Cell-Phone Use and Friendship Preferences of University Students[1]
—An Investigation of the Causal Relationship Using a Panel Survey

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It has been argued that cell-phone use has caused young people to tend to prefer selective friendships in which they choose different friends for different purposes. In this study, we conducted a three-wave panel study with undergraduate students to examine the causal relationship between cell-phone use and preference for selective friendships. The results suggest that there was a short-term effect in which calls on cell phones to convey information and to talk about hobbies and interests and family, along with email used to convey information, may reinforce selective friendships. The study also revealed a long-term causal relationship in which more days per week during which phone calls were made or longer calls over cell phones about personal problems led to a stronger preference for all-around friendships, characterized by individuals always being with the same friends regardless of the situation. Although not much attention has been paid to the effect of cell-phone use on all-around friendships, it will be necessary to examine this in the future.

Key words: cell-phone, selective friendship, panel survey

Introduction

Along with the rapid spread of cell phones among young individuals, concerns are emerging that the use of cell phones may adversely affect the friendships of young people. In particular, some have been arguing that the use of cell phones would reinforce the tendency of young people to avoid intense friendships, thus leaving them to establish only superficial, poor friendships. For instance, Okonogi (2000) argues that, as the relationship between people and media such as cell phones becomes commonplace, interpersonal relationships are reduced, and people rely more on media as a substitute for these reduced interpersonal relationships. Some also think that friendships of young

people are not simply superficial; they tend to prefer selective friendships in that they can choose whom to be with depending on situations or objectives (Matsuda, 2000). A selective friendship refers to a relationship in which, for particular situations or objectives, individuals choose whom to play with or to be with from among their pool of friends based on their hobbies or interests (Matsuda, 2000). This friendship is similar to a selective commitment, in which a friendship is formed in a limited situation (Asano, 1999), and to friendship switching, in which partial friendships result from changing communication channels among friends according to the occasion (Tsuji, 1999). This relationship is considered to be the opposite of an all-around friendship, in

which individuals always see the same person regardless of the situation and they know everything about each other (Kobayashi, 2001).

Several studies have investigated the relationship between selective friendship and the use of cell phones. Studies by Tsuji (1999, 2003) suggested that, although those who were highly likely to go out with different friends for different occasions spent a large amount of time talking on cell phones, this tendency was not observed in email exchanges. Tsuji (2003) noted the differences in purpose between calling and using email, suggesting that when individuals called on cell phones, they used their cell phones as a tool or means for selecting the most suitable friends for particular occasions, but when individuals used email, they tended to exchange email with a self-contained chat type of content to maintain or improve their friendships.

However, there have been studies that did not indicate any relationship between the use of cell phones and a preference for selective friendships. For example, the study by Hashimoto (2003) did not find any significant relationships between selective friendships and use or non-use of cell phones. Examination of the frequency of cell-phone use and selective friendships did not reveal any significant relationships either. As described above, previous studies did not show consistent findings about relationships between selective friendship and cell-phone use. Furthermore, none of these studies investigated causal relationships between selective friendship and cell-phone use, because they involved only correlation research. Thus, in this study, we believe it is necessary to examine the causal relationships between the use of cell phones and selective friendships, and the trend or direction of that relationship.

Furthermore, the earlier studies focused only on the overall amount of cell-phone use, and they therefore appear not to have examined the relationship between modes of use of cell phones and friendships. In this re-gard, Tsuji (1999, 2003) suggested that when cell phones were used to make actual phone calls, the cell phones were being used as a tool or means, and could be considered as a type of media suitable for selecting friendships in accordance with situations. In contrast, the email function of cell phones is often used to chat. However, in addition to chatting, email exchange through cell phones, is often used as a tool or means for more businesslike communications than occurs in cell-phone calls (Dai-ichi life research institute, 2002), and it is thus considered necessary to examine the relationship between types of friendships and the objectives or methods of using cell phones instead of focusing on the functions of cell phones such as calls or email.

Purposes

Based on the discussion above, this study has the following two purposes.

The first purpose is to examine the causal relationship between the amount of cell-phone use and the preference for selective friendships. In order to investigate this relationship, we conducted a three-wave panel study. A panel study refers to a study in which the same survey is administered twice or more to the same group of participants at specific time intervals. This permits the estimation of inter-variable causal relationships. In particular, in a three-wave panel study, in which the same survey is administered three times, not only may short-term causal relationships between the first and second survey results or between the second and third survey results be examined, but it is also possible to simultaneously examine the relatively long-term causal relationship between the first and third survey results. This study compared the short-term and long-term causal relationships between cell-phone use and selective friendship.

Our second purpose is to investigate the causal relationships between the amount of cell-phone use for each purpose and the preference for selective friendships.

Table 1 Attributes of participants

	Number of participants				Average age	
	Total	Male	Female	Noresponse		
Time 1	303	121	181	1	20.02	
Time 2	172	76	92	4	20.42	
Time 3	79	28	51	0	21.13	
Times 1 & 2	137	63	74	0	19.99 (Time 1)	20.43 (Time 2)
Times 2 & 3	63	18	45	0	20.95 (Time 2)	21.10 (Time 3)
Times 1 & 3	67	24	43	0	20.52 (Time 1)	21.08 (Time 3)

Method

Participants

Students from seven universities in a metropolitan area in Japan answered the same questionnaire three times. Note that only six universities participated in the third survey. Although the majors of the participants varied, they all took a class relating to psychology. Attributes of the participants such as their number, average age, and gender are listed in Table 1.

