

# Kei-Tying teens: Using mobile phone e-mail to bond, bridge, and break with social ties – a study of Japanese adolescents<sup>1</sup>

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## Abstract

This paper examines the extent to which Japanese adolescents use mobile phone e-mail to bond, bridge, and break with social ties. Although existing literature shows that adolescents use mobile phone e-mail to bond with intimate strong ties, the fluid nature of social networks during adolescence suggests that mobile phone e-mail may also be used to bridge to new ties and break with old ties. Drawing on a stratified random sample survey of 501 high school students living in Tokyo, we find that mobile phone e-mail is used both to bond and bridge, but not to break with ties. We also find that the intensity with which Japanese adolescents use mobile phone e-mail is more fundamentally a result of bridging than bonding. These findings apply both to typical users and heavy users.

## 1. Introduction

Japanese adolescents have been among the world's earliest and heaviest users of mobile phone e-mail. But what motivates them to use technology and what does it mean for their social networks? Do they use mobile phone e-mail to bond more closely to their inner circles of confidants, or do they use it to develop new ties? Does using this technology lead them to neglect and eventually break-off relationships with their weaker ties? In this paper we examine the extent to which Japanese adolescents use mobile phone e-mail to bond, bridge, and break with their social ties.

In Japanese the word for mobile phone is *keitai*, which literally means 'something that you take with you.' This name is apt given that the heavy use of mobile phones in Japan has made them permanent and arguably pedestrian fixtures of everyday life (see Ito et al., 2005). Unlike in countries such as the United States where mobile phones are primarily used to make calls, in Japan mobile phones are often used to send and receive e-mail. Like many Japanese adults, Japanese adolescents use

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<sup>1</sup> The citation for this paper is:

Jeffrey Boase & Tetsuro Kobayashi (2008) 'Kei-Tying teens: Using mobile phone e-mail to bond, bridge, and break with social ties – a study of Japanese adolescents', *International Journal of Human - Computer Studies*, 66:12, 930-943.

The published version of this paper is available at: <http://www.sciencedirect.com/science/article/pii/S1071581908000815>

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mobile phone e-mail to send short messages to their friends and family throughout the day. As will be discussed in greater detail below, research conducted both in Japan and other countries has focused on how using mobile phones to send e-mail and SMS messages allows adolescents to maintain a sense of intimacy with their strong ties, carve out personal space away from the watchful eyes of parents and teachers, and micro-coordinate in-person get-togethers. Although it has not been a common theme in mobile phone literature, we theorize that the relative fluidity of social networks during adolescence suggests that mobile phone e-mail may also be used to develop relationships with newly met ties, keeping these connections active between classes or extracurricular activities when in-person contact may not be possible. Moreover, we further wonder if adolescents will use mobile phone e-mail to break-off contact with their weaker relationships when they are no longer desirable or when other strong relationships have taken their place.

We examine these issues using survey data gathered from a stratified random sample of first year high school students living in Tokyo. The surveys were completed approximately six months after these students made the transition from junior high school to high school. Given that the data was collected shortly after this transition, this sample is ideal for examining the possible use of mobile phone e-mail for purposes of bridging with new ties and breaking with old ones. Moreover, this survey includes multiple measures of bonding via mobile phone e-mail to ensure that the results of this analysis are not biased towards obtaining only significant bridging and breaking effects. We use this data to address the following research questions:

1. To what extent do Japanese adolescents use mobile phone e-mail to bond, bridge, and break with their social ties?
2. To what extent does the bonding, bridging, and breaking of social ties via mobile phone e-mail account for the intensity with which Japanese adolescents send mobile phone e-mail?
3. Do heavy mobile phone e-mail users bond, bridge, or break with social ties to a greater extent than less heavy users?

The remainder of this article is organized as follows: Section 2 provides a brief history of the mobile phone e-mail use in Japan, discusses adolescent mobile phone use in Japan and in other countries, and reviews literature about the dynamic nature of social networks during adolescence. Section 3 describes how our data was collected, and we present our analyses and results of this data in Section 4. In Section 5 we discuss these results and their implications for research. The implications of these findings for the design of mobile phones are discussed in Section 6.

## **2. Mobile phone e-mail and social networks during adolescence**

### *2.1. The rise of mobile phone e-mail in Japan*

The diffusion of internet-enabled mobile phones occurred quickly in Japan. Within four years the number of mobile phone Internet subscribers in Japan increased ten times, from 7.5 million in 2001 to 75 million in 2005. While internet enabled mobile phones typically offer the opportunity to carry out a variety of activities online, such as downloading maps, ring tone music, or sending photos, Japanese subscribers most commonly use their mobile phone to send and receive e-mail (Ministry of Public Management, Home Affairs, Posts and Telecommunications, 2003). According to a highly regarded report published by the Japanese Ministry of Internal Affairs and Communications (2005),

approximately 88 percent of Japan's 87 million mobile phone subscribers use their mobile phones to send and receive e-mail.

Mobile phone e-mail is functionally similar to SMS (Short Message Services) available in other countries, insofar as it enables people to exchange messages directly from one mobile phone to another. However, e-mail enabled mobile phones further allow users to exchange e-mail messages with PC based e-mail accounts, while this function is not inherent to mobile phone SMS. Despite this added functionality, mobile phone e-mail is typically only exchanged from one mobile phone to another in Japan. This is especially true among young Japanese, who are among the heaviest users of mobile phones (Ikeda et al., 2005; Miyata et al., 2005). Thus, despite the technical differences between mobile phone e-mail and mobile phone SMS, both services are used in very similar ways.

