No mobile, no life: Self-perception and text-message dependency among Japanese high school students

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Abstract

A survey was conducted to investigate how self-perception of text-message dependency leads to psychological/behavioral symptoms in relation to personality factors. Japanese high school students completed a self-report questionnaire measuring frequency of text-messages, self-perception of text-message dependency, psychological/behavioral symptoms, extroversion and neuroticism. Self-perception of text-message dependency was composed of three factors: perception of excessive use, emotional reaction, and relationship maintenance. Although message frequency was significantly related to psychological/behavioral symptoms, this effect was qualified by self-perception and personality factors. In particular, self-perception of text-message dependency strongly affected psychological/behavioral symptoms. Importance of distinction between extroverted and neurotic text-message dependency through the process of self-perception of maladaptive behavior is discussed.
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The recent trend in the use of communication technology in Japan has seen a marked shift from personal computer-based communication to mobile/cell phone communication,

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especially text-messages. According to the White Paper on Information and Communications in Japan (Ministry of Internal Affairs and Communications, Japan, 2007), up to the year 2006, about 97 million Japanese (88% of the population) used mobile phones and 73% of subscribers connected onto the Internet via mobile phones. In particular, over 90% of Japanese high school students have their own mobile phones (Benesse Educational Research, 2005). Japanese adolescents prefer text-messages (including SMS and emails via mobile phones) to direct telephone conversations because of the text-based indirectness, asynchronicity of communication, and cheaper costs (Igarashi, Takai, & Yoshida, 2005).

Although the widespread availability of text-messages provides a convenient way of communication, it has been pointed out that some people show overdependence on text-messages in their daily lives, or the so-called 'text-message dependency' (Masataka, 2005). A relatively great number of Japanese adolescents keep their mobile phones on even while they are asleep in order not to miss the contacts from their peers (Keitai Denwa, 2004). Japanese females tend to feel nervous if they do not bring their mobile phones while away from home (Infoplant, 2007). In other words, some people may be quite sensitive to maintaining their relationships via mobile phones, and even afraid of isolation and disconnection from their peers through text-message communication. Little empirical research, however, has been conducted to investigate the psychological processes in which text-message dependency occurs. The current study sought to address this question from a viewpoint of self-perception of text-message usage.

Prior to investigating text-message dependency, we first consider the dependent behavior on the Internet. Internet dependency (also referred to as Internet addiction and problematic/pathological Internet use; see Chou, Condron, & Bellan, 2006, for the terminology) has been discussed as a dark side of computer-mediated communication (CMC) for a decade (Young, 1996). Internet dependency is broadly defined as online-related compulsive behavior that intervenes with daily life, resulting in psychological/behavioral symptoms (e.g., depressed mood, feeling guilty and anxiety, and work and loss of interest) that produce negative social outcomes (Young, 1998).

We should note that, in this study, Internet and text-message dependency is handled as a dependent tendency on some particular behavior in relation to usage of the communication media rather than as a unique psychiatric disorder. Yellowlees and Marks (2007) recently argue that Internet dependency would be mainly induced by certain predispositions such as impulse control problems and social anxiety. In other words, Internet and text-message dependency should be treated with more care for its antecedents.

Whereas there may be a number of factors related to Internet dependency, Davis (2001) proposed a cognitive-behavioral model in order to sort this issue from a viewpoint of psychological processes, in which cognitive distortion caused by psychopathology (e.g., depression and social anxiety) increases Internet usage and thus results in behavioral symptoms (e.g., obsessive thoughts about the Internet and inability to cease Internet usage). Davis distinguished two types of Internet dependency based on motivation and purpose of usage. The one is special Internet dependency, which refers to preoccupation with the Internet aimed at the satisfaction of particular interests, such as online shopping and gambling. The other is generalized Internet dependency, which pertains to consuming unreasonably large amounts of time on social contacts via the Internet, such as online chats and forum discussions. Davis claimed that special Internet dependency is incurred without Internet if users have a predisposition toward particular addictive behavior (e.g., shopping and gambling) where the Internet is merely a means of satisfying their

addiction. Generalized Internet dependency is, however, wholly related to the attainment of social provisions made exclusively available through the Internet. Caplan (2005) also pointed out that absorption in online interpersonal communication (i.e., generalized Internet dependency) is more crucial than specialized Internet dependency with regard to psychosocial well-being. To a large extent, Internet dependency is thus caused by the need for interpersonal relationships.

