## The influence of cyber-friends on loneliness and social anxiety: The training effects of "natural" simulation of interpersonal relationships

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In the field of simulation and gaming science, a large number of studies have been conducted on education/training using simulated situations. However, in the majority of such studies, individuals experienced created or developed simulated situations. Meanwhile, there are in fact simulated situations in daily life that individuals voluntarily deal with, and these simulated situations provide effective training for those individuals. This paper will present case studies of such "natural" simulations.

## Simulation of Interpersonal Relationships on the Net

Individuals can find other individuals who share their interests much easier on the Internet ("Net," hereinafter) than in real life. This is because the Net allows anonymity, provides little visual information on users, and discloses a wide variety of information. Therefore, the Net is recently becoming a popular type of media for individuals to establish new interpersonal relationships (Parks and Floyd, 1996; McKenna and Bargh, 2000). The characteristics of the Net, especially the anonymity and limited visual information, seem to help shy individuals establish interpersonal relationships. For shy individuals, these characteristics protect them from pressures from other individuals or nervousness arising from directly interacting with other individuals.

Attention has been focused on such ease of establishment of interpersonal relationships on the Net, and studies have been conducted in an attempt to use the Net as a tool for sociality training. For example, Sakamoto et al. (2002) instructed individuals with high degrees of shyness to create their "avatars" in virtual space and to play with other avatars in online games called MUDs or multi-user dungeons. The subjects were instructed to behave sociably and as a result, although a short-term effect, the study showed that their sociality improved in terms of direct interaction with other individuals. In this study, subjects were forced to simulate sociable behavior on the Net, and the experimenters discovered that such simulation served as a training tool. The subjects were believed to learn tips for establishing interpersonal relationships and also how to be self-confident through participation in the simulation sessions, and it seemed that what they learned influenced their sociality in direct interactions with other individuals. In fact, for

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some individuals, not only such experimental and forced simulations but also the use of the Net in daily life is thought to serve as a tool for sociality training.

## The Effects of "Natural" Simulations

There was a case where an individual, who did not have a strong presence because he/she was not confident in his/her own appearance and hardly talked in the presence of other people, became respected by other individuals on the Net for carrying on witty conversations and became confident in dealing with direct interpersonal relationships (Wallace, 1999). Since the Net provides little information on what users look like, it can provide a "natural" simulation session with training effects. Individuals who are not comfortable with directly communicating with others due to their visual information such as lack of physical attractiveness can casually participate in such a session.

Physical attractiveness is something that greatly affects impressions and evaluations, (Berscheid and Walster, 1974) and is an important factor in interpersonal relationships in the real world. Individuals who give a low self-evaluation for their own physical attractiveness feel awkward being in public or expressing themselves, and then become passive since they are too worried about how others evaluate or judge them. This process may cause social anxiety in these individuals (Leary, 1983). Also, such social anxiety may cause a negative chain reaction because the social anxiety prohibits good interpersonal relationships and thus leading to heightened degrees of loneliness. We predict that individuals who evaluate their physical attractiveness as low can benefit more from Net experience than those who evaluate their physical attractiveness as high since, on the Net, those who evaluate their physical attractiveness as low can behave as active individuals and learn how to interact with other individuals and how to be confident.

At the same time, we also predict that those who evaluate their physical attractiveness as low will try to establish more interpersonal relationships on the Net instead of in the real world so that they will be able to reduce their loneliness or social anxiety.

### **Research Objectives**

In this paper, causal relationships were examined between the number of friends (or close friends) that the study subjects made on the Net ("cyber-friends," hereinafter), and the loneliness or social anxiety that they experience when they meet other individuals for the first time. More specifically, we conducted multi-group analyses on two subject groups, one evaluating their own physical attractiveness as high ("high self-evaluation group," hereinafter) and the other one evaluating their own physical attractiveness as low ("low self-evaluation group," hereinafter), using the structural equation model. Then, four hypotheses introduced below were examined.

In this study, we referred to the research of Parks and Roberts (1998) and divided cyber-friends into a same sex category and an opposite sex category. This is because it has been pointed out that existence of friends, regardless of their sex, plays a significant role in interpersonal relationships (Argyle, 1987).