The heavy use of mobile phone e-mail in Japan is much different than in other parts of the world where only a small percent of those with mobile phones actually use them to e-mail or send SMS text messages. For example, according to the 2005 report mentioned above only about 12 percent of Americans who own a mobile phone use it to send text messages. Even in South Korea where Internet enabled mobile phones are more prevalent, the percent of mobile phone subscribers who use their mobile phone to e-mail is still about half of what it is in Japan (43 percent in Korea and 88 percent in Japan). The fact that the percent of mobile phone owners in South Korea using their phones to e-mail is about half that of Japan is especially significant because the same percent of mobile subscribers in both countries have the technological means to send and receive e-mail using their mobile phones. Clearly, mobile phone e-mail plays a greater role in daily life in Japan than in other parts of the world.

Even in Japan the use of mobile phone e-mail is not spread evenly throughout society. Age is one of the largest cleavages, with mobile phone e-mail playing a greater role in the lives of young people than in the lives of older people. A study of 1,302 adults living in Japan's Yamanashi prefecture found that 92 percent of those in their 20's used mobile phone e-mail, while less than 20 percent of those 50 years or older used mobile phone e-mail (Miyata et al., 2005). The percent of mobile users sending e-mail is also pronounced among adolescents. A survey conducted by the Ministry of Public Management, Home Affairs, Posts and Telecommunications (2002) showed that 90 percent of people between the ages of 13 and 19 years old subscribe to mobile phone Internet services. The results of another national survey showed that males aged 14 to 19 send an average of 43 messages per week using mobile phone e-mail, and females of the same age group send an average of 95 messages per week using mobile phone e-mail (Ishii, 2006). These findings are consistent with another survey of youth in Osaka and Tokyo, which found that students send an average of 66 mobile phone e-mail messages per week and receive an average of 72 mobile phone e-mail messages per week (Okada, 2005).

It has been argued that the use of mobile phone e-mail among Japanese adolescents is rooted in their early adoption of pager technology during the late 80's and throughout the 90's. According to Okada (2005), one of the earliest pager systems adopted by adolescents was introduced by NTT (now NTT DoCoMo) in 1987. This service allowed users to see the number of the person calling, but did not display any words or characters. Adolescent girls retooled this technology for their own purposes by decoding the numbers displayed on the screen into words. For example, 0840 would be read as *ohayo*, the Japanese word for 'good morning.' This practice became known as *poke-kotoba* (pager lingo) and interview data collected by Okada and colleagues suggests that adolescent girls used it to unobtrusively and sometimes covertly co-ordinate get-togethers and maintain social contact throughout the day (also see Okada and Habuchi, 1999). Eventually, companies producing pagers decreased subscription costs and modified their pagers to send text messages directly, which lead to greater adoption and use of

these devices among adolescents. The adoption of pager technology by Japanese adolescents did not go unnoticed by mobile phone companies, and by the mid-90's mobile phones began to allow for the transmission of short text messages between customers. By the late 90's mobile phone companies extended this service to allow users to send and receive e-mail either to other mobile phone or directly to PCs (Ohta, 2001).

With mobile phone e-mail becoming heavily adopted by Japanese youth towards the end of the 90's and during the beginning of the new millennium, Japanese mobile phone companies invested heavily in their network infrastructure, improved the technological sophistication of their mobile phones, and lowered the cost of mobile phone internet subscriptions. This investment in-turn promoted mobile phone e-mail adoption among older generations, leading to the rapid increase in the number of mobile phone Internet subscriptions among the general public discussed at the beginning of this section (Funk, 2001). These developments also made it easier and more enjoyable to send mobile phone e-mail because they led mobile phone manufacturers to increase pixel density, battery life, keypad size, and the range of emoticons available to users.

This section has provided a historic account of how pager technology and mobile phone e-mail has developed in Japan. It has shown that the rapid adoption of mobile phone e-mail in Japan occurred first among adolescents who had already integrated pager technology into their social interactions and then spread throughout the rest of the population. Given this historic account of mobile phone e-mail in Japan it is tempting to conclude that the heavy adoption of mobile phone e-mail was a natural progression from earlier pager technology. However this kind of explanation is contradicted by the fact that adoption of pager technology by adolescents in other countries did not lead to similar patterns of mobile phone e-mail adoption, perhaps because countries such as the United States did not have integration across phone carriers that would allow for SMS to become widely adopted after the initial diffusion of pager technologies (Sunada, 2007). These national differences indicate that although this historic narrative describes the context in which Japanese adolescents heavily adopted mobile phone e-mail, the use of pager technology is not a causal mechanism that is alone sufficient condition for the heavy adoption of mobile phone e-mail.

To better understand how various factors contribute to the heavy incorporation of mobile phone e-mail into the everyday lives of Japanese adolescents the next section reviews research about mobile phone use during adolescence.

### *2.2. Mobile phone use during adolescence*

The early and rapid adoption of mobile phone e-mail by Japanese youth has been a source of fascination for both scholars and the popular media. Explanations regarding the heavy use of mobile phones in Japan have sometimes focused on supposedly unique aspects of Japanese culture, such as the high disclosure of the subjective self that may be facilitated through mobile phone texting (Iishi, 2006). Unfortunately, these kinds of cultural generalizations are rarely supported by nationally representative data collected in multiple countries (although see Rivière and Licoppe, 2005). In this section we review literature about the use of mobile phones during adolescence in several developed countries to see if Japanese adolescents are unique in their use of mobile technology. This allows us to draw generalizations regarding the topic at hand without making unsubstantiated claims about the uniqueness of Japanese culture. Our literature review shows that although Japan may be somewhat unique in its history of mobile phone diffusion, Japanese adolescents are quite similar to adolescents in other developed countries regarding their use of mobile phones.