Internet dependency involves a ''psychological dependence on the Internet, and is characterized by (1) an increasing investment of resources on Internet-related activities, (2) unpleasant feelings (e.g., anxiety, depression, emptiness) when offline, (3) an increasing tolerance to the effects of being online, and (4) denial of the problematic behaviors'' (Kandell, 1998, p. 11). Internet dependency is strongly associated with preoccupation with Internet usage, a loss of control and an uncontrollable urge (Young, 2004). Empirical research has demonstrated that psychosocial factors, such as social skills, self-esteem, depression and loneliness, predict Internet dependency (Caplan, 2002, 2005; Morahan-Martin & Schumacher, 2000; Wang, 2001). There is evidence that users dependent on the Internet prefer communicating online versus face-to-face and end up spending excessive hours using email and/or online chats (Kubey, Lavin, & Barrows, 2001) and seeking online sources for social support (Morahan-Martin & Schumacher, 2000).

According to the definition and the characteristics of Internet dependency introduced above, this study operationally defines text-message dependency as ''text-messaging-related compulsive behavior that causes psychological/behavioral symptoms resulting in negative social outcomes.'' Although this definition involves broader ranges of phenomenon caused by text-messages, this study particularly aims to focus on the relationship between psychosocial factors and psychological/behavioral symptoms throughout the process of text-message usage.

In terms of text-message dependency, interpersonal relationships with intimate friends are considered to be a significant trigger, especially in Japan as a collectivist and interdependent culture (Markus & Kitayama, 1991; Triandis, 1995). The contextual mobility of mobile phones provides freedom of choice to users in both private and public situations (Ishii, 2006). In particular, text-message dependency may be based on an acute need for interpersonal communication. Text-messages are exchanged mainly within existing social networks composed of acquaintances who have already known each other (Igarashi, Takai et al., 2005). Although text-messages are useful for maintaining weak and strong relationships, they also cause 'text-messaging ostracism' that leads to isolation or exclusion in text-message-mediated friendship networks (Smith & Williams, 2004). Thus, some people may be obsessive about receiving and sending text-messages to avoid rejection, implying that text-message dependency is related to a compulsion for gaining approval from intimate friends.

Compulsive use of communication media may produce negative social outcomes. Due to excessive time spent online, psychological/behavioral symptoms, such as sleeping disorder and social withdrawal, come to appear (Young, 1998). Existing research has revealed a strong positive relationship between psychological/behavioral symptoms and the amount of time spent on the Internet (Young, 1996). In fact, while people who use the Internet for many hours can become dependent on the Internet, it is also plausible that one can spend large amounts of time on the Internet without experiencing psychological/behavioral symptoms. For example, recent research has reported that first year college students in Japan exchange 20.1 text-messages on average in a day (Sugiura, 2004). People may think this amount is not a few, but of course, not all undergraduates become heavily dependent

on text-messages. The question can be raised as to what is the difference between those who suffer psychological/behavioral symptoms, and those who do not?

We suppose that this difference in psychological/behavioral symptoms is qualified with self-perception of dependency on communication media. Self-perception theory states that people infer their own attitudes from their own behavior (Bem, 1972). Young (1998) argues that self-perception of emotional dependency on the Internet is important to explain psychological/behavioral symptoms of Internet dependency–emotional dependency makes people not to refrain from the compulsive use of the Internet. In other words, the relationship between self-perception and compulsive use of the Internet involves a negative spiral of steps in a mutually reinforcing way. Davis (2001) also claims that people dependent on the Internet holds negatively distorted perceptions toward their environments even when aiming to gain control of themselves. Psychological/behavioral symptoms of dependency on communication media may therefore appear in combination with excessive use and inappropriate self-perception toward the media.