For loneliness, we examined its three aspects: loneliness felt in friend relationships (close relationships); loneliness felt in family relationships (close relationships); and loneliness felt in society, which is a large group of people. Subjects of this study were young individuals of around 20 years of age who in general were supposed to have strong interest in love relationships. Therefore, we expected that: if they evaluated their physical attractiveness as low, then an increase in the number of cyber-friends of the opposite sex could have a positive influence on loneliness they felt in their friend relationships; and the subjects would attempt to obtain cyber-friends of the same sex or opposite sex depending on the types of loneliness.

- **Hypothesis A:** The positive effects of the number of cyber-friends on loneliness would be significant for the low self-evaluation group. Also, such effects would be stronger if the cyber-friends were from the opposite sex.
- **Hypothesis B:** The positive effects of the number of cyber-friends on social anxiety would be significant among the low self-evaluation group. Also, such effects would be stronger if the cyber-friends were from the opposite sex.
- **Hypothesis C:** When the low self-evaluation group experienced high degrees of loneliness, they would actively try to increase the number of cyber-friends. Also, whether they attempt to obtain cyber-friends of the same sex or opposite sex would differ between the types of loneliness they felt.
- **Hypothesis D:** When the low self-evaluation group experienced high degrees of social anxiety, they would actively try to increase the number of cyber-friends.

If Hypothesis A or B is supported, "natural" interpersonal relationship simulations on the Net can be considered to serve as a training tool for those who evaluate their physical attractiveness as low.

## Method

- **Subjects** 178 university students (63 male students and 115 female students). Average age of male subjects was 20.7 and 20.1 for female subjects.
- **Procedure** The first survey was conducted in October 2000, and the second survey was conducted in January 2001.
- Survey contents

- **Number of cyber-friends:** Subjects were asked how many friends and close friends of the same sex and the opposite sex they made on the Net. In the analyses, the number of friends and close friends were totaled for the same sex and the opposite sex and were treated as the "number of friends of the same sex" and the "number of friends of the opposite sex" respectively.

- Self-evaluation of physical attractiveness: Based on the Physical Self-Description Questionnaire (PSDQ) by Marsh et al. (1994), 10-item 7-point scale was created. In both surveys, the  $\alpha$  coefficient was 0.93.

- **Loneliness:** 10 items for loneliness felt in family and friend relationships created by Hirosawa et al. (1984) were used. And 5 items for loneliness felt in society were created. Each item was provided as 7-point scale. For loneliness felt in family relationships, the  $\alpha$  coefficients were .86 and .88. For loneliness felt in friend relationships, the  $\alpha$  coefficients were .88 and .88. For loneliness felt in the society, the  $\alpha$  coefficients were .73 and .77.

- Social anxiety: For social anxiety felt when the subjects met other individuals for the first time, 5 items created by Fenigstein et al. (1975) were used. Each item was provided as 7-point scale. The  $\alpha$  coefficients were .82 and .86.

- Demographical data: Age and sex.

## Results

## Analysis model

In this study, a panel study was conducted to measure twice the relationship between the number of cyber-friends of the same/opposite sex, and loneliness and social anxiety. Then, the structural equation model was used to analyze how two variables in the first survey influenced two variables in the second survey. As a means for data analysis, the cross-lagged effect model was used since it was suitable for using such longitudinal data to predict causal relationships between variables (Fig.1) (Finkel, 1995). Using this model, multi-group comparisons were conducted with the two groups of subjects. For each subject, his/her selfevaluation score for physical attractiveness was divided by the mean score, and depending on the obtained value, subjects were divided into the high-score group (83 subjects) or the low-score group (94 subjects).

In order to examine the fitness of the analysis model, the  $\chi^2$  value, GFI(Goodness of Fit Index), AGFI(Adjusted Goodness Fit Index), RMSEA(Root Mean Square Error of Approximation), and AIC (Akaike's Information Criterion) were used. Conventionally, the model is considered to be well fit to the given data when the GFI value is .9 or higher, the RMSEA value is .10 or lower (.05 or lower is further desirable), and the AIC value is the lowest.



