The Effects of Need Factors and Environment on the Formation of Security Consciousness

[1]Yuhiko Toyoda, [2]Mika Takeuchi, [3]Hiroshi Ichikawa, [4]Mitsuteru Tashiro and [5]Masao Suzuki

[1]*School of Business Administration, Sanno University, Japan;*
[2]*Department of Humanities and Social Sciences, Jissen Women's University, Japan;*
[3]*Department of Home Economics, Otsuma Women's University, Japan;*
[4]*Institute for Info Socionomics, Tama University, Japan;*
[5]*Department of Human Sciences, Waseda University, Japan;*
toyoda_yuhiko@hj.sanno.ac.jp; takeuchi-mika@jissen.ac.jp; ichikawa.h@otsuma.ac.jp;
tashiro@ni.tama.ac.jp; masaosuz@waseda.jp

ABSTRACT

Educational institutions are taking initiatives in finding a balance between the benefits and dangers of Internet use. However, current curricula for Internet literacy are generalised to feed information and do not serve the individuals. This research aims to develop an educational tool to help each unique individual and will define the link between personal traits (especially the level of needs) and security consciousness.

An online survey was conducted with 2,223 Japanese participants of both genders between the ages of 20 to 79 about their personal need, security consciousness, and the environment. We analysed the data for need factors, safety consciousness, and environment from an exploratory factor analysis. Covariance structure analysis based on the analysed factors clarified the effects of need factors and safety environment on General Security Consciousness and Higher Security Consciousness.

The study found that some need factors facilitate General Security Consciousness, while others hinder it. The data shows that Security Environment had more effect on Higher Security Consciousness than personal attributes.

Keywords: Internet Risk, Risk Management, Internet Literacy, Educational Tool

1   Introduction

To combat the risks on the Internet, the Japanese government and the Ministry of Internal Affairs and Communications published an Internet Literacy Assessment Indicator for Students (ILAS), which targeted 15-year-old students to measure their ability to utilise the Internet safely and securely [1]. It was due to the OECD Council's adoption of a recommendation in February 2015 and the rapid spread of smartphones, which enabled everyday Internet use among the entire population, especially the youth. We now face the challenge of preparing the population (particularly the youth) with Internet literacy, so they may use the Internet safely and securely.

In order to safely and securely use online resources, ILAS has defined the following seven points for Internet literacy. These were created based on the risk typologies in the OECD Recommendation [2].

1. Ability to deal appropriately with the illegal and harmful contents on the Internet
    1-a Understand the problems with illegal contents and act accordingly.
    1-b Understand the problems with harmful contents and act accordingly.
2. Ability to communicate properly on the Internet
    2-a Process the information and communicate properly
    2-b Understand the problems with digital transactions and act accordingly
    2-c Consider usage charges and time lost when using the Internet
3. Ability to protect privacy and have proper security measures
    3-a Consider privacy while using the Internet
    3-b Use proper safety measures when utilising the Internet

In 2013 and 2014, the Ministry of Internal Affairs and Communications surveyed elementary, junior high, and high school students as well as their guardians on the literacy levels above.

a) The percentage of correct answers was constant for every guardian age group. For junior high and high school students, the percentage of correct answers decreased as their school ages lowered.
b) There is a higher literacy among those who have received awareness education. Most beginner Internet users have lower literacy and have a higher risk of encountering problems
c) The high literacy population uses the Internet but can moderate their use.

With these results, Teachers, pearents and students are advocating for opportunities to discuss Internet use at home and in schools, as well as limiting the time spent on the Internet. Awareness Workshop for the Young are also advocated, along with providing detailed description of specialised terminologies (i.e., laws and regulations). They also encourage sharing the latest news and information at these workshops for the young and their guardians.

ILAS' survey includes knowledge-based questions such as "You have posted your favourite artist's lyrics on a personal SNS. Choose the best explanations for your action." as the survey also contains ethics questions such as "You heard from your friend that you can get paid by sharing your ID and password online. What is the best way to act in this situation?"