Recently, Igarashi, Motoyoshi, Takai, and Yoshida (2005) proposed three factors of self-perception related to psychological/behavioral symptoms of text-message dependency. The first factor is the perception about excessive use of text-messages. Heavy message users spend a substantial amount of time exchanging messages throughout the day and may perceive themselves as being too involved in text-messages without self-control. The second factor is the perception about relationship maintenance function of text-messages by means of an alternative for face-to-face communication. While text-messages are most frequently used among adolescents, there is evidence that adolescents especially yearn for building close relationships and having a strong anxiety toward failure in communication (Leary & Kowalski, 1995). To moderate such obstacles in face-to-face situations, adolescents may prefer indirect communication via text-messages. Consequently, it may cause compulsive use of text-messages, and thus psychological/behavioral symptoms are incurred. Finally, the third factor is emotional reaction to text-messages. Since text-messaging is asynchronous communication, people with text message dependency would pay excessive attention to message replies. Most people would attribute a delay in response to inevitable causes, such as the receiver being busy at work, or already being engaged in a conversation with another person. However, if people with text message dependency do not receive an instant reply to the message they send, they may feel neglected or isolated, and increase their anxiety about being ostracized. Thus, these perceptions, rather than the actual amount of text-messages, would be potential causes of psychological/behavioral symptoms.

Finally, we aimed to explore the important personality factors that drive text-message dependency in interpersonal communication. Although there is no specific personality factors predicting Internet dependency (Armstrong, Phillips, & Saling, 2000), several studies have examined the relationship of Internet dependency with individual dispositions, such as self-esteem (Armstrong et al., 2000), perceived social skills (Caplan, 2005), and loneliness (Morahan-Martin & Schumacher, 2000).

In this study, we placed the focus on extroversion and neuroticism as antecedent predictors of text-message dependency. The Big-Five personality factors (extraversion, neuroticism, conscientiousness, agreeableness, and openness to experience) have been widely accepted as the basic dimensions of human personality over decades (McCrae & John, 1992). In particular, extraversion and neuroticism are two important and frequently studied factors as a predisposition for psychological disorders (Wright et al., 2006).

Extroversion is the social dimension of personality, whereas neuroticism is a pervasive sensitivity to negative cues in the social environment. Extroversion and neuroticism are mood-based personality factors that are independent with each other (Tellegen, 1985; Watson, Clark, & Carey, 1988). In particular, neuroticism is a source of cognitive biases in evaluating others' intentions and attitudes (Watson & Clark, 1984). Previous research has also shown that both extroversion and neuroticism are significantly related with pathological alcohol use (Ruiz, Pincus, & Dickinson, 2003) and substance abuse (McCormick, Dowd, Quirk, & Zegarra, 1998).

Since extroverts are interested in other people in their social environments (Cheek & Buss, 1981), they would tend to exchange a greater number of text-messages and accordingly adjust their perception of what would be considered excessive usage, such that they can remain regarding themselves as average users. In contrast, people with neuroticism have strong anxiety toward interpersonal communication (Leary, 1983). Neurotics may therefore react emotionally to message replies. In addition, neuroticism may also focus on the role of relationship maintenance via text-messages, because social compensation may be made for poor performance in face-to-face communication.