One of the most prevalent themes emerging from research in developed countries is the tendency of adolescents to send text messages using mobile phone SMS or e-mail, rather than making calls like

adults (Lenhart et al., 2005). Even in America where adolescents often used PC based IM instead mobile phone texting, American adolescents have recently started to supplement their IM habits with mobile phone based text messages (Ling and Baron, 2007). This shows that even though Japanese adolescents were among the first of their kind to incorporate mobile phone text messaging into their lives, adolescents in other countries have followed suit.

Research conducted in Japan, America, and many parts of Europe also shows that adolescents typically use mobile phone text messages in similar ways and for similar reasons. One of the most common research findings is that adolescents use mobile phone text messages to bond closely with their friends by using them express a range of emotions that helps them maintain a strong sense of connection (Döring et al., 2005, in Germany; Furutani and Sakata, 2007, in Japan; Höflich and Rössler, 2002, in Germany; Ito and Okabe, 2005, in Japan; Kasesniemi and Rautiainen, 2002, in Finland; Kobayashi and Ikeda, 2007, in Japan; Ling, 2005, in Norway; Ling and Yttri, 2005, in Norway; Lobet-Maris and Henin, 2002, in Belgium; Matsuda, 2000, in Japan; Nakamura, 2001, in Japan; Oksman and Rautiainen, 2002, in Finland; Selian, 2004, in America; Thurlow and Brown, 2003, in America). These messages are often sent in situations where a call would be impossible or unsuitable, making mobile phones the “back door of communication” (Kasesniemi and Rautiainen, 2002, p. 171). Using mobile phones to covertly send messages provides new freedom for adolescents, helping them to subvert control imposed by parents, teachers, and other authority figures (Ito and Okabe, 2005, in Japan; Fortunati and Magnanelli, 2002, in Italy; Ling 2000, 2002, 2005, in Norway; Ling and Yttri, 2005, in Norway). This subversion of authority helps adolescents maintain a sense of independence that is crucial to the process of identity formation (Ling, 2002, in Norway; Mante and Piris, 2002, in the Netherlands; Selwyn, 2003, in Britain; Ito, 2005, in Japan). Being available for contact at all times throughout the day also helps maintain a sense of connection when communication is not occurring (Höflich and Rössler, 2002, in Germany; Ito and Okabe, 2005, in Japan; Leung and Wei, 2000, in Hong Kong; Ling, 2000, in Norway).

Although the use of mobile phones to bond with peers has been a common finding of research conducted in many developed countries, still other reasons for mobile phone use during adolescence exist. In contrast to the emotional bonding that typically happens with peers, adolescents also use their mobile phones to coordinate events or change plans with family (Matsuda, 2005, in Japan; Selian, 2004, in America). Still, mobile phones help family bond by providing parents with the sense of security that comes with knowing that they can be in touch with their children at all times during the day (Ling, 2000, Norway; Matsuda, 2005, in Japan). Research has also shown that adolescents personalize their mobile phones by adding icons or external decoration. This helps them display their personal identity and incorporate mobile phones into their daily lives (Fujimoto, 2005, in Japan; Katz & Sugiyama, 2005, in America; Ling, 2002, in Norway; Lobet-Maris & Henin, 2002, in Belgium). This level of personalization has also been argued to reflect the consumption patterns of fashion conscious adolescents, especially young women (Wilska, 2003, in Finland).

The combination of social and nonsocial factors used by researchers to explain the heavy integration of mobile phones by adolescents throughout the world indicates that this technology has become domesticated by adolescents such that it fits into common social dynamics of distance, power, status and identity (Kato, 2005, in Japan; Katz & Sugiyama, 2005, in America; Ling, 2001, in Norway). This points to the possibility that despite cultural differences, adolescents in many different countries use mobile phones in similar ways due to their common situations, i.e. their desire to bond closely with peers and form identity at a time when school and family obligations act to limit their autonomy. Rather than focusing on issues of power and identity, we examine peer relationships during adolescence to

help explain the intense use of mobile phones. We suspect that although most research has focused on the social bonding that occurs by way of mobile phones, the dynamic nature of social networks during adolescents may also mean that adolescents use their mobile phones to form new social ties and break with older ties. The dynamic nature of adolescent networks is likely similar in most developed countries where the change from elementary to high school may contribute to the bridging and breaking of peer relationships. Given the common nature of these social dynamics in developed countries, our research has the potential to produce generalizations that can be extended beyond Japan. The next section provides a more detailed understanding of these dynamics by reviewing literature about social network change during adolescence.

### *2.3. The fluid nature of social networks during adolescence*

Social network studies have found that social networks are typically fluid during adolescence, especially with respect to weak ties. Although Granovetter (1973) previously theorized that weak ties tend to be short-lived by their very nature, empirical research has since shown that this is not a property that is inherent to their existence (Marsden and Campbell, 1984; Burt 2002). Ties may be known for long periods of time, but still be considered weak because they lack emotional closeness. Despite the potential for weak ties to be long lasting, research has shown that weak ties tend to be fluid during adolescence. For example, in a longitudinal study by Degirmencioglu et al. (1998) junior high school and high school students were asked to nominate up to 10 of their closest friends at the beginning and end of the school year. They found that best friends nominated at the beginning of the year were also nominated as either best or at least close friends at the end of the year. However, less close friends nominated at the beginning of the year were far less likely to be renominated by the end of year, at which point students instead nominated new friends. These results suggest that adolescents maintain a stable network of strong ties while at the same time forming and breaking relationships with weaker ties. Another study measuring relationships during the fall and spring of a school year found similar results concerning the stability of strong ties among first and fourth grade students (Berndt and Hoyle, 1985). Changes to social networks also occur during shorter periods of time throughout the school year, even among strong ties. When tracking pairs of relationships over a three week period, Cairns et al. (1995) showed that less than half of the pairs who mutually nominated each other as best friends at Time 1 again nominated each other as best friends just three weeks later at Time 2. Similar findings have been observed with regard to the social networks of Japanese adolescents (Toya, 1996; Oka 1999).