ILAS only targets the youth and their guardians. However, education for Network Literacy is not only for the younger population, as spam emails and frauds target all ages. Workshops and information dissemination are the main measures to raise the Internet security consciousness. However, most problems linked to Networks depend on personal attributes and the environment. School curriculums focus on lecture-style classes. To actualise a dynamic teaching style, the standard of faculty consciousness, skill, and knowledge depends on each faculty and how much effort they put into preparing their classes [3].

This research examines an effects model of network user attribute and environment factor on personal security consciousness, as well as investigating the mechanism of network-related problems. This investigation also opens new doors for developing an education tool that serves each individual, rather than the current interaction-free literacy education.

2 Background and Literature Review

2.1 Types of Network Problems

The OECD Recommendation has categorised network-related risks as follows.

I. Illegal and harmful information risks

II. Risk of inappropriate use

III. Privacy security risk

Unlawful and damaging risks include being exposed to hate speech, illicit drug trades, and sexual information. The risk of inappropriate use involves purchasing age-restricted products or becoming fraud victims from online shopping. Privacy security risk refers to when personal information is collected or when harmful software is executed without the owner's permission.

According to the reports from the National Police, Ministry of Internal Affairs and Communications, Consumer Affairs Agency and the Media [4], Internet issues can be categorised (see Table 1). Financial problems refer to any problems that arise from online monetary transactions. It is further broken down into categories of criminal cases and uncertain cases between criminal and civil cases.

Communication problems result from unintended online communication. There are two types of communication problems: When the receiver is victimised or becomes involved in a crime and when a sender is criminalised. Management issues include privacy and other information leakages. It is further divided into involuntary malicious leaks or accidental leaks..

Mind-body problems refer to an information tools addiction. There are multiple factors involved in safe Internet use, thus demonstrating a further need to expand the current Internet safety education.

Table 1 Types of Network Problems

Main Category	Minor Category
Financial	Fraud, no delivery, stolen/illegal merchandise
	Returns, bills
Communication	Spam, invitations, false inducement
	Cyber-bullying, announcing crimes
Management	Illegal information, information leakage
	Illegal access, hacking
Mind-body	Internet and game addiction

2.2 Relationship between Online Behaviors and Personal Attributes

Studies have already been conducted on the relationship between online behaviours and personal attributes. One studied how receiving education on information morality, user experience in information systems, and social motives is related to the user's level of information morality [5]. From this study, the researchers discovered that further education in information morality resulted in appropriate behaviours when using information systems. A link between daily behavioural motives and decision-making within information systems also became apparent. The study further found the social motives that place importance on order is based on internal standards (e.g., the feeling of shame),_while other social motives that emphasise society is based on external standards such as following rules, not disturbing others, and etiquette.

A study on the relationship between Internet usage and general trust/uncertainty avoidance [6] found that specific Internet services are particularly related to the uncertainty avoidance index (UAI). General trust refers to the feeling of security, while UAI refers to a fear of uncertainty and the unknown. It was concluded from the study that groups with a high general trust and UAI often used SNS; groups with low general confidence and high UAI often used anonymous forums, and groups with great general confidence and low UAI often used online auctions.

Internet addiction is also a rapidly growing issue. Some reports say that just below 10% of Japanese elementary and junior high school students feel restless when they do not have access to mobile phones and games [7]. A study measuring Internet addiction has pointed out that some addicts' excessive Internet use results from their attempt at forming personal relationships.

In another study on the relationship between social skills and problematic online behaviours, users with low social skill tend to seek online interactions. This leads to their uncontrollable Internet use, which had negative impacts on the user. However, there is a report that shows how heavy Internet communication tool use does not lead to a decline in communication skills, such that it negatively affects the quality of life [9].