In sum, the goal of the present study is to examine the way in which self-perception of dependent behavior leads to psychological/behavioral symptoms in relation to personality factors. We hypothesized that text-message frequency is not a sole factor to raise psychological/behavioral symptoms. Rather, self-perception of dependent behavior would increase psychological/behavioral symptoms in combination with extroversion and neuroticism. The model we investigated in this study is summarized in Fig. 1. As a consequence of social activity, extroversion is positively related to self-perceptions of excessive use of text-messages. This uncontrollable feeling toward text-message usage increases the amount of text-messages. On the contrary, as a cue of emotional sensitivity, neuroticism is positively related to self-perceptions of emotional reaction and relationship maintenance, and then increases message frequency. Although message frequency itself has a positive relationship to psychological/behavioral symptoms, this relationship is qualified with self-perceptions of text-message dependency that are facilitated by extroversion and neuroticism.
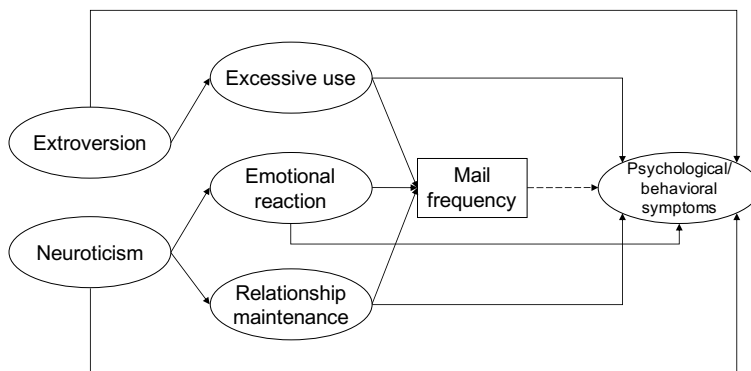

Fig. 1. Psychological process of text-message dependency.

1. Method

1.1. Participants

A pencil-and-paper survey was conducted at a high school in central Japan. The survey was approved by the local institutional review board. Questionnaires were administered during a periodic health examination of high school students. A total of 1581 high school students, ranging in age from 15 to 18 years old, participated in this survey. The response rate was 96.3%. We excluded 186 respondents who did not have any mobile phones, and/ or did not specify their gender or year of study. As a result, the data were analyzed for 1395 students (841 males and 554 females), including 576 tenth graders (354 males and 222 females), 476 eleventh graders (284 males and 192 females), and 343 twelfth graders (203 males and 140 females). According to the data reported by students, most respondents (82.5%) had a history of mobile phones usage of greater than a year, and 74% of them exchanged more than 30 text-messages per week. About 40% of them spent more than an hour a day using text-messages. The average number of people with whom they exchanged text-messages daily was 4.22 ($SD = 1.23$), and the average number of text-messages sent and received per day was 6.19 ($SD = 7.72$).

1.2. Measures

1.2.1. Self-perception of text-message dependency

A short-version of the self-perception of text-message dependency scale (Igarashi, Motoyoshi et al., 2005) serves to measure the way in which people perceive their usage of text-messages along with their attitude toward compulsive use of text-messages in the context of interpersonal relationships. The original scale consists of three subscales: *perception of emotional reaction*, *excessive use*, and *relationship maintenance*. The emotional reaction subscale measures sensitive responses to text-messages (e.g., "I feel disappointed if I don't receive any text-messages"). The perception of excessive use subscale involves self-perception about compulsive usage of text-messages (e.g., "I sometimes spend many hours on text-messages"). The relationship maintenance subscale is composed of items related to fear of disruption of relationships without text-messages (e.g., "I cannot maintain new friendships without text-messages"). For the current study, we chose five representative items from each subscale based on the factor loadings of the original scale[1]. Respondents were asked to rate each of the item on a 5-point scale anchored by *strongly agree* to *strongly disagree*.

1.2.2. Psychological/behavioral symptoms

Five items were developed to measure psychological/behavioral symptoms concerning heavy usage of text-messages in accordance with the DSM-IV-TR criteria of alcoholic and drug dependencies (American Psychiatric Association, 2000). This measure serves a

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[1] In this research, we picked up 15 items from the original scale in order to save the time for answer during the health examination. Each of the three factors (perception of emotional reaction, excessive use, and relationship maintenance) contains five items with high factor loadings in the original scale. We conducted a confirmatory factor analysis of the 15 items with the three subscales on the data collected by Igarashi, Motoyoshi et al. (2005). Results were consistent with those of the original 40 items with better convergence and relatively high Cronbach's α coefficients (all αs > .70), suggesting the structural validity and the internal consistency of the shorter scale.

continuous variable measuring a general tendency of psychological/behavioral symptoms caused by text-message dependency. Respondents were asked to rate the following five statements: "I have tried to cut down on the amount of text-messages I use;" "I sometimes worry that life would be boring and empty without text-messages;" "I use text-messages to escape from my personal problems/issues or from feeling down;" "Using text-messages breaks up my daily schedule;" and "I use text-messages even if I had something else I must do," on a 5-point scale anchored by *not true at all* to *extremely true*. Cronbach's α coefficient was .78.