The fluidity of adolescent networks can be attributed both to social environmental changes, and to socio-emotional needs that are common early in the life course. Socio-environmental changes are typically brought on by transitions that occur between grades, and especially during transitions from elementary school to junior high school, or from junior high school to high school (Bukowski and Newcomb, 1984). These changes to social environments typically result in social network fluidity because they allow students new opportunities to interact with others from diverse social groups, and at the same time make it difficult for them to maintain friendships. This explanation is consistent with findings collected from a study of students transitioning from elementary to junior high school, which showed that students both gained and lost an equal number of relationships during this transition (Hard et al., 2002).

The theory of socio-emotional selectivity suggests that the social networks of adolescents are fluid because adolescents tend to form relationships based on the knowledge that they offer rather than on emotional stability (Carstensen et al., 1999). According to this theory, adolescents may be more prone

to form numerous weak tie relationships because these ties allow them to bridge to new social groups, in-turn allowing them to access new pools of knowledge. By contrast, adults prefer to select relationships based on their emotional stability, leading them to nurture their strong and stable relationships with close family. This theory is consistent with the results of a national longitudinal study conducted in England, which shows that younger people typically select non-kin as their close friends, while the close networks of older adults more often include kin (Pahl and Pevalin, 2005). However, adolescent networks are not only fluid when compared to the networks of adults, but also when compared to the networks of children. Shrum and Cheek (1987) find that adolescents have less stable relationships than do elementary school children, and they also find that adolescents are more prone to break from friendship cliques and to form weak tie relationships with diverse social groups than elementary school children.

#### *2.4. The social utility of mobile phone e-mail – three arguments*

The literature reviewed thus far shows that mobile phone e-mail is highly embedded in the lives of Japanese adolescents. Moreover, it has shown that the social networks of adolescents are typically fluid, with network change occurring more among weak ties than among strong ties. In this section we draw on additional literature about the social utility of mobile phone e-mail to develop three arguments about how Japanese adolescents may use mobile phone e-mail to bond, bridge, and break with social ties.

##### *2.4.1. Argument 1 - using mobile phone e-mail to bond*

Of the three arguments discussed in this section, the use of mobile phone e-mail to bond has garnered the most attention from researchers. As discussed above, research conducted in Japan and in other countries shows that adolescents use mobile phones to maintain constant contact with their peers throughout the day. This perpetual contact helps them to maintain strong ties both through emotionally expressive messages, and through the sense of that peers are always be available for contact.

In sum, according to this argument, Japanese adolescents typically use mobile phone e-mail to stay in close contact with their strong ties. For this reason, bonding is what accounts for the heavy use of mobile phone e-mail among this age group.

##### *2.4.2. Argument 2 - using mobile phone e-mail to bridge*

Although the bridging argument has not been studied as well as the bonding argument, the social network literature reviewed above suggests that it may have validity. According to this argument, adolescents use mobile phone e-mail to form new relationships with others who they meet in-person at school or during extracurricular activities. Mobile phone e-mail helps them to bridge to new social groups by allowing them to stay in close contact with newly met ties. According to this argument, Japanese adolescents use mobile phone e-mail to communicate heavily with newly formed ties.

Although few studies examine the role of mobile phone use in the bridging of new social ties, evidence that supports this argument is not lacking entirely. A longitudinal study of Japanese undergraduate students conducted by Igarashi et al. (2005) found that students using mobile phone e-mail in conjunction with in-person contact increased the intimacy of their relationships. By contrast, those who communicated only in-person maintained stable levels of intimacy, but did not increase their intimacy over time.

### *2.4.3. Argument 3 - using mobile phone e-mail to break with social ties*

According to this argument, using mobile phone e-mail to form new ties and bond with close ties may lead to the neglect and erosion of weak ties. Thus, the more emotional investment made by sending mobile phone e-mail to desirable interaction partners, the less time and energy that will be put into interacting with weak ties. In this way using mobile phone e-mail may result in a breaking of social ties. Moreover, not sending mobile phone e-mail when such communication is expected – either purposefully or through unintentional neglect – may also be a way of breaking ties.

The unintentional and unperceived ways that mobile phone e-mail could be used to break ties makes breaking ties by way of mobile phone e-mail a particularly difficult phenomenon to measure. For the purposes of this paper, we will only focus on instances where Japanese adolescents have a perceived awareness that their use or neglected use of mobile phone e-mail has led to the breaking of their social ties. Although this approach is limiting because it does not include instances when respondents are unaware that mobile phone e-mail is damaging their relationships, it has the advantage of allowing for comparisons to other perceived measures that tap bridging and bonding to ties by way of mobile phone e-mail. We discuss the advantages and disadvantages of using perceived measures below.

After an extensive literature search, we could not find any studies that investigated the role of mobile phone e-mail in the breaking of relationships among Japanese adolescents. This could be because findings regarding this issue have not been reported, or more likely it is because the relatively short amount of time that mobile phone e-mail has been used by adolescents has meant that researchers simply have not yet studied this issue. Given the fluid nature of relationships during adolescence, this argument is plausible and worthy of investigation.