3   Methods

3.1   Participants

An online survey was conducted with 2,223 Japanese participants of both genders between the ages of 20 to 79. The participants were members of an Internet investigation company, and they volunteered to this research with consent. While Internet surveys are cheap and quick, they have issues such as the ambiguity of which social group the collected data belongs to and the influence of factors (e.g., the level of participants' computer literacy and substituted answers). However, the main topic of this study was to investigate Internet usage. Therefore, we do not have to inquire which social group participants belong to as long as they are Internet users. Moreover, research comparing the effects of computer literacy in a mail survey and Internet survey found that there was no significant difference. [13]

In this study, we explained that the survey results will be processed statistically, and will not be analysed to identify an individual. Also, we have specified that the participants do not need to answer any question they do not wish to answer. We additionally told the participants that suspending the answer is allowed. The data obtained from this study are those collected upon the above explanations with the participants' consent and does not conflict any interests.

3.2   Period of the survey

The online survey was conducted with consent in November 2015.

3.3   Research battery

Question items were made based on the Risk Management Test (RMT) [10] developed by Takeuchi and Suzuki (2000) for providing education on unscrupulous business damage. Forty-five items that guaranteed fixed convergence properties and showed high factor loading on the exploratory factor analysis were used. Also, the questions were structured to elicit information on Internet usage status, trouble experience on the Internet, and the environment, and the consciousness of computer security.

A)   Survey item groups on the usage status of cyber-communication: Connected device, used SNS.

B) Risk Management Test (RMT)

RMT is based on Maslow's (1954) hierarchy of needs. It is a test that combines Physiological need, Safety need, Love/ Belonging, Esteem, and Self-actualisation, as well as the Stimulus/Inquisitiveness needs that could increase risk-taker factors in a Risk Management Test (RMT). Participants could answer on a 5-point scale and through self-assessment, such that 1 is "Strongly Disagree" and 5 is "Strongly Agree".

C) Environment and consciousness on security (SAT)

Questions were asked about the environment factors that create security consciousness in computer/network, as well as about the resulting attitude/behaviour. The answer choice ranged from 1 (Strongly Disagree) to 5 (Strongly Agree).

3.4 Procedure of Analysis

RMT exploratory factor analysis was conducted to analyse the need characteristics of individual safety. Also, SAT exploratory factor analysis was carried out to analyse the composing factors of the security environment and safety consciousness. For factor analysis, maximum likelihood method was used, and Promax rotations were applied to the obtained results. Factors detected from RMT and SAT were calculated for an individual composite score and were analysed by covariance structure analysis to see the relationship clearly.

4 Results

4.1 Risk Management Test (RMT) factor analysis

As a result of RMT exploratory factor analysis, seven factors (shown in Table 2) were detected: Pursuit of self-worth, pursuit of purity/virtue, tendency of self-restraint/prioritising others, inclination to conform to external value standards, intent to avoid physical pain, tendency of addiction to superstitions, and pursuit of physical pleasure. Eight factors had eigenvalue over 1. However, factors with only 1 item were considered an anti-convergence factor and were excluded from this analysis.

Table 2   Results of the Risk Management Test Factor Analysis.

	Factor							
	Pursuit of self-worth	Pursuit of purity/virtue	Tendency of self-restraint/ prioritising others	Inclination to conform to external value standards	Intent to avoid physical pain	Tendency of addict to superstitions	Pursuit of physical pleasure	Anti-convergence factor
	RMT1	RMT2	RMT 3	RMT 4	RMT 5	RMT 6	RMT 7	8
I have a desire to complete something "Original" that only you can do	**.701**	.387	.163	.100	-.028	.150	.116	.041
I Want to try something that you have not experienced before	**.696**	.316	.237	.216	-.042	.228	.434	-.075
I Want to be a special person	**.683**	.157	.159	.494	.008	.321	.181	-.115
I am an ambitious person	**.648**	.418	.102	.209	-.254	.183	.115	-.089
I Desire stimulation in life	**.628**	.177	.190	.254	.006	.259	.402	-.059
Do not want to become an "ordinary people", "many others" or a "general public"	**.593**	.304	.038	.203	-.054	.132	.097	-.080
I Tend to like drawing attention from others	**.589**	.052	.083	.455	-.102	.253	.185	-.152
I am a person full of curiosity	**.566**	.494	.173	-.051	-.063	.092	.364	.143
I tend to like dangerous and thrilling activities	**.539**	-.138	.016	.442	-.155	.195	.308	-.360
I Admire a perfect person, and desires to become one	**.434**	.274	.348	.376	.055	.315	.208	-.240
I dislike wrong ways of thinking	.250	**.776**	.186	-.183	.009	.008	.046	.168

