Analysis of Introversion and Extroversion of HCI Over-Engagement in Korean and Chinese University Students

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Abstract: ***Background/Objectives: It is to investigate adverse effects of Human Computer Interface (HCI) for over-engagement; to enhance understanding how over-engagement affects introversion and extroversion behaviors in Korean and Chinese university students. Methods/Statistical analysis: The study aims to determine the differences of HCI over-engagement in introversion and extroversion behaviors by gender and by levels related to risky groups to know the level of HCI over-engagement introversion and extroversion behaviors. The study also analyzes HCI over-engagement influences by assessing K-indexes in 421 and 422 Korean and Chinese university students, respectively. T-test, one-way ANOVA, cross-tabulation analysis, and correlation analysis were performed as the statistical methods. Findings: Korean university students showed more extroversion over-engagement behaviors with a rating of 2.29 compared to introversion behaviors which had a rating of 2.16. Chinese students, on the other hand, showed more introversion over-engagement behaviors with a rating of 2.64 compared to 2.63 rating for extroversion behaviors. Females demonstrated more vulnerability to the risk of HCI over-engagement than males in case of simultaneous exposure, alike in both countries. As the level of over-engagement by risk groups increased, the internal distress and problematic behaviors and extroversion behaviors also increased significantly. These results justified the classifications of introversion and extroversion, which is the main concept in this study. With respect to the comparisons of risk groups of two countries' students, it shows the order: potential risk group < high-risk group < general group. This demonstrates that high-risk group is bigger than potential risk group in both countries.***

Improvements/Applications: HCI over-engagement could be measured as two different behaviors: introversion and extroversion; and by their levels. Thus clearly Negative-entropy viewpoint is planted in one system to deal with HCI.

Keywords: HCI, introversion, extroversion, over-engagement, negative entropy

I. INTRODUCTION

Though pregnancy, violence, consumptions of drinking alcohols, and smoking trend in adolescents has been decreasing over the past 20 years, HCI related problems in the adolescents were deemed to have adverse effects due to the difficulties encountered in understanding the new environment that was never experienced by previous generations[1-2]. The main reason behind the HCI related problems is the extended time to mature from adolescents to adults. The delayed transition to the social roles to get married, children, and employed has been depicted as one of the main causes of HCI related problems in adolescents [3-5]. A recent study demonstrated high correlation of interpersonal communication skill by HCI with daily interpersonal communication skill. In addition, studies in view of over-engagement have been facilitated upon understanding of positive correlation with systematic activities such as mutual communication, sharing closeness, and expressing affection [6-7]. As the interpretation method in view of over-engagement, the indexes of over-engagement postulate that humans and machines interaction could be classified as either introversion or extroversion [8]. Diagnostic tools for internet addiction have been developed without considering them as the integrative information model for processing by humans and computers during their interaction but as the independent structures of information processing. As a result, they could be diagnosed as individual, social, and internet variables focusing on the addiction and adverse effects of tolerance. Quantum mechanical human-computer interaction in Law of Entropy, which is the second law of thermodynamics supports the viewpoint that encapsulates human and computer within one system by the concept of Negative Entropy [9].

Considering the information model in the interaction between human and computer as one integrated system, it is interpreted that one sub-element affects the structure of the class within the other sub-element differently as the two-dimensional cyclic model of Cybernetics. This concept assists the information to be interpreted as a change in the organization level upon the interaction of one system with other system. E. Roy John and John R. Battista, psychologists who used this model [10], defined integrative information theory for the entire consciousness of human-beings as a statistical information theory [11]. This concept consists of seven internal information for the cognitive statuses. These information includes Senses, Perception, Emotion, Subjective perception by emotions, Cognition, Abstract thought, and Information or consciousness of self-awareness. The use of these concepts in studies is possible since the responders need to recognize them as their internal information.

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In addition, they should find out how the outcome affects the human internal changes using by linguistic diagnostic tools. However, it is hard to develop the diagnostic tools to measure the level of their feeling upon dividing them by 7 internal information. Among the methods used in the classification of the functions of human consciousness, introversion and extroversion, the great achievements of Carl Gustav Jung, are treated as major elements in explaining the differences of humans in Big 5 model that defines the personalities in psychology. To measure the organizational changes that reflect the outcome of interaction between human and computer, studies have been considered to differentiate between introversion and extroversion [8,12].

II. OBJECTS AND METHODS OF STUDY

Article analysis of over-engagement of internet addition in Korean University students indicated that extroversion problems are more pronounce than introversion related problems [8]. In addition, males showed higher level of both introversion and extroversion than females.