### Selection of an analysis model

For high and low self-evaluation groups, causal relationships between the number of their cyber-friends of same/opposite sex, and loneliness and social anxiety (Path e and f in Figure 1) were examined. In order to conduct the multi-group analyses, equivalent restrictions were eliminated one by one from Model 1 to Model 10. In Model 1, all the relationships shown as path a through f in Figure 1 were assumed to be the same between the high and low self-evaluation groups. Model 10 is a saturated model in which all relationships shown as the same path were different between the two groups

**Table 2. Equivalent restrictions** 

Model	equivalent restrictions	df
Model1	a.b.c.d.e.f	6
Model2	a.b.c.d.f	5
Model3	a.b.c.d.e	5
Model4	a.b.c.d	4
Model5	a.b.c	3
Model6	a.b.d	3
Model7	a.b	2
Model8	а	1
Model9	b	1
Model10	none	0

(Table 2). Then, based on the fit indices, the model that was considered the most appropriate in predicting causal relationships between variables was selected. Table 3 shows each fit index value for the selected model. According to each of the indices, each set of the model and data can be judged to have degrees of fitness.

### Causal relationship

Based on the hypotheses above, the following items will be discussed in sequence: A. the influence of the number of cyber-friends of the same sex and opposite sex on loneliness (shown as Path e); B. the influence of the number of cyber-friends of the same sex and opposite sex on social anxiety (shown as Path e); C. the influence of degrees of loneliness on the number of cyber-friends (shown as Path f); and D. the influence of degrees of social anxiety on the number of cyber-friends (shown as Path f).

Table 3. Fit index value for the selected mode	Га	a	bl	e	3.	F	it	index	x va	alue	for	the	selected	mode	ł
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	Model	$\chi^2$	df	GFI	AGFI	RMSEA	AIC
< <u>cyber-friends of opposite sex&gt;</u>							
loneliness (friend relationships)	Model5	6.61	3	.98	.88	.08	40.61
loneliness (family relationships)	Model8	.25	1	.99	.99	.00	38.25
loneliness (society)	Model10	.00	0	1.00			40.00
social anxiety	Model1	12.41	6	.97	.90	.08	40.41
< <u>cyber-friends of same sex</u> >							
loneliness (friend relationships)	Model10	.00	0	1.00			40.00
loneliness (family relationships)	Model8	1.04	1	.99	94	.02	39.04
loneliness (society)	Model10	.00	0	1.00			40.00
social anxiety	Model8	2.79	1	.99	.84	.10	40.79

	loneliness						
	frie	ends	far	nily	society		
	path e	path f	path e	path f	path e	path f	
<high-score group=""></high-score>							
opposite sex cyber-friends	n.s.	26*	n.s.	.25*	.23**	n.s.	
same sex cyber-friends	n.s.	28**	n.s.	n.s.	.15†	23*	
< <u>low-score group&gt;</u>							
opposite sex cyber-friends	12*	n.s.	.16**	.38***	n.s.	.41***	
same sex cyber-friends	11 <sup>†</sup>	.21***	n.s.	n.s.	n.s.	.19***	
NL ( *** < 001 ** < 01 *	< 05 1	< 10					

Table 4. Causal relationship between the number of cyber-friends and loneliness

Note: p < .001, p < .01, p < .05, p < .10.

*Causal relationship between the number of cyber-friends and loneliness* For the low self-evaluation group, loneliness felt in friend relationships was reduced regardless of the sex of cyber-friends so long as they increased in number. Between the sexes of the cyber-friends, those of the opposite sex had stronger effects on loneliness than the same sex. Meanwhile, loneliness felt in family relationships became higher as the number of cyber-friends of the opposite sex increased. On the other hand, the high self-evaluation group showed or tended to show heightened loneliness in society regardless of the sex of cyber-friends so long as they increased in number. Also, no causal relationship was found between the number of cyber-friends and loneliness felt in friend or family relationships (Table 4). Therefore, Hypothesis A, "the positive effects of the number of cyber-friends on loneliness would be significant for the low self-evaluation group. Also, such effects would be stronger if the cyber-friends were opposite sex," was supported.