### *2.5. Research questions*

Having made arguments about the utility of mobile phone e-mail to bond, bridge, and break with social ties, we now pose three research questions that will help us evaluate their validity during our analysis. To directly address the bonding, bridging, and breaking arguments, we first ask:

1. To what extent do Japanese adolescents use mobile phone e-mail to bond, bridge, and break with their social ties?

Our second question addresses the issue of how this bonding, bridging, and breaking activity may be related to the intensity with which Japanese adolescents use mobile phone e-mail. As discussed above, Japanese adolescents use mobile phone e-mail extensively throughout their everyday lives. However, it is possible that even though mobile phone e-mail may allow them to bond, bridge, and break with ties, this social activity itself is not really what motivates them to use this technology so extensively. Instead, it is possible that nonsocial factors such as time spent commuting, the amount of money that they receive from their parents in the form of allowance, free time, and gender, are all more fundamental reasons for the intensity with which they use mobile phone e-mail in their daily lives. This leads us to our second question, which is:

2. To what extent does the bonding, bridging, and breaking of social ties via mobile phone e-mail account for the intensity with which Japanese adolescents send mobile phone e-mail?

Not only do average Japanese adolescents use mobile phone e-mail extensively throughout their daily lives, but research has also shown that some adolescents have extraordinarily high levels of mobile phone e-mail use. Using psychological dependency scales adapted for e-mail use, Motoyoshi et al. (2005) find that a sizable minority of college students could be considered psychologically



dependent on mobile phone e-mail. They find that this group of heavy users sends an average of about 22 e-mails each day using their mobile phones. The existence of these users leads us to pose our third research question:

3. Do heavy mobile phone e-mail users bond, bridge, or break with social ties to a greater extent than less heavy users?

In our analysis presented in Section 4, we address each of these questions in turn.

### **3. Kei-tying teens in Tokyo – the study**

To address the three research questions proposed above we draw on a stratified random sample survey completed between October and November 2005 by 501 high school students living in Tokyo. At the time of the survey all students were in their first year of high school, making a majority of them 16 years old.

This survey was conducted using a two-stage stratified random sampling method. At Stage 1, all of the high schools in the Tokyo metropolitan area<sup>2</sup> were stratified by sector (public/private), system (boys' school/girls' school/coeducational), and average entrance exam score (high/middle/low). High schools were then sampled from each stratum and asked to cooperate in the research. The number of people sampled from each stratum was calculated based on the ratio of the number of students in each stratum to the grand total. The number of schools sampled from each stratum was calculated by dividing the number of students from each stratum by 50 (the approximate number of students expected to complete the survey at each school). At Stage 2, one first-year class from each school was selected at random by high school teachers and the data was collected from all of the students in these selected classes. 43 high schools were approached to participate in the survey, and eight schools agreed to cooperate.

After data cleaning approximately 72 percent of the respondents were male. This is because two of the eight randomly sampled schools that agreed to cooperate were boys' schools.

## **4. Analysis and results**

### *4.1. Mobile phone e-mail use – a brief overview*

94 percent of our respondents own a mobile phone, and all of those who own a mobile phone use it to send e-mail. When asked about the length of time that they owned a mobile phone, 35 percent said that they owned one for more than three years and less than five years. This means that over a third of our mobile phone using students started using mobile phones at an early stage of junior high school. Of the students who own a mobile phone, 75 percent indicated that their parents paid their monthly mobile phone bills, while 13 percent indicated that they pay their mobile phone fees directly from their allowance.

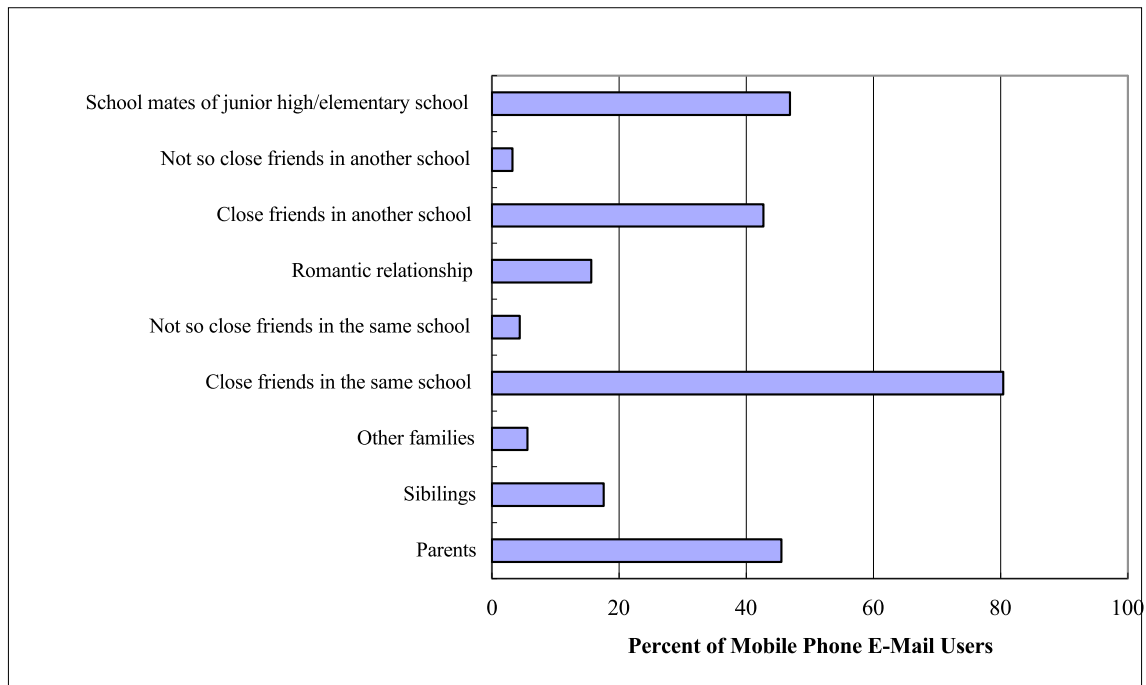
Respondents were asked to report the average number of mobile phone e-mail that they send daily by selecting the most appropriate answer from a six-point scale. Approximately 91 percent said that they send at least one mobile phone e-mail daily, indicating that mobile phone e-mail is used on a daily basis by most of the respondents. Approximately 25 percent of the respondents send one to five mobile phone e-mails daily, and another 25 percent send 11 to 25 mobile phone e-mails daily. About 9 percent of respondents show extraordinarily high levels of use, sending an average of more than 50 mobile phone e-mails daily.

