their own competence to evaluate a behavior or a situation. Finally, South Korea has a less

masculine culture where individuals pay more attention to the opinions and behaviors of the others, in contrast to more masculine cultures where goal achievement is of greater importance. Therefore:

H2: A cumulative effect of lower individualism, higher power distance, higher uncertainty avoidance, and lower masculinity is that individuals in South Korea will exhibit a stronger relationship between subjective norms and behavioral intention than their U.S. counterparts.

Pavlou and Chai (2002) argued that attitudes towards behavior would have a stronger effect on behavioral intention in collectivist than in individualist cultures. They further argued that in an effort to maintain group harmony, collectivist societies had the tendency to internalize an attitude toward something if that attitude had been accepted within the group. In this case, however, the argument overlapped with the subjective norm's influence, i.e., the attitude and norms of the group. Tan et al. (2004) argued in the opposite direction. Agreeing with Tan et al. (2004), we believe that how an *individual's* attitudes influence his or her intention to behave in a certain way is moderated by how strongly he or she feels as an *individual* and how strongly he or she feels compelled to act as an *individual*. Thus, contrary to Pavlou and Chai (2002), we posit that attitudes toward behavior would have a stronger effect on behavioral intention in individualist cultures than in collectivist cultures. Further, Tan et al. (2004) argued that the masculinity index also moderates attitudes in the same direction as individualism does. Indeed, a goal and achievement-oriented individual from a more masculine culture will be more prone to act based on his or her individually formed attitudes than an individual in a more feminine culture where personal attitudes would matter less and people's attitudes and relationships might be a higher priority. Following Tan et al. (2004), we posit:

H3: Individuals in South Korea will exhibit a weaker relationship between attitudes toward behavior and behavioral intention than their U.S. counterparts due to the lower individualism and masculinity of their culture.

Several studies argue about the moderating effect of the long-term orientation dimension on the relationship between perceived behavior control and behavioral intention (Pavlou and Chai 2002, Tan et al, 2004), and between perceived behavior control and actual behavior (Tan et al, 2004). The Confucian doctrine, emphasizing persistence, patience and respect for tradition is firmly embedded in the Asian and, therefore, in South Korean culture (Hofstede and Bond 1988). This would be reflected in a tendency to steadiness and stability, thus more control over behavior and stronger relationships between control and behavior and behavioral intention. However, Pavlou and Chai (2002) did not find empirical support for this hypothesis. We argue that the lack of empirical support is indicative of insufficient theoretical justification of the relationship and the complex cultural influence. We believe that long-term orientation is only one of the factors, among masculinity, individualism and the uncertainty avoidance index of the culture that influences this relationship. A person in a more individualistic and masculine society will be more prone to act or to form an intention to act if he or she feels enough control over a certain behavior. Thus, the lower masculinity and lower individualism characteristics of a society will render a weaker relationship between PBC and BI. In our attempt to form a hypothesis, we return to Hofstede's measured magnitudes of cultural indices. We find that the cumulative difference between the two societies' masculinity and individualism indices is larger than the cumulative difference between their uncertainty avoidance index and the long-term orientation indices. Thus, we believe that the strength of the PBC-BI and PBC-B relationships may be largely moderated by individualism and masculinity which may override the influence of uncertainty avoidance and long-term orientation. We thus propose:

H4: Individuals in South Korea will exhibit a weaker relationship between perceived behavior control and behavioral intention than their U.S. counterparts.

H5: Individuals in South Korea will exhibit a weaker relationship between perceived behavior control and actual behavior than their U.S. counterparts.