*Causal relationship between the number of cyber-friends and social anxiety* The analysis results showed that: for the low self-evaluation group, social anxiety lowered as the number of cyber-friends increased; and for the high self-evaluation group, social anxiety heightened as the number of cyber-friends increased. The increase of the number of cyber-

friends of the opposite sex in particular did not result in any changes to the degrees of social anxiety in both groups (Table 5). Hence, Hypothesis B was partially supported since the positive effects of the number of cyber-friends on social anxiety were significant for the low self-evaluation group, but there were no such effects when the cyber-friends were from the opposite sex.

 Table 5. Causal relationship between the number of cyber-friends and social anxiety

	social anxiety		
	path e	path f	
< <u>high-score group</u> >			
opposite sex cyber-friends	n.s.	n.s.	
same sex cyber-friends	.19**	n.s.	
< <u>low-score group</u> >			
opposite sex cyber-friends	n.s	n.s.	
same sex cyber-friends	47	n.s.	
Note: *** $p < .001$ . ** $p < .01$ .			

*Causal relationship between loneliness and the number of cyber-friends* For the low self-evaluation group: the number of cyber-friends of the same sex increased when the subjects showed high degrees of loneliness in friend relationships; the number of cyber-friends of the opposite sex increased when the subjects

showed high degrees of loneliness in family relationships; and the number of cyber-friends, regardless of their sex, increased when the subjects showed high degrees of loneliness in society. On the other hand, for the high self-evaluation group: the number of cyber-friends of the opposite sex increased when the subjects showed high degrees of loneliness in family relationships; the number of cyber-friends of the same sex decreased when the subjects showed high degrees of loneliness in society; and the number of cyber-friends, regardless of their sex, decreased as the subject showed high loneliness in friend relationships (Table 4). Therefore, Hypothesis C, "when the low self-evaluation group experienced high loneliness, they would actively try to increase the number of cyber-friends. Also, whether they attempt to obtain cyber-friends of the same sex or opposite sex would differ between the types of loneliness they felt," was supported.

*Causal relationship between social anxiety and the number of cyber-friends* Social anxiety showed no significant effects on the number of cyber-friends (Table 5). Therefore, Hypothesis D, "when the low self-evaluation group experienced high social anxiety, they would actively try to increase the number of cyberfriends," was not supported.

## Discussion

# Causal relationship between the number of cyber-friends and loneliness (Path e): Hypothesis A

Hypothesis A was supported. The positive effects that the number of cyberfriends had on loneliness were more clearly indicated in the low self-evaluation group than the high self-evaluation group, and also the cyber-friends of the opposite sex showed more powerful effects. However, while the increase of the number of cyber-friends of the opposite sex had positive effects, meaning that it reduced loneliness in friend relationships, it also heightened loneliness in family relationships. This complicated result can be interpreted by using the theory by Kraut et al.(1998) that the subjects spent a reduced amount of time with their family members as they were on the Net for longer periods than before. This was because communicating with cyber-friends of the opposite sex was fun to the subjects since it allowed the subjects to anticipate that the relationship could grow into a love relationship.

Meanwhile, the number of cyber-friends did not have any positive effects for the high self-evaluation group. Only the negative effect that the increase in the number of cyber-friends of the opposite sex heightened loneliness in society was found. Explanations for this result must be discussed in the future; however, it could be because those who had a confidence in their physical appearance and were comfortable with actual interpersonal relationships felt vague loneliness since it was difficult to completely know about someone who they met on the Net.

## Causal relationship between the number of cyber friends and social anxiety (Path e): Hypothesis B

Hypothesis B was partially supported; the study showed that the positive effects of the number of cyber-friends on social anxiety were more clearly indicated in the low self-evaluation group than the high self-evaluation group. However, this effect was observed only when the cyber-friends were from the same sex. Therefore, for those who evaluated their physical attractiveness as low, communication on the Net with someone from the opposite sex did not work as a training tool to learn how to behave in real-world situations where they met someone for the first time. Rather, these subjects would better reduce their social anxiety in the same situation in real life through communicating with cyber-friends of the same sex and establishing interpersonal relationships.