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<sup>2</sup> High schools located on islands near Tokyo were excluded.

Figure 1 illustrates the types of ties that respondents contact using mobile phone e-mail. Respondents most commonly reported exchanging mobile phone e-mail with “close friends in the same school” and “schoolmates from junior high/elementary school.” “Parents” and “close friends in another school” follow.

Figure 1. Types of ties contacted using mobile phone e-mail.



#### 4.2. Addressing research question 1 – using mobile phone e-mail to bond, bridge, and break with social ties

In this section we use descriptive statistics to address our first research question:

1. To what extent do Japanese adolescents use mobile phone e-mail to bond, bridge, and break with their social ties?

To measure the use of e-mail to bond, bridge, and break with social ties, we draw on a set of perceived measures. Following the leading sentences, “What do you think about the statements listed below in regards to your use of mobile phone e-mail? Do you believe that mobile phone e-mail has...” respondents were asked to report their level of agreement in regards to nine separate statements. These statements, corresponding response items, and distribution of answers, are shown in Figure 2. Figure 2 also shows our classification of these statements with regards to their presumed function in bonding, bridging, and breaking with ties. To help avoid response bias, this classification was not made known to the respondents.

These nine items measure retrospective change perceived by respondents. In this sense, these data are subjective and do not directly measure the change of personal networks over time. However, in addition to the fact that costly and time consuming panel surveys are necessary in order to more objectively measure network change, subjective data has its own advantage. Given that the perception of the change is essential for subsequent psychological and behavioral change, subjective measurement of network change can have more explanatory power than objective measurement. For example, if a

respondent thinks that he has strengthened his close relationships by way of mobile phone e-mail *and* even if actually his close relationships have not been strengthened when measured more objectively, this false perception may still explain why he uses mobile phone e-mail in his everyday life. The explanatory power of these subjective measurements is particularly useful in the multivariate analyses that we use to address our second question.

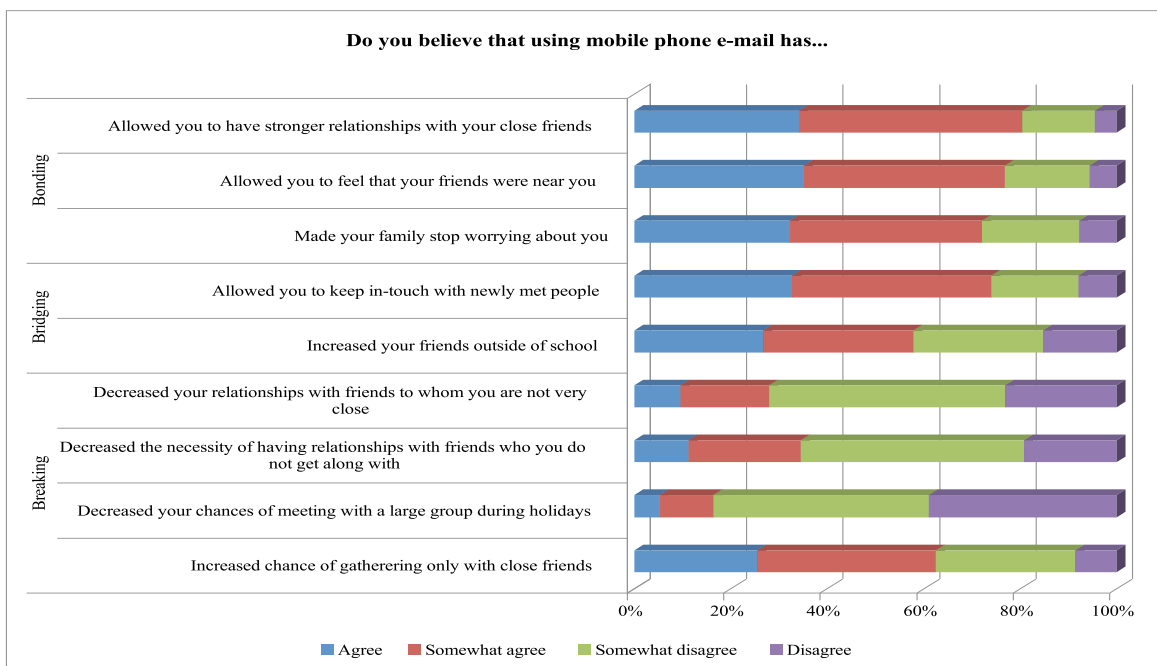
#### 4.2.1. Results pertaining to research question 1

Figure 2 shows that roughly 70 percent of our respondents at least somewhat agreed that using mobile phone e-mail has allowed them to have stronger relationships with their close friends, feel as though their friends are near them, and helped their family feel more at ease. These perceptions suggest that mobile phone e-mail is used to bond with friends and family, which is consistent with the previous research discussed in Section 2.3.

The results presented in Figure 2 also suggest that mobile phone e-mail is used to bridge and develop new social ties. More than 68 percent of the respondents at least somewhat agreed that using mobile phone e-mail has made it easier for them to keep relationships with newly met people. Moreover, more than 54 percent of the respondents at least somewhat agreed that mobile phone e-mail helped them make friends outside of their own schools.