In their protective technology usage model, Hu and Dinev (2005) also showed that the critical role of awareness (A). When comparing two cultures, it is important to understand how an individual who has

already been aware of an existing problem would form his or her attitudes toward a behavior (AB) that would solve this problem. Similarly, it is interesting to understand how this awareness will affect directly his or her intention to act (BI). We believe that the major cultural factors, such as masculinity and individualism, will moderate the relationships A-AB and A-BI. A person who is aware of a problem and who comes from an individualist society will more readily form an attitude toward the issue. On the contrary, a person from a collectivist society would be more careful in forming his or her personal attitudes. Similarly, the culture with both higher masculinity (achievement, "can-do," "act-now to fix the problem" attitude) and higher individualism ("act regardless of what others think") would forge stronger relationships between A and BI. Thus:

H6. Individuals in South Korea will exhibit a weaker relationship between awareness and attitudes towards behavior than their U.S. counterparts.

H7: Individuals in South Korea will exhibit a weaker relationship between awareness and behavioral intention than their U.S. counterparts.

3 RESEARCH METHODOLOGY

3.1 Data Collection

Surveys of IS professionals and students of enrolled in a large university in the Southeastern U.S. and a large university in South Korea were conducted to collect data that could be used to test the theoretical model and the hypotheses. All constructs in the survey were measured using multi-items with five-point Likert scales developed by Hu and Dinev (2005). For data collection in the U.S., students enrolled in various classes were asked to fill in either the online or paper-based questionnaire in class time. Additionally, e-mails with a request to participate in the study were sent out to IT professionals who graduated from the U.S. University with MIS/CS degrees. In about four weeks, a total number of 339 responses were received, out of which seven were unusable because of many missing data items. For data collection in South Korea, the questionnaire was translated into Korean by a person who is proficient in both languages. Next, it was back-translated into English by another person with similar qualifications. Based on this double translation process, minor corrections were made to the Korean versions to insure that the meanings of all items of the questionnaires had been preserved during translation. Both undergraduate and graduate students enrolled in various classes of the South Korea university were asked to fill in either the online or paper based questionnaire in class time. A total number of 227 responses were received. The relevant characteristics of the respondents are shown in Table 1.

Computer Knowledge								
Scale	Overall (%)		MIS/CS (%)		Business (%)		Other (%)	
	US (N=332)	Korea (N=227)	US (N=161)	Korea (N=28)	US (N=163)	Korea (N=132)	US (N=8)	Korea (N=67)
Basic [a]	56.6	55.9	34.8	28.6	81	68.2	0	49.3
Advanced [b]	23.8	37.9	30.4	53.6	17.8	31.8	14.3	43.3
Application development [c]	19.6	6.2	34.8	17.9	1.2	3	85.7	7.5
Knowledge of Spyware								
Never heard of it	2.7	18.9	2.5	3.6	3.1	22	0	19.4
Don't know details	16	31.7	6.9	25	24.5	34.1	28.6	29.9
Don't know what to do	26.6	15	19.4	21.4	33.7	14.4	28.6	13.4
Know what to do	16.3	27.8	15.6	39.3	16.6	25	28.6	28.4
Fully aware and know how to protect themselves	38.4	6.6	55.6	10.7	22.1	4.5	14.3	9

a. Basic skills – limited to Word processing, use of e-mail, browsing on the Internet
b. Advanced computer skills – include basic skills plus ability to manage, configure and install applications
c. Application development – include advanced skills plus use of programming languages to develop applications.

Table 1. Computer Skills and Spyware Knowledge of the Survey Respondents (U.S. and Korea).

3.2 Measurement Validation

The research model was tested through Structural Equation Modeling (SEM) with AMOS version 5. We followed the two-step approach to first assess the measurement model through confirmatory factor analysis (CFA) and then test the hypotheses through the structural model. For U.S. and Korean data sets, the CFA was performed respectively on the entire set of items simultaneously with each observed variable restricted to load on its *a priori* factor. All the necessary steps in the measurement model validation and reliability assessment were conducted following the validation heuristics recommended for SEM (Gefen et al., 2000). Discriminant validity was established by observing that the correlations between all latent constructs were less than the square roots of corresponding average variance extracted (AVE), as shown in Table 4. The analysis resulted in a converged, proper solution with a low χ^2 per degree of freedom and a good fit as indicated by the listed fit indices. Collectively, the data from the model fit indices, factor loadings, and t-values, as well as the correlations, composite reliabilities, and average variance extracted for each construct (Tables 2, 3, and 4) suggest that the indicators account for a large portion of the variance of the corresponding latent construct and therefore provide support for the convergent and discriminant validity of the measurement instrument for both cultures.