I strive to become an exemplary person	.176	**.719**	.272	-.203	.036	.025	.037	.335
I cannot forgive when you see something ethically wrong	.251	**.646**	.173	-.127	.060	.043	.059	.261
I make effort to remove contaminant from air/water/food	.196	**.537**	.285	-.065	.145	.154	.185	.267
I admire the pure way of life	.346	**.503**	.325	-.001	.080	.190	.153	.021
I want to do something that is appreciated by others (want to become a person who is appreciated)	.439	**.493**	.476	.049	.008	.251	.164	.098
I love interesting and cheerful things	.356	**.479**	.257	-.092	.127	.115	.266	.454
I have times when I cannot say something, thinking that it might offend the other person	.057	.181	**.672**	.003	.422	.195	.208	.060
I cannot say "No" to something asked	.148	.337	**.613**	-.010	.152	.207	.221	-.014
Sometimes I change my decision by listening to opinions from others	.055	.031	**.611**	.251	.291	.416	.349	-.037
I often endure to make good atmosphere among friends	.186	.385	**.601**	-.071	.180	.179	.180	.087
I often keep silent when I have a different opinion than others	-.041	-.013	**.547**	.172	.329	.277	.203	-.046
I cannot go home alone when my friends are enjoying a party	.182	.279	**.541**	.113	.119	.270	.257	.021
I tend to unconsciously behave in the same manner as others	.035	-.007	**.517**	.324	.235	.330	.491	-.171
I prefer to do anything that would make others happy	.446	.360	**.478**	.203	-.038	.350	.243	-.121
I often decide whether the situation is "Safe" or "Dangerous" by information from others	.130	.042	**.440**	.283	.285	.288	.420	-.136
I use clothes, hairstyle, and make-up that are popular.	.342	-.154	.076	**.746**	-.043	.342	.275	-.378
I feel at ease when I have clothes and accessories that are fine and rich	.260	-.005	.251	**.685**	.054	.390	.268	-.123
I like brand products although they are expensive	.299	-.053	.078	**.610**	-.042	.302	.205	-.149
If I have the chance, I want to become a musician, actor or a talent.	.348	-.174	.051	**.504**	.029	.259	.151	-.291
I feel uneasy when being alone.	.156	-.118	.238	**.397**	.298	.322	.199	-.254
I want to avoid being physically stressed	-.158	.127	.199	-.043	**.675**	.047	.145	.426
I don't have stamina	-.133	.026	.267	-.093	**.643**	.069	.187	.083
I cannot endure works that are "physically tough"	-.028	-.033	.154	.101	**.631**	.107	.135	.115
My physical strength does not come with my mental.	.071	.141	.335	-.053	**.586**	.153	.199	.007
I do not prefer making myself physically driven to a limit	-.242	.114	.210	-.070	**.533**	.026	.093	.335
I had given up something before due to lack of physical strength which I really wanted to do.	.135	.091	.360	.071	**.476**	.238	.202	-.210
I am attentive to proverbs and superstition that are said to be good for [Safety] and [Auspicious]	.204	.078	.378	.388	.146	**.866**	.326	-.099
I believe in [Amulet] and [Good luck charm] for safety	.225	.003	.285	.406	.116	**.744**	.279	-.179
I avoid foods that are not good for the body and tend to eat foods that are [Good forοо]	.279	.233	.334	.317	.061	**.429**	.288	-.131
I might be easily tempted to delicious food and comfortable things	.309	.287	.351	.108	.219	.263	**.587**	.172
I would like try new activities and foods prior from other people	.498	.102	.202	.499	-.002	.328	**.515**	-.218
I am a type who pursues physical pleasure	.450	.096	.255	.359	.113	.351	**.487**	-.072
I might be selfish to things that are comfortable to myself	.297	.230	.233	.144	.278	.236	**.410**	.121
I want to be rich	.190	.334	.261	-.015	.280	.150	.241	.414
Percent variance	17.190	9.107	7.531	3.259	2.439	1.749	1.673	1.016
Cumulative percentage	17.190	26.297	33.828	37.087	39.525	41.274	42.947	43.963
Cronbach's α	0.853	0.797	0.799	0.723	0.760	0.698	0.663	