In contrast to beliefs regarding the bonding and bridging functions of mobile phone e-mail, few respondents believed that their use of mobile phone e-mail led them to break with their social ties. Although more than 58 percent at least somewhat agreed that mobile phone e-mail helped them gathering with only close friends, a relatively small percent thought that mobile phone e-mail led them to break with weak relationships. 70% or more of the respondents at least somewhat *disagreed* with statements saying that their use of mobile phone e-mail decreased relationships with friends with whom they were not very close, decreased the necessity of having relationships with friends with whom they do not get along, and decreased their chances of gathering with a large group of friends during holidays.

Figure 2. Perceived bonding, bridging, and breaking using mobile phone e-mail.



As a whole these results show that respondents perceived positive benefits of mobile phone e-mail in terms of bonding and bridging with social ties, and they do not believe that mobile phone e-mail has led them to break with their social ties.

#### *4.3. Addressing research question 2 – the extent to which bonding, bridging, and breaking activity accounts for mobile phone e-mail intensity*

As discussed in Section 2.4, although Japanese adolescents may use mobile phone e-mail to bond, bridge, and break with social ties, this kind of social activity does not necessarily explain why they typically use this technology so intensely in their daily lives. Non-social factors, such as time spent commuting or available free time, might instead be the more fundamental reasons for the use of mobile phone e-mail among this age group. This led us to pose our second research question:

2. To what extent does the bonding, bridging, and breaking of social ties via mobile phone e-mail account for the intensity with which Japanese adolescents send mobile phone e-mail?

In order to investigate the relationships between the intensity with which respondents send mobile phone e-mail and the bonding, bridging, and breaking with social ties via mobile phone e-mail, we conduct multivariate regression analyses.<sup>3</sup> This analysis allows us to examine the extent to which changes in perceived bonding, bridging, and breaking account for variation in the intensity with which respondents send mobile phone e-mail on a daily basis. Thus, in this analysis we treat the bonding, bridging, and breaking via mobile phone e-mail as independent variables, and the average number of mobile phone e-mail sent each day as the dependent variable. Our analytical strategy is not to reveal the causal direction between network change via mobile phone e-mail and mobile phone e-mail intensity, but instead to evaluate the extent to which variation in our independent variables can account for variation in mobile phone e-mail intensity.

Moreover, this multivariate approach allows us to take into account the impact of other non-social variables, such as amount of time spent commuting, to insure that bonding, bridging, and breaking of social ties truly account for mobile phone e-mail intensity. For instance, the statistically significant explanatory power of perceived network change via mobile phone e-mail on mobile phone e-mail intensity might disappear when controlling for the effects of non-social variables such as time spent commuting or free time. By putting social and non-social variables simultaneously into the analysis, we can infer which factors more fundamentally account for the intensity with which our respondents use mobile phone e-mail in their daily lives.

##### *4.3.1. Dependent variable – intensity of mobile phone e-mail*

Intensity of mobile phone e-mail: the average number of mobile phone e-mail that the respondent sends in a day. This variable is composed of six ordered categories, ranging from zero to five. The distribution of dependent variables is shown in Figure 1.

##### *4.3.2. Independent variables - perceived network change via mobile phone e-mail*

Bonding: the three items shown at the top of Figure 2 are summed to create one scale. The Cronbach's alpha for this scale is 0.74.

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<sup>3</sup> We also ran an ordered probit analyses, the results of which were almost identical to those of the regression analyses in terms of coefficient strength and statistical significance.

Bridging: the two items shown at the middle of Figure 2 are summed to create one scale. The Cronbach's alpha for this scale is 0.62.

Breaking: the four items shown at the bottom of Figure 2 are summed to create one scale. The Cronbach's alpha for this scale is 0.69.

In order to compare the relative explanatory power of these variables on the dependent variable and to subdue the potentially inflating effects of outliers, these three scales are standardized. The correlations among these variables are 0.53 (bonding and bridging), 0.29 (bonding and breaking), and 0.29 (bridging and breaking). Although the correlation between bonding and bridging is relatively high, this does not cause multicollinearity in any models<sup>4</sup>

#### 4.3.3. Control variables – non-social factors

In order to tap the net effects of the bonding, bridging, and breaking variables, we control for variables that are presumed to have effects on intensity of mobile phone e-mail.

Gender: gender has been known to have effects on mobile phone e-mail in Japan, with females typically using mobile phone e-mail more intensely than males (Igarashi et al., 2005). Seventy two percent of the respondents were male.<sup>5</sup>

Allowance: the amount of allowance given to adolescents can have an effect their intensity of mobile phone e-mail because the monthly fees for using mobile phone typically increase with each mobile phone e-mail sent. Amount of allowance per month was measured using a five-point scale, ranging from “less than 5,000 yen”<sup>6</sup> to “more than 50,000 yen”.

Commuting hours: we have observed that youths living in Tokyo use mobile phone e-mail when riding to school on commuter trains, subways, and buses. Thus, time spent commuting may affect the number of mobile phone e-mail messages sent daily. The average commuting time of our respondents was 55 minutes (SD = 25 minutes). Because this variable has a positively skewed distribution and obvious outliers, we broke down commuting time into four categories.

Free time: although it is well known that people often send text messages using mobile phones while they are doing other activities, it is logically necessary that engaging in activities will curb their intense use of mobile phone e-mail, which is our dependent variable. On the other hand, it may also be argued that busy people have less time to interact in-person with their friends and family, and therefore are likely to send mobile phone e-mail. Given the uncertain influence of free time on intensity of sending mobile phone e-mail, we include free time as a control variable that may be interpreted using a post-hoc explanation. The average free time per week was 43 hours (SD = 29 hours). As with commuting time, we broke free time down into four categories in order to avoid inflation brought about by skewed distribution and outliers.