In this study, there were not many participants in the third survey, and only 54 students participated in all three surveys.[2] Therefore, instead of analyzing data obtained from the participants who participated in all three surveys, we analyzed data obtained from those who participated in two surveys. In order to estimate the short-term causal relationship, we analyzed data obtained in the first and second survey or the second and third survey. We analyzed data in the second and third surveys to estimate the long-term causal relationship. Table 1 lists the attributes of the respondents in each analysis.

Procedure

The questionnaire was administered and collected during a class relating to psychology. The first survey was conducted in July 2002, the second in October 2002, and the third in January 2003.

Questionnaire

The administered questionnaire was structured as described below.

Use/Non-use of cell phones and duration of use The participants were asked if they owned a cell phone (including PHS). They were also asked how long they had been using cell phones, which they answered using an eight-point scale (Table 3) Finally, they were asked when they started using cell phones, which they answered using a nine-point scale (Table 4).

Amount of cell phone use Based on the scale devised by Ando et al. (2004), we asked the participants their average number of phone calls made with a cell phone and their average amount of use of the cell phone email function during the past two weeks. The participants answered with (a) the amount of use per day, (b) the number of times of use per day, and (c) the number of days of use per week, using an eight-point scale (Appendix 1). Note that, for the amount of cell-phone use and the number of times of cell-phone use per day, the ranges

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[2] Structural equation modeling analyses were conducted using data obtained from 54 students who participated in all three surveys. The cross-lagged-effect model was used in the analyses. In all of these analyses, this model was rejected by the chi-square goodness-of-fit test. According to Asano, Kojima, & Suzuki (2005), the goodness of fit should be evaluated by conducting a chi-square test when the number of samples is small. In particular, when the number of samples is below 100, it is necessary that the model not be rejected as a result of the test. In this study, instead of conducting a structural equation modeling analysis using data obtained from the participants of all three surveys, we conducted a multiple-regression analysis using data obtained from participants who participated in any two of the three surveys in order to estimate causal relationships.

indicated for each point in the individual scales become larger as the values become larger because the number of times of cell-phone use would weigh differently for different amounts of cell-phone use.

Amount of cell-phone use for each purpose The purposes for talking on a cell-phone or using the email function were divided into simply conveying information, talking about trivial matters, talking about hobbies and interests, talking about personal problems, talking about persons of the opposite sex or about love, and talking about family. For each of these purposes, the participants answered how much they use their cell phones using a five-point scale from 0 "I do not use a cell phone at all" to 4 "I use my cell phone quite often."

Score on the friendship preference scale We developed a scale to measure the preference for selective friendships. A preference for selective friendships refers to both the desire for selective friendships and the attitudes and behavioral tendencies involved in seeking selective friendships. In this study, we developed a friendship preference scale consisting of items associated with a preference for selective friendships, in which individuals preferred to select whom to be with from a pool of friends depending on the situation, and items associated with a preference for all-around friendships, in which individuals preferred to be with the same friends regardless of the time or situation. Here, the items for the latter preference are referred to as reversed items. The scale had a total of 19 questions. There were 11 questions regarding a preference for selective friendships such as "I choose friends depending on what I am going to do," and eight questions regarding a preference for all-around friendships such as "Being best friends means no secrets between us." A higher score on this scale would indicate a strong preference for selective friendships, and a lower score would indicate a strong preference for all-around friendships. An item analysis was conducted using the data obtained from 303 participants in the first

Table 2 Internal consistency and retest reliability of friendship preference

		Time 1	Time 2	Time 3
Internal consistency (α)		.73	.72	.78
Retest reliability (γ)	Time 1	—	.74	.74
	Time 2	—	—	.67

survey. In the analysis, four inadequate items (items 4, 8, 10, and 18) were eliminated, and the remaining 15 items were used as the friendship preference scale (Appendix 2). Values obtained for the reversed items were reversed, and we could then add up the values of the 15 items to calculate scores on the friendship preference scale. The internal consistency of this scale is $\alpha=.72$ to .78 and the retest reliability is $r=.67$ to .74 (Table 2). Questions were answered using a six-point scale from 1 "I strongly disagree," to 6 "I strongly agree."

Attributes The participants provided information on their gender, age, and university.

Results

Cell-phone ownership ratio and duration of use

Among the 303 participants in the first survey, 289 (95.4%) reported that they owned a cell phone.

As for duration of use, three years to less than five years was most frequently selected (46.53%), followed by two years to less than three years (22.44%) and five years or longer (12.54%) (Table 3). Results indicated that 81.51% of the participants had been using cell phones for over two years.

As for the timing of starting to use cell phones, "When I was in the first year of senior high school" was most frequently selected (34.98%), followed by "When I was in the second year of senior high school" (22.44%) and "When I was in the third year of senior high school" (16.17%), indicating that approximately 70% of the participants (73.59%) started to use cell phones when they were senior high school students (Table

Table 3　Duration of mobile phone use

	Response	Ratio (%)
Do not use a mobile phone	13	4.29
3 months or less	3	0.99
4 to 6 months	8	2.64
7 to 12 months	5	1.65
1 yearto less than 2 years	26	8.58
2 years to less than 3 years	68	22.44
3 years to less than 5 years	141	46.53
5 years or longer	38	12.54
No response	1	0.33
Total	303	100.00

Table 4　Timing of starting to use cell phones

	Response	Ratio (%)
Do not use a mobile phone	11	3.63
Junior high school student	25	8.25
First year of senior high school	106	34.98
Seccnd year of senior high school	68	22.44
Third year of senior high school	49	16.17
First year of university	40	13.20
Second year of university	2	0.66
Third year of university	1	0.33
Fourth year of university	0	0.00
No response	1	0.33
Total	303	100.00

4).