2.1. Object

In this article, comparison of introversion and extroversion behaviors through over-engagement of HCI is done between the university students in Korea and China in a bid to confirm whether this issue is general in the oriental culture. In addition, problematic behaviors by degree of over-engagement are done to confirm how these differences are exposed. Relations of over-engagement risk groups in both countries and relations of HCI over-engagement to affect the introversion and extroversion behaviors are identified, as well.

2.2. Test Method

The survey was conducted using K-index in 431 and 422 Korean and Chinese university students, respectively (N=853). Descriptive statistical analysis was performed in an effort understand introversion and extroversion behaviors in the students from both countries. T-test was performed to investigate introversion and extroversion behaviors by gender of the university students in Korea and China. To investigate introversion and extroversion behaviors by levels of HCI over-engagement in both country students, one-way ANOVA was performed and Duncan was used as post-hoc test. Cross-tabulation analysis was also performed to comprehend the relationship among over-engagement risk groups in Korea and China. Correlation analysis was also performed to construe the relationship among the influences to introversion and extroversion behaviors.

III. FINDINGS AND DISCUSSION

3.1. Level of HCI over-engagement introversion and extroversion behaviors in the university students from Korea and China

Descriptive statistics was performed to investigate introversion and extroversion behaviors in the university students from Korea and China. Upon t-test results, significant differences in introversion and extroversion behaviors were found between two groups. Introversion and extroversion behaviors in Korean students were 2.16 and 2.29 out of 4.0, respectively, which was lower than average. Introversion and extroversion behaviors in Chinese students were 2.64 and 2.63, respectively, which was somewhat higher than average. Korean students showed lower introversion and extroversion behaviors than Chinese students. The comparison between introversion and extroversion behaviors in Korean students indicated that introversion behavior was 2.16 and extroversion behavior was 2.29 out 4.0, which reflected significantly higher in extroversion behavior. For the comparison between two behaviors in Chinese students, they showed 2.64 for introversion behavior and 2.63 for extroversion behavior, as shown in table 1.

Table 1: Differences of introversion and extroversion by countries (N:853)

Classification		N	M	S.D	t value	p-value
Introversion	Korea	431	2.16	.530	-13.446***	.000
	China	422	2.64	.501		
Extroversion	Korea	431	2.29	.453	-11.324***	.000
	China	422	2.63	.406		

***: p <.001

As seen in the previous study results [8], Korean university students showed higher extroversion behavior than introversion behavior. Korean students showed higher extroversion over-engagement behavior (introversion over-engagement: 2.16, extroversion over-engagement: 2.29) while Chinese students showed higher introversion over-engagement (introversion over-engagement: 2.64, extroversion over-engagement: 2.63).

3.2. Differences of HCI over-engagement introversion and extroversion behaviors by gender in the university students from Korea and China

T-test was performed to investigate introversion and extroversion behaviors by gender in Korean and Chinese university students. The results indicated a significant difference in introversion behavior in terms of gender in both country students. In Korean students, females and males introversion behavior rating were 2.28 and 2.07, respectively. This indicated introversion behavior in females was higher than the introversion behavior in males. In Chinese students, the rating of introversion behavior in females and males were 2.66 and 2.46, respectively. This indicated the introversion behavior was higher in females than males.

Korean university students showed significant difference in extroversion behavior by gender in comparison to Chinese students who did not show any significant difference. Extroversion behaviors in Korean university students were 2.39 for females and 2.22 for males. The extroversion behaviors in females were higher than in males, as shown in table 2.

Table 2: Differences of introversion and extroversion by gender (N:853)

Classification			N	M	S.D	t value	p-value
Introversion	Korea	Male	247	2.07	.534	-4.053***	.000
		Female	184	2.28	.504		
	China	Male	48	2.46	.571	-2.612**	.009
		Female	374	2.66	.487		
Extroversion	Korea	Male	247	2.22	.455	-3.812***	.000
		Female	184	2.39	.433		
	China	Male	48	2.55	.439	-1.366**	.173
		Female	374	2.64	.402		

**: p<.01 *** : p < .001

In case of simultaneous exposure to the risk of HCI over-engagement, females were more vulnerable than males, which was not different by countries. This is consistent with the study results that indicated females were happy and distressed as well more than males. This meant that, if both males and females were exposed to the risk of HCI over-engagement simultaneously, females are more vulnerable in comparison to their male counterparts.

3.3. Differences of introversion and extroversion by levels of over-engagement in Korean and Chinese university students

One-way ANOVA was performed to investigate introversion and extroversion behaviors by levels of over-engagement in Korean and Chinese university students. Duncan was used for post-hoc test. The test results indicated a significant difference in introversion and extroversion behaviors were found between two groups by levels of over-engagement. With respect to introversion behavior in Korean students, high risk group, potential risk group and general group were 3.23, 2.82, and 2.05, respectively, demonstrating the highest in high risk group. In Chinese students, high risk group, potential risk group and general group were 3.30, 2.90, and 2.43, respectively, demonstrating the highest in high risk group. The group classification was divided into high-risk group, potential risk group and general group, as shown in table 3.