Constructs	# of Items	Mean (STD)	Cronbach's Alpha	Composite Reliability^	AVE	Loadings (t-Statistics)
Behavior (B)	3	2.96 (1.33), 3.04 (1.28), 3.02 (1.32)	0.92	0.95	0.86	0.93 (85.60), 0.95 (126.43), 0.90 (72.34)
Behavioral Intention (I)	3	3.84 (0.93), 3.66 (0.95), 3.68 (0.97)	0.86	0.92	0.78	0.83 (33.04), 0.91 (63.43), 0.92 (72.26)
Attitudes towards Behavior (AB)	3	4.36 (0.82), 4.36 (0.81), 4.38 (0.84)	0.91	0.95	0.85	0.89 (48.63), 0.95 (127.95), 0.93 (72.21)
Subjective Norm (SN)	2	3.69 (0.95), 3.73 (0.88)	0.93	0.97	0.94	0.97 (200.57), 0.97 (200.57)
Perceived Behavior Control (PBC)	2	3.39 (1.06), 3.17 (1.01)	0.85	0.93	0.87	0.93 (103.89), 0.93 (103.89)
Perceived Ease of Use (PEOU)	3	3.21 (1.06), 3.08 (1.15), 3.30 (1.10)	0.84	0.90	0.75	0.82 (29.88), 0.90 (78.49), 0.89 (66.91)
Perceived Usefulness (PU)	2	4.23 (0.86), 4.21 (0.91)	0.89	0.95	0.90	0.95 (87.96), 0.95 (87.96)
Awareness (A)	3	2.97 (1.11), 3.24 (1.12), 3.42 (1.09)	0.81	0.89	0.72	0.84 (43.02), 0.85 (45.89), 0.86 (42.86)
Perceived Controllability (PC)	2	3.51 (1.05), 3.50 (1.07)	0.93	0.97	0.94	0.97 (151.70), 0.97 (151.70)
Self-Efficacy (SE)	2	3.38 (1.00), 3.25 (1.04)	0.85	0.93	0.87	0.93 (105.81), 0.93 (105.81)

^ Fornell and Larcker's (1981) internal consistency reliability; AVE=Average Variance Extracted; STD=Standard Deviation

Table 2. Summary of the Assessment of the Measurement Models (U.S.)

Constructs	# of Items	Mean (STD)	Cronbach's Alpha	Composite Reliability^	AVE	Loadings (t-Statistics)
Behavior (B)	3	2.38 (1.06), 2.44 (1.13), 2.64 (1.24)	0.90	0.94	0.84	0.93 (69.21), 0.94 (131.10), 0.88 (42.90)
Behavioral Intention (I)	3	3.72 (0.92), 3.68 (0.91), 3.77 (0.88)	0.90	0.94	0.83	0.90 (54.30), 0.90 (31.68), 0.93 (68.11)
Attitudes towards Behavior (AB)	3	4.00 (0.86), 4.10 (0.70), 4.08 (0.81)	0.87	0.92	0.80	0.83 (19.24), 0.93 (79.28), 0.92 (56.12)
Subjective Norm (SN)	2	3.67 (0.87), 3.66 (0.87)	0.88	0.94	0.89	0.94 (86.22), 0.94 (86.22)
Perceived Behavior Control (PBC)	2	3.30 (1.00), 2.93 (1.02)	0.78	0.90	0.82	0.91 (65.20), 0.91 (65.20)
Perceived Ease of Use (PEOU)	3	2.84 (0.99), 2.44 (1.07), 2.58 (1.20)	0.84	0.90	0.76	0.83 (30.80), 0.92 (96.57), 0.86 (36.72)
Perceived Usefulness (PU)	2	3.83 (0.97), 3.77 (0.95)	0.89	0.95	0.90	0.95 (69.76), 0.95 (69.76)
Awareness (A)	3	2.56 (1.00), 2.54 (1.07), 3.21 (0.94)	0.76	0.86	0.69	0.82 (28.80), 0.85 (42.23), 0.80 (26.67)
Perceived Controllability (PC)	2	2.67 (1.13), 2.59 (1.11)	0.95	0.97	0.95	0.97 (151.70), 0.97 (151.70)
Self-Efficacy (SE)	2	2.51 (1.05), 2.66 (1.02)	0.79	0.90	0.82	0.97 (184.87), 0.97 (184.87)