4.2 Factor analysis on the results from the survey about security consciousness and environment

As a result of the SAT exploratory factor analysis, three factors were detected shown in Table 3, namely general security awareness, security environment, and high degree of security awareness.

Table 3: Factor Analysis Results Regarding Security Awareness and Environment

	Factors		
	General security awareness	Security environment	High degree of security awareness
	SS1	SS2	SS3
I make sure to check the senders of emails I received before opening them.	**0.753**	0.159	0.128
I make sure to install anti-virus software on my personal computer and smartphone.	**0.663**	0.145	0.118
I make sure to read over what I wrote before sending it as an email or posting it on the Internet.	**0.642**	0.21	0.1
I think it is dangerous to click on the links (URLs) that appear on the posts of bulletin boards.	**0.591**	0.147	0.162
I have received education on computer and computer networks, or I am currently receiving it.	0.151	**0.8**	0.23
I have taken training courses on information morale and security in school or workplace.	0.158	**0.774**	0.188
I sometimes talk about the Internet and computer with people around me.	0.377	**0.561**	0.147
I work on the computer or network-related field.	-0.028	**0.539**	0.281
I try to put a lock on my mobile smartphone or normal mobile phone with passwords.	0.36	**0.409**	0.361
I have acquaintances who are well-informed in computer and networks.	0.259	**0.368**	0.177
I regularly change my passwords even before the system prompts me to do so.	0.23	0.261	**0.742**
I always read the licence agreement before installing software.	0.307	0.301	**0.579**
I put a daily limit on how long I use the Internet privately.	-0.043	0.148	**0.5**
I do not write down my passwords in memos.	0.202	0.276	**0.407**
I do not do Internet shopping or auctions.	-0.206	0.019	**0.407**
I think it is dangerous to input my credit card number on the Internet shopping sites.	0.262	0.001	**0.341**
Percent variance	25.03	11.85	9.11
Cumulative percentage	25.03	36.89	45.99
Cronbach's α	0.755	0.752	0.645

4.3 Structure of security awareness development

A covariance structure analysis was conducted on the RMT composed scores and the composed scores of security consciousness and environment. This was done to clarity how individual desires and the environment affects participants' Internet literacy. We drew paths from all factors to general security consciousness and higher security consciousness. The path diagram is shown in Fig. 1.
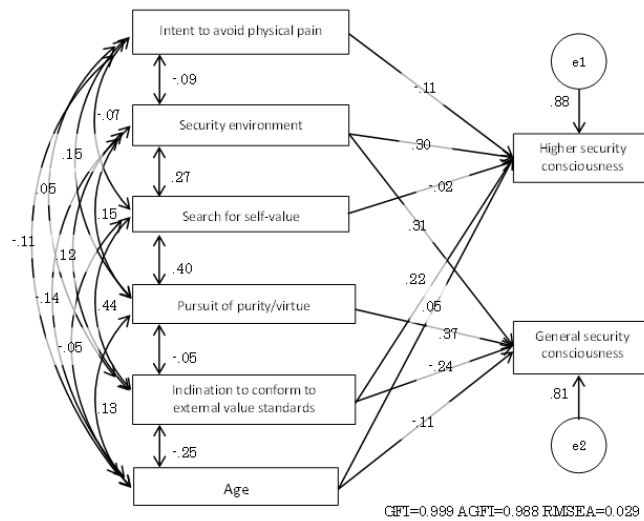
Figure 1: Relationships between individuals' desire characteristics and security consciousness

Thus, the "general security consciousness", "pursuit of purity/virtue", "security environment", "age", and "search for self-value" are effective factors, while the "inclination to conform to external value standards" is the obstructive factor.