1.2.3. Extroversion and neuroticism

Extroversion and neuroticism were assessed with the Big-Five Personality Inventory[2] (McCrae & John, 1992; translated into Japanese by Wada, 1996) on 7-point scales anchored by *strongly agree* to *strongly disagree*. Extroversion was composed of four adjectives: 'talkative,' 'quiet (reversed),' 'cheerful,' and 'outgoing.' Neuroticism consisted of four adjectives: 'distressed,' 'sensitive,' 'nervous,' and 'tense.' Cronbach's α coefficients were .78 and .75, respectively.

2. Results

2.1. Factor analysis of the self-perception scale

2.1.1. Exploratory factor analysis

First, an exploratory factor analysis was conducted on the self-perceptions of text-message dependency to test whether the factor structure was consistent with the original scale. The first four eigenvalues were 5.54, 1.79, 1.48, and .84, suggesting that a three-factor solution is clearly acceptable. Table 1 shows the result of a maximum-likelihood exploratory factor analysis with oblique rotation. The factors in this short-version scale corresponded to those in the original scale: emotional reaction, perception of excessive use, and relationship maintenance. Cronbach's α coefficients were .81, .85, and .78, respectively.

2.1.2. Confirmatory factor analysis

Second, a confirmatory factor analysis was conducted to test the fit of the three-factor structure obtained above. Structural equation modeling (SEM) was done by AMOS 5.0 (Arbuckle, 2003). The model proved to fit the data well, χ^2 (87, $N = 1264$) = 374.20, $p < .01$; GFI = .92; AGFI = .89; CFI = .92; RMSEA = .08 (90% CI = .07, .08). All factor loadings and factor variances were significantly different from zero (all $ps < .01$). Correlations among the three factors were moderately strong ($rs = .51$–.55). This conceptualization supported the idea that self-perception of text-message dependency is coherent, but also consists of three separable facets that are positively related with each other.

2.1.3. Measurement invariance

Third, we tested for configural invariance of the model across males and females. The three-factor model of self-perception of text-message dependency fit the data reasonably well for both genders, χ^2 (174, $N = 1028$) = 731.92, $p < .01$; GFI = .91; AGFI = .88;

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[2] McCrae, Terracciano, and 79 members of the Personality Profile Project (2005) revealed the scalar equivalence of the facets and factors of the five-factor personality models across different cultures, including Japan and the US.

Table 1
Exproratory factor analysis on self-perception of text-message dependency

	I	II	III	h^2	M	SD
I: Emotional reaction						
T1 After sending a text message, I check my mailbox repeatedly to see if I had received a response	.79	−.02	−.09	.52	2.87	1.21
T2 I feel disappointed if I don't get a reply to my message immediately	.79	−.09	.09	.55	2.75	1.22
T3 I feel anxious when people don't immediately reply to my text message	.70	−.03	.08	.47	3.15	1.22
T4 I often check my mailbox to see if I had a new text message	.64	.08	−.02	.48	2.69	1.19
T5 I feel disappointed if I don't receive any text-messages	.63	.13	.02	.47	2.97	1.24
II: Perception of excessive use						
T6 I sometimes send text-messages while engaging in a conversation with another person	−.11	.75	.10	.49	3.09	1.27
T7 I sometimes spend many hours on text-messages	.08	.73	−.04	.50	3.24	1.43
T8 I often exchange many text-messages in a short period of time	.05	.69	−.04	.44	3.46	1.12
T9 I use text-messages even while I am talking with friends	−.04	.64	.07	.42	2.52	1.23
T10 I consider myself a quick-typist on mobile phones	.04	.60	−.06	.31	3.05	1.12
III: Relationship maintenance						
T11 I cannot maintain new friendships without text-messages	−.09	−.03	.89	.50	2.07	0.97
T12 I can't form any new relationships without using text-messages	−.05	−.01	.79	.46	2.11	1.01
T13 I think my relationships would fall apart without text-messages	.20	−.03	.55	.42	2.08	1.05
T14 Without text-messages, I would not be able to contact friends whom I cannot meet on a daily basis	.04	.09	.45	.26	2.87	1.30
T15 Without using text-messages, I can't say what is on my mind	.15	.06	.43	.32	2.00	0.99
Inter-factor correlations						
II	.51					
III	.55	.45				