^ Fornell and Larcker's (1981) internal consistency reliability; AVE=Average Variance Extracted; STD=Standard Deviation

Table 3. Summary of the Assessment of the Measurement Models (South Korea)

	US										Korea									
	PU	**A**	**PEOU**	**SE**	**PC**	**AB**	**SN**	**PBC**	**BI**	**B**	**PU**	**A**	**PEOU**	**SE**	**PC**	**AB**	**SN**	**PBC**	**BI**	**B**
PU	**0.95**										**0.95**									
A	0.37	**0.85**									0.24	**0.83**								
PEOU	0.15	0.30	**0.87**								0.11	0.39	**0.87**							
SE	0.25	0.40	0.69	**0.93**							0.20	0.34	0.53	**0.91**						
PC	0.38	0.47	0.54	0.64	**0.97**						0.22	0.43	0.63	0.56	**0.97**					
AB	0.54	0.35	0.16	0.18	0.28	**0.92**					0.31	0.25	0.28	0.17	0.29	**0.89**				
SN	0.45	0.41	0.19	0.33	0.36	0.33	**0.97**				0.33	0.26	0.20	0.17	0.24	0.36	**0.94**			
PBC	0.16	0.29	0.64	0.58	0.54	0.26	0.17	**0.93**			0.17	0.26	0.50	0.48	0.41	0.39	0.21	**0.91**		
BI	0.43	0.53	0.31	0.39	0.38	0.53	0.41	0.39	**0.88**		0.34	0.38	0.29	0.35	0.37	0.50	0.48	0.39	**0.91**	
B	0.34	0.51	0.41	0.48	0.55	0.32	0.37	0.49	0.57	**0.93**	0.27	0.52	0.59	0.47	0.70	0.33	0.29	0.42	0.43	**0.92**

Note: Bolded diagonal elements are the square root of average variance extracted (AVE).
These values should exceed the inter-construct correlations (off-diagonal elements) for adequate discriminant validity.

Table 4. Construct Correlations and Average Variance Extracted

3.3 Structural Model and Hypotheses Testing

The structural model specifies the hypothesized relationships among the constructs. The goodness of fit indices of SEM run with both U.S. and Korea samples are reported in Table 5. All the values are within the acceptable range for a good model fit and thus indicate good empirical support of the theoretical model in both cultures. The results of both U.S. and Korean structural model showed that while overall directions of relationships between latent variables were consistent with the findings of Hu and Dinev (2005), the magnitude and/or significance of the path coefficients for several relationships were different between the two models, indicating the existence of moderation of cultural differences between the two samples. To identify the evidence of model non-invariance between the two countries, we performed the SEM multi-group analysis through a χ^2 difference test (Figure 1). This was accomplished by placing constraints on the parameter whose non-invariance would be tested, thereby testing the statistical difference in χ^2 value ($\Delta\chi^2$) between the unconstrained model and the one with the parameter constrained. The fit of U.S. model provided baseline value against which all subsequently specified models were compared. That is, tests for invariance were performed by constraining each path of U.S. model with imposing corresponding path coefficient estimates generated in the Korean model. Table 6 provides a summary of χ^2 values and χ^2 difference values related to the series analyses involved in testing for non-invariance.