Examination of a short-term effect

The effect of the amount of cell-phone use on friendship preference Multiple-regression analyses were conducted in order to examine the effect of the amount of cell-phone use measured in the first survey on the friendship preferences measured in the second survey. The analyses were conducted by using the amounts of calling and emailing measured at Time 1 as independent variables, and the friendship preference scores obtained at Time 2 as dependent variables. Attributes such as the age, gender, and university (as dummy variables) of the participants as well as the friendship preference scores obtained at Time 1 were controlled (Table 5–1).

The results of the analyses indicated that neither the amount of calling nor the number of times of cell-phone use per day or per week had any significant effect on friendship preference. When the effects were analyzed for each purpose of using cell phones, the amount of calling on cell phones for simply conveying information ($\beta=.13$, $p<.05$), talking about hobbies and interests ($\beta=.13$, $p<.05$) and talking about family ($\beta=.14$, $p<.05$), and the amount of emailing on cell phones for simply conveying information ($\beta=.14$, $p<.05$) had significant positive effects on friendship preference. Therefore, the analysis demonstrated that a larger amount of calling on cell phones to convey information or to talk about hobbies and interests and family, as well as emailing on cell phones to simply convey information, all resulted in a stronger preference for selective friendships.

The effect of the amount of cell-phone use measured in the second survey on friendship preference measured in the third survey was examined through the same analysis method, and no significant effect was indicated (Table 6–1).

Effect of friendship preference on the amount of cell-phone use Multiple-regression analyses were conducted in order to examine the effect of the friendship preferences measured in the first survey on the amount of cell-phone use measured in the second survey. The analyses were conducted using the friendship preference scores obtained at Time 1 as independent variables and the amounts of calling and emailing measured at Time 2 as dependent variables. Attributes such as the age, gender, and university (as dummy variables) of the participants as well as the amounts of calling and emailing measured at Time 2 were controlled (Table 5–2). The results could not confirm the effect of friendship preference on the amount of cell-phone use.

We conducted a similar analysis in order to investigate the effects of the friendship preferences measured in the second survey on the amount of cell-phone use measured in the third survey (Table 6–2). The result of

Table 5 Regression analysis to investigate short-term effects using Time 1 & 2 data

5-1 Cell-phone use → Friendship preference	R^2	Factor analysis F-value	Sex	Age	Univ. A	Univ. B	Univ. C	Univ. D	Univ. E	Univ. F	Friendship	Cell-phone
Call_hours	0.56	15.58***	0.07	−0.04	0.05	−0.04	−0.05	−0.02	−0.09	−0.01	0.74***	0.08
E-mail_hours	0.57	15.89***	0.11	−0.02	0.04	−0.05	−0.05	−0.02	−0.10	−0.02	0.75***	0.11
Call_time	0.56	15.39***	0.08	−0.05	0.05	−0.03	−0.04	−0.02	−0.09	−0.01	0.74***	−0.05
E-mail_time	0.56	15.35***	0.09	−0.04	0.03	−0.05	−0.05	−0.03	−0.11	−0.04	0.74***	0.05
Call_days	0.56	15.28***	0.08	−0.05	0.05	−0.03	−0.04	−0.03	−0.99	−0.02	0.74***	−0.03
E-mail_days	0.56	15.54***	0.10	−0.04	0.05	−0.05	−0.04	−0.02	−0.10	0.00	0.74***	0.08
Call_simply conveyirg information	0.57	15.96***	0.10	−0.05	0.05	−0.06	−0.03	−0.03	−0.09	−0.01	0.74***	0.13*
Call_talking aboul trivial matters	0.55	14.54***	0.06	−0.04	0.04	−0.03	−0.04	−0.03	−0.09	−0.02	0.73***	0.01
Call_talking about hobbies and interests	0.56	15.09***	0.05	−0.03	0.06	−0.05	−0.05	−0.01	−0.09	−0.02	0.76***	0.13*
Call_talking about personal trouble	0.55	14.57***	0.06	−0.03	0.04	−0.03	−0.04	−0.03	−0.09	−0.03	0.73***	0.01
Call_talking about personss of the opposite sex or about love	0.55	14.60***	0.06	−0.04	0.04	−0.03	−0.05	−0.03	−0.09	−0.03	0.74***	0.02
Call_talking about family	0.56	14.92***	0.07	−0.03	0.02	−0.04	−0.03	−0.02	−0.07	−0.03	0.73***	0.14*
E-mail_simply conveyirg information	0.56	15.69***	0.11	−0.04	0.06	−0.06	−0.02	−0.02	−0.07	0.01	0.73***	0.14*
E-mail_talking about trivial matters	0.55	15.01***	0.06	−0.04	0.04	−0.03	−0.04	−0.03	−0.09	−0.02	0.73***	0.00
E-mail_talking about hobbies and interests	0.55	14.90***	0.07	−0.03	0.06	−0.04	−0.05	−0.01	−0.09	−0.02	0.74***	0.08
E-mail_talking about personal trouble	0.54	14.03***	0.05	−0.03	0.04	−0.03	−0.04	−0.03	−0.09	−0.02	0.73***	−0.01
E-mail_talking about persons of the opposite sex or about love	0.55	14.71***	0.08	−0.03	0.05	−0.04	−0.04	−0.02	−0.10	−0.03	0.74***	0.06
E-mail_talking about family	0.56	15.33***	0.11	−0.04	0.02	−0.04	−0.05	−0.03	−0.10	−0.05	0.72***	0.12