Meanwhile, the increased number of cyber-friends of the same sex resulted in the negative effect that it heightened social anxiety of those who evaluated their physical attractiveness as high. The subjects in the low self-evaluation group in general felt stressed about real-world situations where they met someone for the first time; therefore, successful experience in establishing interpersonal relationships on the Net with someone from the same sex would result in positive effects on social anxiety in real world. On the other hand, those in the high selfevaluation group did not feel any stress in situations where they met someone new; therefore, it was quite likely that they took an active part in conversations from the beginning or that they attempted to personally meet their cyber-friends in order to develop their relationships. This type of behavior may cause interpersonal trouble resulting in short-lasting relationships. After repeating such experiences, they may develop anxiety towards establishing new interpersonal relationships. Such negative effects must be studied in the future.

## Causal relationship between loneliness and the number of cyberfriends (Path f): Hypothesis C

Hypothesis C was supported. The study showed that when the low self-evaluation group experienced high degrees of any kind of loneliness, they actively tried to increase the number of cyber-friends. Also, whether they attempt to obtain cyber-friends of the same sex or opposite sex differed between the types of loneliness they had been experiencing.

For loneliness in family relationships, the results were the same in both low and high self-estimation groups. In other words, the number of cyber-friends from the opposite sex increased as their loneliness in family relationships heightened. This result was partially due to the fact that the subjects of this study were young adult of around 20 years old. It is possible to interpret that the study result indicated that when the subjects did not feel loved by their family members, their attention was directed towards communication with cyber-friends of the opposite sex as such communication allowed the subjects to anticipate that the relationship may grow into love relationships. However, as described above, causal relationships of the opposite direction was also found in low self-evaluation group. Therefore, it should be noted that the increase in the number of cyber-friends of the opposite sex may function to multiply loneliness in family relationships.

For loneliness in friend relationships, the number of cyber-friends of the same sex increased when this type of loneliness heightened for the low self-evaluation group. However, the number of cyber-friends of the same and opposite sexes decreased for the high self-evaluation group. Similar results were indicated in terms of loneliness the subjects experienced in society. The number of cyber-friends, regardless of their sex, increased for the low self-evaluation group when such loneliness heightened. For the high self-evaluation group, however, the number of cyber-friends of the same sex decreased as their loneliness heightened. This may be because the subjects in the low self-evaluation group: attempted to increase the number of cyber-friends of the same sex to casually communicate in order to reduce their loneliness in friend relationships; and also attempted to increase the number of cyber-friends of either sex as much as they could in order to assure themselves that they were a part of society when their loneliness in society heightened. On the other hand, the subjects in the high self-evaluation group might put less effort and resources into maintaining interpersonal relationships on the Net so that they could put more effort into real interpersonal relationships when they felt higher degrees of loneliness in friend relationships or in society. Such a tendency will be a future study objective.

## Causal relationship between social anxiety and the number of cyberfriends (Path f): Hypothesis D

No significant causal relationship was found between social anxiety and the number of cyber-friends; therefore, Hypothesis D was not supported. Regardless of self-evaluation of their physical attractiveness, the subjects were believed to have little motivation to establish new interpersonal relationships when they had high degrees of social anxiety in the real world.

## Conclusions

## Cyber-friends, physical attractiveness, loneliness, and social anxiety.

This study has shown that for those who evaluated their physical attractiveness as low: if the number of cyber-friends of the same or the opposite sex increased, their loneliness in friend relationships was reduced and their mental health improved; and if the number of cyber-friends of the same sex increased, their social anxiety that they would feel when they met other individuals for the first time was reduced. This is probably because the subjects learned how to interact with others or how to be confident in themselves. They were able to learn such things because they did not have to be handicapped by their low physical attractiveness self-evaluation on the Net; therefore, they were able to behave actively.

This study also showed that the subjects in the low self-evaluation group attempted to obtain more cyber-friends as the degrees of loneliness became higher in friend relationships, family relationships, and in society. Although some of the study results related to those who evaluated their physical attractiveness as high still require further discussion and studies, this study is the first research that obtained experimental data regarding the functions of the Net in relation to selfevaluation of physical attractiveness. Therefore, we believe this study is meaningful in the field of Net science.

#### Implications for simulation and gaming science

The results of this study have also implied that not only simulated situations forcefully provided by researchers but also simulated situations that individuals spontaneously used in their daily life could have training effects. Previous simulation and gaming science paid little attention to such "natural" simulation, but in the future, understanding of types and roles of simulated situations existing in daily life or society could be the research objectives of this field.

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