Goodness of Fit Indices		**x^2(d.f.)**	**x^2/d.f**	**NFI**	**CFI**	**TLI**	**GFI**	**AGFI**	**RMR**	**RMSEA**
Measurement Model	**U.S.**	350.61 (222)	1.58	0.946	0.979	0.972	0.923	0.887	0.040	0.042
	Korea	404.89 (225)	1.80	0.901	0.953	0.937	0.879	0.825	0.047	0.059
Structural Model	**U.S.**	388.89 (242)	1.61	0.940	0.976	0.971	0.913	0.883	0.057	0.043
	Korea	411.18 (239)	1.72	0.9	0.955	0.943	0.876	0.831	0.058	0.056

Table 5. Goodness of Fit Indices for both Cultures

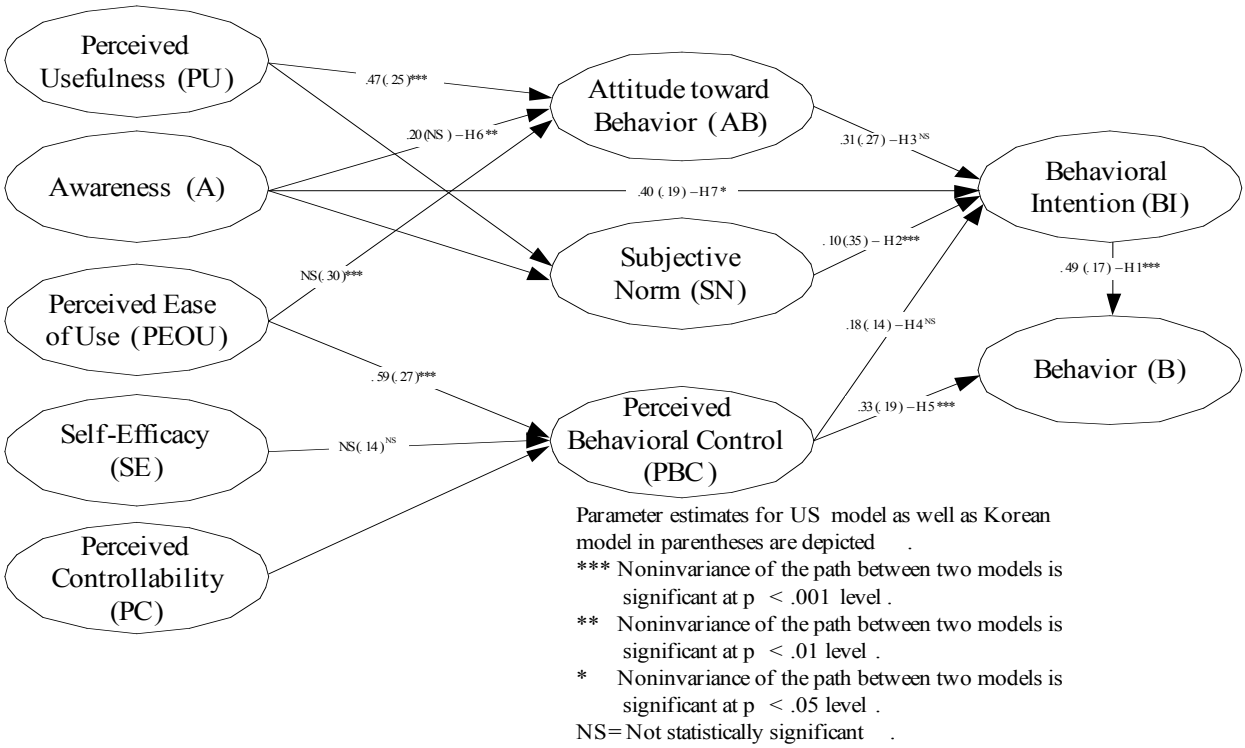

Figure 1. The Comparative Results of Structural Equation Model: U.S. vs. (South Korea)