5-2 Friendship preference → Cell-phone use	R^2	Factor analysis F-value	Sex	Age	Univ. A	Univ. B	Univ. C	Univ. D	Univ. E	Univ. F	Friendship	Cell-phone
Call_hours	0.19	2.77***	0.01	0.07	−0.03	−0.03	−0.05	−0.04	0.12	0.20	0.35***	−0.08
E-mail_hours	0.47	10.74***	−0.11	−0.02	−0.03	−0.01	0.05	0.06	0.07	0.15	0.59***	−0.10
Call_time	0.26	4.21***	0.15	0.07	0.04	0.00	0.15	0.01	0.25	0.20	0.35***	0.06
E-mail_time	0.34	6.10***	−0.07	−0.17	−0.06	0.09	0.06	−0.10	−0.05	−0.03	0.51***	−0.04
Call_days	0.43	9.04***	−0.15	−0.15	−0.07	0.16	0.03	−0.10	0.12	−0.15	0.59***	0.00
E-mail_days	0.39	7.57***	−0.14	−0.06	0.03	0.27*	0.20	0.10	−0.07	0.05	0.43***	−0.12
Call_simply conveyirg information	0.38	7.51***	−0.09	0.19	−0.04	−0.20	−0.15	−0.08	−0.18	−0.23	0.52***	−0.05
Call_talking aboul trivial matters	0.25	4.09***	0.06	−0.04	0.04	−0.03	−0.04	−0.03	−0.09	−0.02	0.73***	0.01
Call_talking about hobbies and interests	0.29	4.91***	−0.14	0.11	−0.17	−0.27*	−0.08	−0.09	0.00	−0.07	0.49***	0.01
Call_talking about personal trouble	0.31	5.44***	−0.12	0.05	−0.10	−0.02	−0.07	−0.07	−0.21	−0.13	0.48***	−0.07
Call_talking about personss of the opposite sex or about love	0.30	5.03***	0.02	0.03	−0.08	0.18	−0.07	−0.05	−0.03	−0.01	0.45***	−0.06
Call_talking about family	0.27	4.28***	−0.11	0.06	0.12	0.07	0.23	0.12	0.24	0.32	0.49***	0.05
E-mail_simply conveyirg information	0.44	9.33***	−0.19*	0.07	−0.08	0.07	−0.12	−0.01	−0.01	−0.14	0.48***	0.00
E-mail_talking about trivial matters	0.28	4.74***	−0.08	−0.10	−0.01	0.10	0.08	−0.14	0.17	0.02	0.40***	−0.13
E-mail_talking about hobbies and interests	0.37	6.92***	−0.23*	−0.08	0.10	0.11	0.16	0.03	0.27	0.17*	0.49***	−0.03
E-mail_talking about personal trouble	0.38	7.23***	−0.22*	−0.01	0.05	0.06	0.10	−0.04	0.06	0.03	0.45***	−0.10
E-mail_talking about persons of the opposite sex or about love	0.35	6.57***	−0.04	−0.14	0.12	0.34*	0.19	0.06	0.29*	0.19	0.45***	−0.14
E-mail_talking about family	0.21	3.24***	−0.08	−0.04	−0.08	0.09	0.10	−0.04	−0.05	0.00	0.40***	0.05

$* p < .05, ** p < .01, *** p < .001$

Table 6 Regression analysis to investigate short-term effects using Time 2 & 3 data

6-1 Cell-phone use → Friendship preference	R^2	Factor analysis	Standard partial regression coefficients (β)								
		F-value	Sex	Age	Univ. A	Univ. B	Univ. C	Univ. D	Univ. E	Friendship	Cell-phone
Call_hours	0.52	6.50***	0.16	−0.06	0.12	0.04	0.08	−0.11	−0.16	0.68***	−0.11
E-mail_hours	0.52	6.30***	0.13	−0.05	−0.12	0.03	0.08	−0.10	−0.17	0.66***	−0.05
Call_time	0.53	6.71***	0.21	−0.06	−0.01	0.03	0.09	−0.11	−0.11	0.68***	−0.17
E-mail_time	0.53	6.56***	0.13	−0.11	−0.13	0.07	0.07	−0.11	−0.15	0.68***	−0.13
Call_days	0.53	6.75***	0.12	−0.04	−0.13	0.05	0.09	−0.14	−0.17	0.65***	−0.15
E-mail_days	0.51	6.25***	0.14	−0.03	−0.12	0.02	0.07	−0.10	−0.18	0.64***	0.02
Call_simply conveyirg information	0.52	6.24***	0.15	−0.03	−0.11	0.00	0.07	−0.10	−0.18	0.65***	0.03
Call_talking aboul trivial matters	0.54	6.69***	0.17	−0.04	−0.14	0.03	0.07	−0.11	−0.17	0.64***	−0.15
Call_talking about hobbies and interests	0.53	6.40***	0.15	−0.03	−0.15	−0.02	0.07	−0.13	−0.20	0.64***	−0.09
Call_talking about personal trouble	0.52	6.28***	0.13	−0.03	−0.11	0.02	0.07	−0.09	−0.19	0.65***	−0.06
Call_talking about personss of the opposite sex or about love	0.52	6.22***	0.15	−0.02	−0.11	0.00	0.07	−0.09	−0.18	0.65***	0.01
Call_talking about family	0.52	6.08***	0.15	−0.04	−0.09	0.03	0.08	−0.11	−0.16	0.64***	−0.06
E-mail_simply conveyirg information	0.54	6.85***	0.15	−0.03	−0.11	−0.05	0.08	−0.12	−0.20	0.67***	0.17
E-mail_talking about trivial matters	0.55	6.31***	0.15	0.01	−0.09	−0.01	0.07	−0.06	−0.19	0.66***	0.07
E-mail_talking about hobbies and interests	0.52	6.23***	0.15	−0.01	−0.11	0.00	0.07	−0.09	−0.18	0.65***	0.02
E-mail_talking about personal trouble	0.50	5.70***	0.17	−0.01	−0.12	−0.01	0.07	−0.09	−0.19	0.62***	0.03
E-mail_talking about persons of the opposite sex or about love	0.54	6.73***	0.10	−0.06	−0.11	0.07	0.06	−0.12	−0.15	0.64***	−0.16
E-mail_talking about family	0.54	6.65***	0.19	0.01	−0.12	−0.04	0.07	−0.09	−0.20	0.63***	0.14