The goodness of fit index of this model is GFI: 0.999 and AGFI: 0.988, which determines the path diagram is highly explanatory. The index of RMSEA: 0.029 confirms that the model is highly compatible as well.

5 Discussions and Conclusion

In this research, we have examined network security consciousness from the individual characteristics and environment affecting network usage. We have verified the survey results by using covariance structure analysis.

Both the"general security awareness" and "high degree of security awareness" factors had a large effect on the security environment. It showed that it was important to have knowledge about security (e.g., having computer or network education, having security related classes or working related to the computer networks).

Against the"general security awareness"and seeing that the"pursuit of purity/virtue"is the largest effective factor, it is conceivable that honesty increases safe consciousness network usage. Also, as "age" is an effective factor, it is conceivable that growing up and maturing can explain for this result. Concerning the results on "inclination to conform to external value standards" being the hindrance to "general security awareness," it shows some individuals have a tendency to be careless and to show off.

We can understand that the security environment and the general security awareness are greatly affect the high degree of security awareness. However, we have to keep in mind that the inclination to conform to external value standards is also an effective factor. A person with a strong inclination to conform to external value standards may generate false correlation, such as a strong orientation for specialised professions. The intent to avoid physical pain is hinders security awareness. Furthermore, selfish behaviour and attitudes or tendencies to dislike putting in effort are thought to prevent individuals from actually utilizing their security consciousness.

By researching the RMT as well as the security consciousness/environment, we have revealed how security consciousness is formed. It is possible to implement a more efficient network literacy education to members entering the Internet environment, where we can warn them before their entry with individualized instructions. By gathering large-scale basic data, we have explored models of psychological/social factors that obstruct risk consciousness and security literacy for members who participate in the network environment. We therefore have to refine these prediction models by gathering more data in the future.

REFERENCES

[1]. Ministry of Internal Affairs and Communications Institute for Information and Communications Policy. The announcement of Issuance of FY2013 Internet Literacy Indicator for Students Etc. Http://www.soumu.go.jp/main_content/000175589.pdf (accessed 2016-1-29).

[2]. OECD: THE PROTECTION OF CHILDREN ONLINE: Risks faced by children online and policies to protect them. http://www.oecd.org/sti/ieconomy/childrenonline_with_cover.pdf (accessed 2016-1-29)

[3]. Toyoda, Y. et al. (2014). Research for Education Programs Reducing Online Risks: Research on Textbooks of Technical Arts and Home Economics and Information Studies, and Syllabi of Information Literacy Programs in Secondary Education. SANNO College Jiyugaoka Bulletin Vol47, 1-12, 2014-06

[4]. Tashiro, M. (2011). Proposal of classification method of Internet-related troubles. The Infosocionomics Society, Vol.6, No.1, 101–114, 2011-6-18.

[5]. Ueda, Y. (2006). A possibility of education of "Joho Moraru" (information ethics in school education) as ethical education (2). Shitennoji International Buddhist University Bulletin, Vol.43, 111-127, 2006-12

[6]. Fujiwara, M. (2009). The relation between the Internet behavior and general social trust/uncertainty avoidance. The Japan Association for Social Informatica, Vol.20, No.2, 43-55, 2009-03-31

[7]. Ishida, T. (2011).A pilot survey of "internet-media addiction" by Japanese school pupils. Bulletin of Center for Clinical Psychology and Human Development, Kyushu University, Vol.4, 1-9, 2013-03-29.

[8]. Caplan, S.E. (2005). A Social Skill Account of Problematic Internet Use. Journal or Communication December 2015.721-736.2005-12

[9]. Ohki, M. (2011). The Influence of interpersonal communications over the Internet on Loneliness and QOL. The Society for Socio-Informatics, Vol.26, 383-386, 2011

[10]. Takeuchi, M., Suzuki, M. (2000). The basic study of the Self-Risk Management Test (SRMT) as a new tool for the educational programs informing lifetime risks of swindling victimization, Sanno College Junior Bulletin, Vol.33, 11–24.