Model Description	χ^2	$\Delta\chi^2$	Statistical Significance with 1 d.f.
U.S. model (Comparative Model)	388.9		
Path on BI to B constrained	443.9	55	*p*< .001
Path on SN to BI constrained	424.2	35.3	*p*< .001
Path on ATB to BI constrained	389.6	0.7	*NS*
Path on PBC to BI constrained	388.9	0	*NS*
Path on PBC to B constrained	401.6	12.7	*p*< .001
Path on A to ATB constrained	396.2	7.3	*p*< .01
Path on A to BI constrained	395.3	6.4	*p*< .05
Path on PU to ATB constrained	399.7	10.8	*p*< .001
Path on PEOU to ATB constrained	413.4	24.5	*p*< .001
Path on PEOU to PBC constrained	403.2	14.3	*p*< .001
Path on SE to PBC constrained	389.5	0.6	*NS*
Path on PC to PBC constrained	389.7	0.8	*NS*
Path on A to SN constrained	389.8	0.9	*NS*
Path on PU to SN constrained	393.4	4.5	*p*< .05

Table 6. χ^2 Tests for Path Invariance between U.S. Model and South Korean Model.

4 DISCUSSION AND IMPLICATIONS

The empirical results from our study rendered strong support for the core hypotheses and for the validity of Hu and Dinev (2005) model. Using data collected from two distinct cultures, we observed a notable difference in the relationship between behavioral intention and behavior (H1), with statistical significance at p<.001. As hypothesized, the link for South Korean users was weaker than the one for U.S. users. The strong relationships fostered by society, where individuals tend to identify with

members of their group discourage individually motivated behavior. H2 is strongly supported (significance at $p<.001$) by the data: the effect of social norms on individual behavior is three and a half times stronger in the Korean sample than in the US one. As argued in the theoretical section, this major difference in the two cultures is a cumulative result of individualism, masculinity, power distance, and uncertainty avoidance. However, the hypothesized difference between attitudes towards behavior and behavioral intention (H3) was not statistically significant. Prior studies (e.g., Pavlou and Chai, 2002 and Tan et al., 2004) reported mixed results about this relationship. At this point, we do not have a strong and clear explanation about why the hypothesized moderating effect of culture on this relationship was not supported. More studies are needed to clarify and refine this complex relationship.

H4 and H5 dealt with the differences between perceived behavioral control (PBC) and behavioral intention (BI), and actual behavior (B), respectively. Although the path coefficients for PBC-BI (H4) for the two cultures indicate a small difference in the hypothesized direction, this difference was not statistically significant. The path difference on PBC-B (H5), however, was very strong at level $p<.001$ and in the hypothesized direction. The fact that for South Koreans PBC did not have as strong an effect on BI as on B, may be explained by the culture's strong uncertainty avoidance norms. For the Korean culture, perception of having control over a situation is very important in shaping *actual* behavior, regardless of how strong the initial behavioral intention may be. In general, however, we can assert that the theoretically argued moderating effect of culture on the relationship between PBC and behavior is supported by our results. Because of the strong influence of the more feminine and more collectivist characteristics of the Korean culture, South Koreans exhibit a *weaker* relationship between PBC and B (and probably between PBC and BI). The cultural effect on these relationships is also difficult to predict since it is a cumulative effect of several cultural factors (long-term orientation and uncertainty avoidance among them) acting in opposite directions. Pavlou and Chai (2002), and Tan et al. (2004) have reported that for a culture with higher long-term orientation, this relationship is *stronger*. Although South Koreans tend to have higher long-term orientation, our results show that masculinity and individualism override the long-term orientation effect.

Finally, H6 and H7 argued for the cultural effects on the relationships between awareness (A) and attitudes toward behavior (AB), and awareness (A) and behavioral intention (BI), respectively. Both hypothesized differences were supported by the data. An awareness of a problem (in our case, the presence of spyware) in South Korean users has less influence on their attitudes and intention to use antispyware than a user in the U.S. This could be attributed to differences in the masculinity and individualism indices of these two countries.