6-2 Friendship preference → Cell-phone use	R^2	Factor analysis	Standard partial regression coefficients (β)								
		F-value	Sex	Age	Univ. A	Univ. B	Univ. C	Univ. D	Univ. E	Friendship	Cell-phone
Call_hours	0.32	2.76**	−0.08	0.01	−0.33	−0.30	−0.10	−0.38	−0.15	0.44***	−0.01
E-mail_hours	0.61	9.31***	−0.09	−0.19	−0.09	0.18	0.03	−0.16	0.09	0.70***	0.13
Call_time	0.20	1.44	−0.04	0.18	0.13	0.05	0.17	−0.07	0.24	0.05***	0.27*
E-mail_time	0.41	4.09***	−0.15	0.00	0.00	0.02	−0.04	−0.06	0.06	0.59***	0.06
Call_days	0.49	5.60***	0.00	0.15	0.14	0.00	0.14	0.15	−0.06	0.67***	0.08
E-mail_days	0.16	1.10	−0.07	−0.05	−0.40*	−0.31	−0.03	−0.15	−0.28	0.22	−0.09
Call_simply conveyirg information	0.27	2.08*	0.01	0.08	−0.02	0.18	0.08	0.13	−0.05	0.38**	0.02
Call_talking aboul trivial matters	0.40	3.85***	0.05	0.15	−0.13	−0.08	0.00	−0.13	−0.31	0.51***	−0.18
Call_talking about hobbies and interests	0.24	1.82	0.10	0.05	−0.10	0.02	−0.10	−0.12	−0.24	0.34*	−0.20
Call_talking about personal trouble	0.34	2.92**	−0.21	0.09	−0.26	−0.13	−0.11	−0.30	−0.21	0.42**	−0.20
Call_talking about personss of the opposite sex or about love	0.38	3.47***	−0.23	0.04	−0.27	−0.05	−0.21	−0.33	−0.24	0.32*	−0.25*
Call_talking about family	0.26	2.00	0.05	−0.08	0.10	0.00	−0.12	−0.17	−0.29	0.25	0.14
E-mail_simply conveyirg information	0.67	11.94***	0.07	−0.19	−0.02	0.08	0.20*	0.01	0.05	0.81***	−0.03
E-mail_talking about trivial matters	0.33	2.83**	−0.07	0.02	−0.23	0.23	0.12	0.03	0.05	0.39**	0.00
E-mail_talking about hobbies and interests	0.40	3.89***	−0.10	0.02	0.00	0.41	0.07*	0.04	0.02	0.53***	0.12
E-mail_talking about personal trouble	0.53	6.27***	−0.20	−0.21	−0.34	0.05*	−0.01	−0.20	−0.01	0.52***	−0.17
E-mail_talking about persons of the opposite sex or about love	0.74	16.37***	−0.19*	0.04	−0.12	−0.12	0.13	−0.24*	−0.07	0.75***	−0.09
E-mail_talking about family	0.49	5.60***	−0.04	−0.16	−0.09	−0.05	−0.01	−0.27	−0.31*	0.51***	0.18

$* p<.05,\ ** p<.01,\ *** p<.001$

Table 7 Regression analysis to investigate short-term effects using Time 1 & 3 data