CFI = .90; RMSEA = .06 (90% CI = .05, .06). All loadings were significantly different from zero (all $p < .01$). Then we examined the metric invariance of the factor loadings across gender by constraining the factor loadings between males and females. This model did not result in a significant loss of fit over the configural model, χ^2 (186, $N = 1028) = 745.11$, $p < .01$; GFI = .91; AGFI = .88; CFI = .90; RMSEA = .05 (90% CI = .05, .06); $\Delta\chi^2 = 13.14$, $\Delta df = 12$, $p > .10$. In sum, the measurement invariance of the self-perception instrument was established across gender.

2.2. Personality, self-perceptions, and psychological/behavioral symptoms

Prior to examining the effect of self-perception on psychological/behavioral symptoms, we tested a simple model in which the amount of text-messages predicted psychological/behavioral symptoms. The amount of text-messages was positively related to psychological/behavioral symptoms, $\beta = .46$, $p < .01$, indicating that greater number of text-messages increased psychological/behavioral symptoms.

SEM analysis was then conducted to test the impact of self-perception and personality on psychological/behavioral symptoms. Each latent variable contains observed variables of each scale. Because of relatively strong inter-factor correlations, we set correlations among error variables of the three factors of the self-perception. The model fit the data well, χ^2 (357, $N = 1028$) = 1411.03, $p < .01$; GFI = .91; AGFI = .89; CFI = .91; RMSEA = .05 (90% CI = .05, .06). All the parameter estimates are shown in Fig. 2. Note that critical ratios of differences (CRD) between parameters were calculated by AMOS to compare the difference between standardized path coefficients (β).

All the factors of self-perception had positive effects on psychological/behavioral symptoms, but the strength of the effects differed with each factor. Emotional reaction showed less impact on psychological/behavioral symptoms than perception of excessive use, $\beta = .20$ vs. $\beta = .52$, CRD = 4.50, $p < .01$, and relationship maintenance, $\beta = .20$ vs. $\beta = .41$, CRD = 2.92, $p < .01$. Perception of excessive use and relationship maintenance indicated no significant difference in the impact on psychological/behavioral symptoms. Interestingly, the amount of text-messages did not significantly predict psychological/behavioral symptoms after self-perceptions were included in the model, $\beta = .02$, ns. Both extroversion and neuroticism showed no significant direct effects on psychological/behavioral symptoms and mail frequency.

There were also meaningful differences in the effects of personality factors on self-perception of text-message dependency. Perception of excessive use was affected by extroversion rather than neuroticism, $\beta = .54$ vs. $\beta = .17$, CRD = 7.15, $p < .01$. However, emotional reaction and relationship maintenance were influenced more by neuroticism than extroversion, $\beta = .28$ vs. $\beta = .49$, CRD = 3.95, $p < .01$ for emotional reaction, and $\beta = .01$ vs. $\beta = .28$, CRD = 4.92, $p < .01$, for relationship maintenance.

With regard to the relationships between self-perception and mail frequency, perception of excessive use had a strong positive impact on the amount of text-messages, whereas emotional reaction had a weak negative impact. Relationship maintenance showed no significant effect on the amount of text-messages.
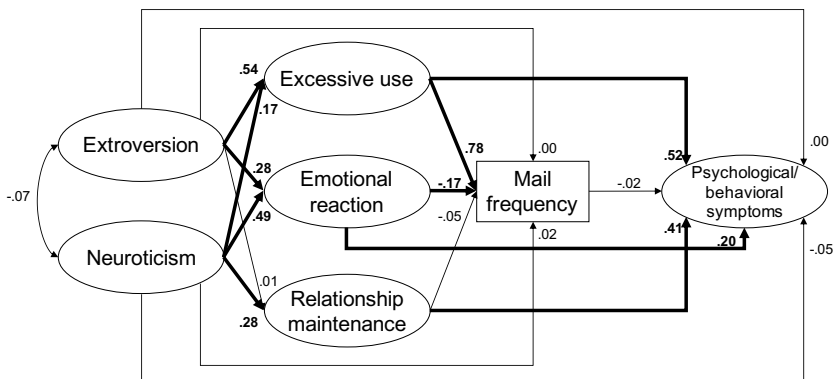

Fig. 2. Results of the SEM analysis. Significant parameters ($p < .05$) are presented in boldface.