In addition to these hypothesized relationships, differences in several other relationships in the research model were statistically significant. They are the paths between self-efficacy (SE) and PBC, perceived ease of use (PEOU) and PBC, PEOU and AB, and perceived usefulness (PU) and AB. We believe that these differences can be attributed to the demographic differences as presented in Table 1. For example, self-reported knowledge about spyware and advanced knowledge on how to protect oneself is 38.4% for the overall U.S. sample versus 6.6% for the overall Korean sample. As indicated by Hu and Dinev (2005), the level of computer technical skills and knowledge of the threat impact the magnitude of the relationships associated with ease of use, self-efficacy and perceived usefulness. For example, the insignificance between PEOU and ATB for the U.S. sample may be attributed to the phenomenon that an *informed* user may use a protective technology not because he or she likes it but because he or she perceives there is a real threat to the computer and/or the personal information. In that sense, the perceived ease of use is less likely to affect his or her attitude toward using the technology. This is analogous to the situation in medicine where whether an individual feels that a protective measure such as an exam or a procedure is *easy* or not has little to do with his or her attitude toward going to the office to be examined or treated. The individual feels compelled to use protective measures as long as he or she perceives the technology or treatment is *useful*, regardless whether it is *easy to use*. A similar argument can be made about the diminished influence of SE on PBC for the U.S. sample. Since the Koreans respondents seem less knowledgeable and with slightly less self-

reported computer skills, they still feel the need to perceive a technology easy to use in order to form a positive attitude towards it. We believe that because of this demographic difference in the two samples, there is statistically significant difference in the PU-ATB path. Whether an anti-spyware is useful or not would matter less in shaping the Korean respondent's attitude simply because he or she may still have vague knowledge about spyware and its threats.

Our findings have significant theoretical and practical implications. Theoretically, our study fills an important theoretical gap in the research of protective technology use. We validated the Hu and Dinev model (2005) across two cultures and showed that key relationships remained statistically significant, but substantially moderated by cultural dimensions. Our study informs scholars and practitioners about the factors that influence the user's decision to use protective technologies to protect from negative technologies. Since negative technologies disenchant many users from using the Internet and may form inhibitions and anxiety toward computer and technology use, it is important to understand how users react to these types of threats in the global environment. Many theoretically interesting cultural effects remain to be uncovered in future studies, such as how attitudes shape behavioral intention and actual behavior. So far conflicting arguments and empirical results have been reported. We believe, however, that our comprehensive model and cultural arguments present an important step in cross-cultural research which is finally entering the mainstream in MIS research (Gefen et al 2005).

Practically, our findings provide insights for managers to design effective security policies and practices in conjunction with protective technologies in the fight against the onslaught of spyware and other Internet-spawned negative technologies, especially in today's globally networked economy that span diverse cultures. For example, in order to reach average computer users, our findings show that for both cultures it is important to create social advocacy groups and networks that educate and raise consumer awareness to the potential damages of negative technologies. Because U.S. users in general are not part of cohesive social groups, traditional information channels – media, television and newspapers could play an important role in forming social pressures and policies that address and compel protection and prevention of computer systems in a globally connected society and economy. In contrast, of utmost importance for South Korea is to work with social groups and their leaders in order to disseminate the need for using protective technologies, to establish the need to fight negative Internet technologies as an important social norm of the society, something that helps the group and the entire society.

Despite the strong empirical results, our research has some limitations which also suggest future research opportunities. One limitation is the use of convenience samples for both cultures which may limit the external validity and generalizability of the study results. Future studies could broaden the sample to include more general computer users. Another limitation is that we did not control for the technical background of the two samples of users. Although we attempted to get comparable groups in the two cultures by using undergraduate students enrolled in universities (and their graduates), the U.S. sample was stronger in technical skills than the South Korean sample. Future research could correct this bias by having stricter control of the samples. We hope that this study establishes a baseline for cross cultural studies on user behavior toward protective technologies and opens more opportunities for future studies in this important area.

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