7-1 Cell-phone use → Friendship preference	R^2	Factor analysis F-value	Standard partial regression coefficients (β)								
			Sex	Age	Univ. A	Univ. B	Univ. C	Univ. D	Univ. E	Friendship	Cell-phone
Call_hours	0.68	13.86***	0.32**	−0.15	−0.08	−0.04	0.04	−0.17	−0.35**	0.67***	−0.09
E-mail_hours	0.69	13.43***	0.31**	−0.14	−0.10	−0.05	0.04	−0.17	−0.38**	0.68***	0.04
Call_time	0.71	14.59***	0.33**	−0.15	−0.06	−0.03	0.04	−0.17	−0.35**	0.68***	−0.14
E-mail_time	0.69	13.36***	0.31**	−0.15	−0.08	−0.04	0.04	−0.16	−0.37**	0.68***	−0.01
Call_days	0.72	15.74***	0.31**	−0.12	−0.02	−0.01	0.08	−0.15	−0.35**	0.67***	−0.20*
E-mail_days	0.69	13.36***	0.31**	−0.15	−0.09	−0.05	0.04	−0.17	−0.37**	0.68***	0.00
Call_simply conveyirg information	0.69	13.48***	0.31**	−0.15	−0.09	−0.04	0.04	−0.16	−0.37**	0.68***	−0.05
Call_talking aboul trivial matters	0.71	14.34***	0.30**	−0.14	−0.12	−0.02	0.05	−0.18	−0.36**	0.64***	−0.14
Call_talking about hobbies and interests	0.70	14.08***	0.32**	−0.14	−0.10	−0.02	0.05	−0.18	−0.38**	0.64***	−0.12
Call_talking about personal trouble	0.71	14.86***	0.26**	−0.15	−0.04	0.03	0.04	−0.15	−0.33**	0.64***	−0.17*
Call_talking about personss of the opposite sex or about love	0.69	13.37***	0.28**	−0.13	−0.09	−0.02	0.04	−0.18	−0.37**	0.66***	−0.05
Call_talking about family	0.70	13.53***	0.26**	−0.14	−0.04	0.00	0.04	−0.15	−0.34**	0.69***	−0.06
E-mail_simply conveying information	0.69	13.36***	0.31**	−0.15	−0.09	−0.04	0.04	−0.17	−0.37**	0.68***	−0.01
E-mail_talking about trivial matters	0.70	13.85***	0.30**	−0.12	−0.07	−0.05	0.04	−0.15	−0.39**	0.68***	0.10
E-mail_talking about hobbies and interests	0.69	13.34***	0.29**	−0.14	−0.08	−0.03	0.04	−0.16	−0.36**	0.68***	0.04
E-mail_talking about personal trouble	0.70	13.49***	0.30**	−0.15	−0.10	−0.04	0.04	−0.19	−0.38**	0.68***	0.02
E-mail_talking about persons of the opposite sex or about love	0.69	13.43***	0.31**	−0.13	−0.09	−0.05	0.05	−0.16	−0.39**	0.69***	0.06
E-mail_talking about family	0.69	13.40***	0.28**	−0.15	−0.07	−0.02	0.04	−0.17	−0.37**	0.68***	−0.06

7-2 Friendship preference → Cell-phone use	R^2	Factor analysis F-value	Standard partial regression coefficients (β)								
			Sex	Age	Univ. A	Univ. B	Univ. C	Univ. D	Univ. E	Friendship	Cell-phone
Call_hours	0.25	1.99	−0.13	0.07	−0.21	−0.14	−0.07	−0.23	−0.01	0.38**	−0.16
E-mail_hours	0.48	5.70***	−0.25*	−0.11*	−0.26	−0.01	0.00	−0.10	0.06	0.64***	0.01
Call_time	0.29	2.54*	−0.20	0.33	0.19	0.04	0.14	0.12	0.24	0.38**	0.16
E-mail_time	0.28	2.43*	−0.22	−0.10	−0.09	0.07	−0.04	−0.06	0.15	0.44**	−0.09
Call_days	0.56	7.91***	−0.03	−0.01	0.00	0.09	0.10	0.04	0.04	0.73***	0.01
E-mail_days	0.38	3.75***	−0.15	0.18	−0.19	−0.26	−0.04	−0.09	−0.29	0.64***	0.00
Call_simply conveyirg information	0.45	5.06***	0.15	0.11	0.13	−0.01	0.09	0.18	0.01	0.60***	0.09
Call_talking aboul trivial matters	0.35	3.28***	−0.20	0.08	−0.13	−0.07	−0.01	−0.07	0.01	0.51***	−0.18
Call_talking about hobbies and interests	0.35	3.29***	−0.15	0.05	−0.01	0.04	−0.09	−0.02	0.07	0.49***	−0.25*
Call_talking about personal trouble	0.39	3.83***	−0.28*	0.16	−0.10	0.05	−0.07	−0.11	0.00	0.42**	−0.27*
Call_talking about personss of the opposite sex or about love	0.36	3.40***	−0.24	0.09	0.08	0.32	−0.10	0.06	0.17	0.32**	−0.24
Call_talking about family	0.32	2.73*	0.02	0.02	0.19	0.25	−0.01	0.09	0.09	0.47**	0.06
E-mail_simply conveyirg information	0.42	4.34***	0.09	−0.13	0.14	0.16	0.20	0.23	0.23	0.60***	0.16
E-mail_talking about trivial matters	0.50	5.91***	−0.18	−0.11	−0.49	0.15	0.09	−0.13	0.00	0.45***	−0.07
E-mail_talking about hobbies and interests	0.45	4.83***	−0.20	−0.08	0.06	0.48**	0.08	0.13	0.26	0.58***	0.06
E-mail_talking about personal trouble	0.32	2.74*	−0.40**	−0.05	−0.22	0.04	−0.03	−0.16	0.04	0.11	−0.38**
E-mail_talking about persons of the opposite sex or about love	0.49	5.81***	−0.32*	−0.04	0.03	0.23	0.15	−0.12	0.16	0.37**	−0.26**
E-mail_talking about family	0.41	4.24***	0.01	0.01	−0.02	−0.04	0.07	−0.18	−0.26	0.55***	−0.03

$* p < .05, ** p < .01, *** p < .001$

the analysis indicated that neither the amount of calling nor the number of times of cell-phone use per day or per week had any significant effect on friendship preference. (Although the standard partial regression coefficient of the number of times of use per day ($\beta=.27$, $p<.05$) is significant, its model was not significant.) When the effect was analyzed for each purpose of using cell phones, the results suggested less preference for selective friendship when the frequency of email use to talk about persons of the opposite sex or about love ($\beta=-.25$, $p<.05$) increased.