3. Discussion

The current research investigated the way in which psychological/behavioral symptoms of text-message dependency occur in relation with self-perception of dependent behavior. Our hypothesis is that self-perception of dependent behavior increases psychological/behavioral symptoms in relations with extroversion and neuroticism. Whereas personality factors exerted a significant influence on self-perception, these factors did not directly predict psychological/behavioral symptoms. Likewise, frequency of text-messages had little effect on psychological/behavioral symptoms. In line with the framework presented at the outset, self-perception of text-message dependency would be one of the key predictors of psychological/behavioral symptoms. These results are consistent with the findings showing that people with high Internet dependency have loss of time control, high neuroticism, and high emotional symptoms (Cao & Su, 2006).

The effect of message frequency on psychological/behavioral symptoms dissipated after entering self-perception into the model. In particular, perception of excessive use showed the strongest influence on psychological/behavioral symptoms of text-message dependency. There is no doubt that compulsive use of text-messages is the most fundamental characteristic of dependency. This factor contains the items regarding the perception of socially inappropriate behavior in Japanese culture, such as using text-messages while having a face-to-face conversation with another person. Subjective perception of maladaptive and inordinate text-message usage in interpersonal contexts may lead to participants getting afflicted with psychological/behavioral symptoms. However, we should note that this result is carefully interpreted because of the possibility of confounding between perception of excessive use and a subjective report of the amount of text-messages. Although a feeling of compulsive usage of communication media is an important characteristics of dependency on the media (Young, 1998), people truly dependent on text-messages may have a difficulty in reporting their actual usage of text-messages. Further research including more objective measures of text-message usage is needed to investigate the importance of perception of excessive use in order to clearly explain the cause of text-message dependency.

Along with perception of excessive use, relationship maintenance increased psychological/behavioral symptoms. This factor is concerned with motivation for perpetual contact via text-messages and therefore has potentials for interpersonal dependency (Pincus & Gurtman, 1995). Interpersonal dependency implies a central need to stay close to others and to maintain nurturing and supportive relationships. At the societal level, Japanese are likely to form a secure-based society rooted in sanctions and punishments against betrayers (Yamagishi, 1986), which may have people focus on a fear of ostracism in text-message communication. Whereas text-messaging is an easy and convenient way to keep contact with friends even while people are physically distant, it may also drive excessive dependence on the medium in order to compensate for face-to-face communication and to adapt to friendship networks.

On the contrary, emotional reaction showed a significant but weak effect on psychological/behavioral symptoms. This factor involves a strong urge to receive immediate replies from message receivers. E-mail senders are likely to overestimate receivers' ability of understanding their messages, especially sarcastic content (Kruger, Epley, Parker, & Ng, 2005). Thus construed, the effect of emotional reaction may not be as strong as the other two factors of text-message dependency.

With regard to personality factors and self-perception, extroversion affected perception of excessive use, whereas neuroticism contributed to increasing relationship maintenance and emotional reaction. Considering the evidence, text-message dependency may occur through two different processes. The first is extroverted dependency, concerned with the process in which extroversion increases perception of excessive use of text-messages and the consequent occurrence of psychological/behavioral symptoms. People with high extroversion are outgoing and sociable, and hold a strong desire to communicate with peers. Text message is suitable for satisfying this purpose. Along with its definition, extroversion is positively correlated with the number of friends (McCrae & John, 1992). Meanwhile, extroversion may foster 'hyperactive' impulsion to maintain social relationships via text-messages, resulting in the uncontrollable feeling toward excessive use of text-messages that causes psychological/behavioral symptoms.