Table 3: Differences of introversion by levels of over-engagement (N:853)

Classification		Introversion			F value	p-value	Duncan's
		N	M	S.D			
Korea	High risk group	27	3.23	.353	117.839***	.000	c
	Potential risk group	18	2.82	.144			b
	General group	386	2.05	.440			a
China	High risk group	79	3.30	.277	188.464***	.000	c
	Potential risk group	37	2.90	.208			b
	General group	306	2.43	.397			a

*** : p < .001

With respect to extroversion behavior in Korean students, high-risk group, potential risk group and general group were 3.15, 2.88, and 2.20, respectively, demonstrating the highest in high-risk group. In Chinese students, high-risk group, potential risk group and general group were 3.21, 2.81, and 2.45, respectively, with the highest rating in high-risk group. For the classification by groups, they were divided by high risk group, potential risk group and general group, as shown in table 4.

Table 4: Differences of extroversion by levels of over-engagement (N:853)

Classification		extroversion			F value	p-value	Duncan's
		N	M	S.D			
Korea	High risk group	27	3.15	.270	106.223***	.000	c
	Potential risk group	18	2.88	.143			b
	General group	386	2.20	.383			a
China	High risk group	79	3.2132	.313	237.729***	.000	c
	Potential risk group	37	2.8117	.196			b
	General group	306	2.4591	.277			a

*** : p < .001

As the level of over-engagement by risk groups increased, distress feeling internally and problematic behaviors from extroversion behavior also increased. These results reflect the classification of introversion and extroversion which is the main concept of this study was logically right.

3.4. Relations among risk groups of HCI over-engagement by countries

Cross-tabulation analysis was performed to investigate the relations among risk groups of over-engagement in Korea and China. Upon the results, significant relations were found among risk groups in both countries. The shares of general group, high risk group, and potential risk group were 89.6%, 6.3%, and 4.2%, respectively, in Korea, while 72.5%, 18.7%, and 8.8% in China, as shown in table 5.

Table 5: Relations among risk groups of over-engagement by countries (N:853)

Classification	Frequency of high risk group (%)	Frequency of potential risk group (%)	Frequency of general group (%)	X^2	p-value
Korea	27(6.3)	18(4.2)	386(89.6)	41.231***	.000
China	79(18.7)	37(8.8)	306(72.5)		

*** : p < .001

Also, it showed the shares by potential risk group < high risk group < general group, reflecting more high risk group than potential risk group in both countries.

3.5. Relations among influences of HCI over-engagement to introversion and extroversion

Correlation analysis was performed to investigate the relations between influences of HCI over-engagement to introversion and extroversion behaviors. The results indicated, over-engagement showed a positive correlation with introversion and extroversion behaviors (r=.780, p<.001), and negative correlation in countries (r=-.419, p<.001) and gender (r=-.333, p<.001). The results also showed the positive correlation with over-engagement risk groups (r=.588, p<.001), as shown in table 6.

Table 6: Relations among influences to introversion and extroversion (N:853)

	Introversion	Extroversion	Country	Gender	Addiction risk group
Introversion	1				
Extroversion	.780***	1			
Country	-.419***	-.362***	1		
Gender	-.333***	-.287***	.483***	1	
Addiction risk group	.588***	.602***	-.189***	-.139***	1

*** : p < .001

IV. CONCLUSION

In this article, introversion and extroversion behaviors by HCI were compared between Korean and Chinese students. Korean students showed higher extroversion over-engagement behaviors in comparison to Chinese students who had higher introversion over-engagement behaviors (introversion over-engagement: 2.16, extroversion over-engagement: 2.29) (introversion over-engagement: 2.64, extroversion over-engagement: 2.63). Regardless of the countries, females showed more vulnerability than males on exposure to the risk of HCI over-engagement, simultaneously. The fact that introversion and extroversion behaviors were increased by risk groups tells us the justification of the classifications of introversion and extroversion, which is the main concept in this study. Increase of introversion and extroversion behaviors in the risk groups justified the classification of introversion and extroversion, which were the main concepts of this study. In the two countries, high risk group was found to be more than the potential risk group in both countries. The analyzed results indicated that HCI over-engagement can quantify the influences in the communication process between cyber and real world. This supports the viewpoint of Negentropy to deal with interactions between human and computer within one system. It also meant that HCI over-engagement is an organizational change from the result of interaction between human and computer.

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