Examination of long-term effects

Effect of the amount of cell-phone use on friendship preference Multiple-regression analyses were conducted in order to examine the effects of the amount of cell-phone use measured in the first survey on the friendship preferences measured in the third survey. The analyses were conducted using the amount of calling and emailing measured at Time 1 as independent variables and the friendship preference scores obtained at Time 3 as dependent variables. Attributes such as age, gender, and university of the participants as well as the friendship preference scores obtained at Time 1 were controlled (Table 7-1). In the results, the number of days on which calls were made on cell phones per week indicated a significant negative effect ($\beta=-.20$, $p<.05$), although the amount of use or the number of times of use per day did not indicate any significant effect. Also, when the effect was analyzed for each purpose of cell-phone use, the amount of calling on cell phones to talk about personal problems had a significant negative effect on friendship preference ($\beta=-.17$, $p<.05$). The analyses therefore indicated a causal relationship in which a larger amount of calling on cell phones to talk about personal problems resulted in a weaker preference for selective friendships as well as a stronger preference for all-around friendships.

Effect of friendship preference on the amount of cell-phone use Multiple-regression analyses were conducted in order to examine the effects of the friendship preferences measured in the first survey on the amount of cell-phone use measured in the third survey. The analyses were conducted using the friendship preference scores obtained at Time 1 as independent variables and the amounts of calling and emailing measured at Time 3 as dependent variables. Attributes such as the age, gender, and university (as dummy variables) of the participants as well as the amounts of calling and emailing measured at Time 3 were controlled (Table 7-2).

In the results, the amount of calling on cell phones to talk about hobbies and interests ($\beta=-.25$, $p<.05$) and to talk about personal problems ($\beta=-.27$, $p<.05$), along with the amount of emailing about personal problems ($\beta=-.38$, $p<.01$) and love ($\beta=-.26$, $p<.01$), had significant effects. In other words, there was a causal relationship in which individuals with a weak preference for selective friendships and a strong preference for all-around friendships tended to use cell phones for the purposes listed above.

Discussion

Short-term effects

Effect of the amount of cell-phone use on friendship preference The result of an analysis of data obtained in the first and second surveys indicates that a large amount of calling on cell phones had a short-term effect that strengthened the preference for selective friendships and weakened the preference for all-around friendships.

Phone calls to talk about hobbies and interests seemed to require the selection of a receiver who shared the same hobbies or interests, instead of a randomly selected friend. The study has indicated that this specific selection of a receiver could reinforce the preference for selective friendships.

In addition, the results of this study indicate that there was a causal relationship in which a larger amount of emailing on cell phones to simply convey information re-

sulted in the reinforcement of selective friendships. This result is not consistent with the findings of a previous study, which indicated a relationship between calling on cell phones and selective friendship (Tsuji, 2003). Tsuji (2003) suggested that calling on cell phones (often used as a tool or means) was suited to selective contact with friends, based on his findings. However, the email function of cell phones is often used to simply convey information (Dai-ichi life research institute, 2002). The result of this study has indicated that it was not the functions of cell phones such as calling and emailing but the method of use of cell phones that influenced selective friendships. However, the analysis of the data obtained in the second and third surveys did not reveal the significant effect that was observed between the data obtained in the first and second surveys. Therefore, the effect of the behavior in which cell phones are used to select who to be with is not robust, and if there is such an effect, it is considered to be a short-term effect.

Effect of friendship preference on the amount of cell-phone use Tsuji (1999, 2003) suggested the possibility that the intensity of selective friendships reinforced calling on cell phones. Our findings do not agree with the suggestion offered by Tsuji (1999, 2003). We demonstrated less preference for selective friendship with increasing frequency of calling on cell-phones to talk about love. This short-term effect should be investigated further because this study did not indicate a constant direction.

Long-term effects

Effect of the amount of cell-phone use on friendship preference As for long-term effects, a causal relationship in the opposite direction from that of the short-term effects was found in which more days per week during which phone calls were made or longer calls over cell phones to talk about personal problems led to a weakened preference for selective friendships and a stronger preference for all-around friendships, characterized by individuals always being with the same friends regardless of the situation. This finding does not match with any of the earlier studies or discussions that examined the relationship between cell-phone use and selective friendships. There are, however, studies indicating that cell phones are most frequently used between very close individuals and serve to increase the closeness between them (Nakajima, Himeno, & Yoshii, 1999). Cell phones thus could be considered as a type of medium that reinforces relationships with particular individuals over a long period of time instead of a type of medium that strengthens the preference for a type of friendship in which different friends are selected for different situations.

Effect of friendship preference on the amount of cell-phone use A causal relationship was found in this study wherein individuals with a strong preference for all-around friendships tend to call or send email to talk about personal problems and to send email to talk about love. This suggests that those who preferred to be with the same people in any type of situation frequently used cell phones to discuss their personal problems or love. As a result, there may be cyclical effects in which the preference for friendships that individuals already had would be reinforced.

There have been almost no studies to date examining the effects of establishing all-around friendships, and it will thus be necessary to study this in the future. Also, since the number of days during which phone calls are made would increase in the presence of strong all-around friendships, this style of friendship, in which individuals choose to be with the same friends anytime and anywhere, may cause excess use of cell phones. From the perspective of preventing excess use of cell phones, it seems necessary to further examine the effects of all-around friendships.