The other type of text-message dependency is triggered by neuroticism, which intensifies fear of rejection from peers and thus increases psychological/behavioral symptoms. At a cognitive level, people with high neuroticism are very sensitive to other people's response to their messages. Since text-messages usually include only letters, receivers may sometimes confuse an ambiguity in the meanings and misunderstand the intention of senders. Emoticons and paralanguages are other useful ways for expressing senders' feelings in text-messages. Even these cues are embedded, the receivers especially with high neuroticism would rather bewilder and increase serious anxieties about the relationship with the senders, resulting in psychological/behavioral symptoms. Insofar as relying on indirect communication, ambiguity is always a problem for improving personal relationships. Understanding cognitive process of people with high neuroticism from self-focus and rumination (see Muris, Roelofs, Rassin, Franken, & Mayer, 2005) may help them to avoid overinvolving text-messages. In addition, no direct effects of extroversion and neuroticism were found on psychological/behavioral symptoms. These results suggesting that these symptoms increase in accordance to self-perception of text-message dependency, rather than general personality factors.

It is important to consider the generalization of the current findings across cultures and other age groups. In this study, participants were Japanese high school students. Collectivist cultures emphasize the role of personal interdependence and groups more than individualistic cultures (Triandis, 1995), which may lead people in collectivist and individualistic cultures to involve text-messages in different ways or based on different self-perceptions. In addition, it has been pointed out that the way of use of text-messages varies according to ages (Ministry of Internal Affairs and Communications, Japan, 2007). In general, the age of text message users tend to be getting younger. Whereas high school and university students appear to be one of the most dominant age groups of text-messages, the older generation uses text-messages to communicate mainly with their family. This generation gap indicates that text-message dependency is more likely to occur among younger people.

Although the results of the current study provide insightful perspectives to understand text-message dependency, there are several limitations to this study. First of all, according to the theoretical aspect of this research, we did not handle negative social outcomes that may be another important dependent variable of the model. Future research should care for the variables included in the model in order to understand a whole process of text-message dependency in details. Also, dependency on mobile phones can produce negative social outcomes not only to individuals, but also to our society. This could perhaps be

another important issue. In recent days, a glowing number of functions have been equipped on mobile phones, including Internet browsers, portable media players, digital cameras, and even televisions. In other words, mobile phones are a tool not only for communicating with others via voices and text-messages, but also for accessing to a convenient gateway to the 'ideal' world separating from immediate surroundings. Indeed, Hirooka and Yagami (2004) showed that people tend to feel annoying to others who overinvolve mobile phones in public situations (e.g., watching the display on their phones even while walking on a street). In terms of compliance with social norms, this type of overinvolvement with mobile phones in social settings could raise a new question about the negative outcomes of mobile phone dependency, which should be further investigated from a broader range of perspectives in the future.

Social networks may also play an important role in text-message dependency. Adolescents tend to conform to norms of peer groups to which they belong, and adjust their behavior to environments (Harris, 1999), especially in Japanese culture (Williams & Sogon, 1984). In accordance with text-messaging ostracism, response styles of text-messages may be embedded within a group as a crucial norm to maintain their friendship ties. In addition, this study treated cross-sectional data to examine the relationship between self-perception and psychological/behavioral symptoms of text-messages. Longitudinal data collection would tell us a better explanation for the process.

Finally, it is plausible that text-message dependency causes unconsciously and automatically. The questionnaire used in this study measured the degree of text-message dependency at a conscious level. However, adolescents are used to their lives with mobile phones, and many may not be able to imagine living without their phones. If the adolescents are taken away from their phones, they may be plagued with a very negative feeling from not being able to connect with their friends, and that may lead to strong despair, which in turn causes psychological/behavioral symptoms (Masataka, 2003). Also, the validity of the subjective measures regarding the use of text-messages may need to be reinvestigated by collecting the objective amount of text-messages (e.g., analyzing message logs) since it is somewhat doubtful how capable are true heavy users in reporting their actual use. Future research and experiments should clarify these issues.

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