Conclusion

The objective of this study was to examine the causal relationship between the amount of cell-phone use and a preference

for selective friendship. The results of this study revealed the following influences of the amount of cell-phone use on friendship preference. It was suggested that the style of cell-phone use in which individuals choose different friends for different situations influenced the amount of cell-phone use. However, this was only a short-term effect, and it was not seen consistently. Meanwhile, a long-term causal relationship in the opposite direction was found in which a larger amount of cell-phone use reinforced all-around friendships, in which individuals are with the same friends regardless of the situation.

This study indicated that the influence of friendship preference on the amount of cell-phone use was as follows. It did not confirm a consistent short-term influence of cell-phone use. However, it did indicate that all-around friendships increased the amount of cell-phone use in the long term.

It may thus be possible that there is a cyclic effect in which close all-around friendship leads to an increase of cell-phone use, and, as a result, the preference for already-existing friendships is reinforced. Earlier studies focused only on the effect of cell-phone use on selective friendships. In the future, however, it will be necessary to focus on and examine the causal effect in which cell-phone use strengthens the preference for all-around friendships.

References

Ando, R., Sakamoto, A., Suzuki, K., Kobayashi, K., Kashibuchi, M., & Kimura, F. 2004 Effects of the Internet Use on Life Satisfaction and Social Efficacy: A Panel Study of Male Students in a Vocational College of Information Technology. *The Japanese journal of personality*, **13**, 21–33 (in Japanese with English abstract).

Asano, H., Kojima, T., & Suzuki, T. 2005 Introduction to practices of covariance structure analysis. Tokyo: Kodansha Ltd. (in Japanese, translated by the author of this article)

Asano, T. 1999 New type of intimacy. In H. Tomita, & M. Fujimura (Eds.), *The world of collective solitude*. Tokyo: Kouseisha-Kouseikaku Corporation, pp. 41–57. (in Japanese, translated by the author of this article)

Dai-ichi life research institute, Life design research unit. 2002 Investigation of communication media use in youth. 〈http://group. dai-ichi-life. co. jp / dlri / ldi / news / news0204b.pdf〉 (in Japanese, translated by the author of this article).

Hashimoto, Y. 2003 Information behaviors and interpersonal relationships of young people. In T. Masamura (Ed.), *Informatization and acculturation*, Kyoto: Minerva Publishing CO. Ltd., pp. 26–57 (in Japanese, translated by the author of this article).

Kobayashi, M. 2001 Why does e-mail make people emotional?—The psychology of E-mail. Tokyo: DIAMOND, Inc. (in Japanese, translated by the author of this article).

Matsuda, M. 2000 Friendship of young people and their use of mobile phones: From the view of "superficial relation" to "selective relation". *Journal of socio-information studies*, **4**, 111–122 (in Japanese).

Nakajima, I., Himeno, K., & Yoshii, H. 1999 Diffusion of cellular phone and PHS and it's social meanings. *Journal of information & communication research*, **16**(3), 79–92 (in Japanese with English abstract).

Okonogi, K. 2000 *Psychoanalysis of people with cell-phones and internet—The age of social withdrawal in youth and adult*. Tokyo: Asukashinsha publishing. (in Japanese, translated by the author of this article).

Tsuji, D. 1999 New media and changes in youth communication. In Y. Hashimoto, M. Hunatsu, & O. Hiroi (Eds.), *Children and youth communications* Tokyo: Hokujyu Pub. Co., pp. 11–27 (in Japanese).

Tsuji, D. 2003 Summary report on a questionnaire survey of young people's communications and relationships with friends and parents. *The bulletin of faculty of sociology, Kansai University*, **34**, 373–389 (in Japanese with English abstract).

Appendix 1   Items in cell phone use

The amount of use per day
Hours	none
	1 sec to less than 5 min
	5 min to less than 15 min
	15 min to less than 30 min
	30 min to less than 1 hour
	1 hour to less than 2 hours
	2 hours to less than 3 hours
	3 hours or longer

Times	none
	once or twice
	3 to 4 times
	5 to 7 times
	8 to 10 times
	11 to 13 times
	14 to 16 times
	17 times or more

The amount of use per week
Days	none
	1 day
	2 days
	3 days
	4 days
	5 days
	6 days
	7 days (Every day)

Appendix 2   Items in the friendship preference scale

Preference for selective friendships
1 I want to get along with my friends, but I do not want to be too involved. (R)
2 I do not have to tell everything to my good friends.
3 I choose friends depending on what I am going to do.
5 I would like to maintain relationships with my good friends. (R)
8 It is not natural to choose different friends for different purposes such as to hang around, to go out for drinks, or to go shopping. (R)
9 I always pick up the phone when the call is from my good friends. (R)
10 I usually do not say no when my friends ask me out.
12 I always show different sides of myself to different friends.
14 I am not comfortable with the idea of ending friendships. (R)
16 I sometimes do not feel like seeing my friends even though they are good friends.
18 I do not have to do everything my friends' way.

Preference for all-around friendships
4 When my good friends point out my weaknesses, I worry that they may not like me anymore. (R)
6 I try not to rely on my friends even though they are good friends. (R)
7 I am not interested in the daily life of my good friends. (R)
11 Good friends must always keep promises made to each other.
13 I would like to be open with my friends to have close relationships.
15 Good friends do not have secrets.
17 I would do what I can when my good friends are in trouble.
19 Good friends accept each other's faults.

Note: "R" means "reversed item."