#### 4.3.4. Results pertaining to research question 2

The results of our regression analyses are shown in Table 1. Robust standard errors specifying clusters (each high school) were calculated in order to consider the bias of variation brought about from non-independence of measurement within each cluster (Rogers, 1993).

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<sup>4</sup> Variance Inflation Factors (VIFs) in any estimated models does not exceed 2.0, which is the conventional level after which models show the existence of problematic multicollinearity.

<sup>5</sup> The reason for the uneven distribution of gender is discussed in Section 3.

<sup>6</sup> At the time of this study 5,000 Japanese yen was equivalent to roughly 30 Euros or 40 U.S. dollars.

Models 1, 2, and 3 each separately show the extent to which bonding, bridging, and breaking are associated with the average number of mobile phone e-mail sent daily. Model 1 shows a statistically significant and positive association between bonding and the average number of mobile phone e-mail sent daily, while Model 2 shows statistically significant and positive association between bridging and the average number of mobile phone e-mail sent daily. These models also show that the relative magnitude of bridging via mobile phone e-mail (0.40) is larger than that of bonding via mobile phone e-mail (0.22). The breaking coefficient is not statistically significant, indicating that there is no relationship between breaking ties and the number of mobile phone e-mail sent daily.

As shown in Model 4, including all the variables simultaneously reveals that only bridging has a statistically significant and positive association with the average number of mobile phone e-mail sent daily. It also shows that the coefficient for bonding via mobile phone is greatly reduced to a statistically insignificant level, from 0.22 in Model 1 to 0.04 in Model 4. Meanwhile the coefficient for bridging via mobile phone e-mail remains at the same level (0.40) in both Model 2 and Model 4. These results will be discussed in Section 5.

Table 1. Regression analyses - the average number of mobile phone e-mails sent daily.

	Average number of mobile phone e-mail sent daily			
	model 1	model 2	model 3	model 4
	Robust coef. (B)			
Gender: female	0.48 *	0.50 *	0.53 *	0.52 *
Allowance	0.34 *	0.30 *	0.36 *	0.30 *
Commuting hours	-0.02	-0.03	-0.01	-0.02
Free time	-0.10 +	-0.07	-0.12 *	-0.06
Perceived network change via keitai email				
Bonding	0.22 *			0.04
Bridging		0.40 **		0.40 **
Breaking			0.08	-0.05
Constant	1.47 **	1.48 **	1.41 **	1.41 **
Number of observations	435	435	434	429
R-squared	0.12	0.18	0.10	0.19

+ significant at 10% level; \* significant at 5% level; \*\* significant at 1% level

Control variables show that female students send mobile e-mail more than male students, and that the more allowance students have, the more they send mobile phone e-mail. Free time is negatively associated with sending mobile phone e-mail in Model 1 and Model 3, but this association is rather small and its statistical significance disappears in the full model (Model 4).

#### 4.4. Addressing research question 3 – bonding, bridging, and breaking among heavy mobile phone e-mail users

In Section 2.4 we drew on literature about mobile phone e-mail dependency to show that a sizable number of adolescents use mobile phone e-mail to an extraordinary degree. Our findings confirm the existence of this sizable minority among our respondents - approximately nine percent of our

respondents report sending an average of more than 50 mobile phone e-mail a day. Given the unusual and extreme nature of this intrinsically social behavior, we pose our third research question:

3. Do heavy mobile phone e-mail users bond, bridge, or break with social ties to a greater extent than less heavy users?

To answer this question we conducted logistic regression using a dichotomous version of the dependent variable. The independent and control variables used in this analysis are described in Sections 4.3.1 to 4.3.3.

#### *4.4.1. Dependent variable – heavy mobile phone e-mail users*

Heavy mobile phone e-mail users (or not): the six-point scale that measures the average number of e-mail sent daily is recoded into a dichotomous variable. Respondents who send an average of more than 50 mobile phone e-mail daily are coded as one, while respondents sending an average of 50 mobile phone e-mail or less daily are coded as zero. Nine percent of respondents qualify as heavy users, sending more than 50 mobile phone e-mail daily.

#### *4.4.2. Results pertaining to research question 3*

The results of the logistic analysis are presented in Table 2. These results show that heavy mobile phone e-mail users bridge with new social ties via mobile phone e-mail more than less heavy users. Although the bridging coefficient is smaller in the full model (Model 4) than in the partial model (Model 2), it still remains statistically significant. On the other hand, the marginal association between bonding and heavy use shown in the partial (Model 1) disappears in the full model (Model 4). Consistent with Table 1, breaking social ties is not associated with being a heavy mobile phone e-mail user in either the partial model or the full models (Model 3 and Model 4).

The consistency of these results with the results presented in Table 1 shows that bridging via mobile phone e-mail accounts for e-mail intensity more than bonding via mobile phone e-mail among a variety of users and among heavy users.

The control variables differ somewhat between Table 1 and Table 2. There is no gender difference between heavy users and non-heavy users. Though Table 1 shows that female students in general send mobile phone e-mail more frequently than male students, heavy users are no more likely to be female than non-heavy users. Allowance has significant associations with being a heavy mobile phone e-mail user in Models 1, 2 and 3, but not in Model 4. This indicates that in order for adolescents to be heavy mobile phone e-mail users, they require financial backing from their parents. This association, however, is not as large as bridging via mobile phone e-mail, as can be seen by its lack of statistical association in Model 4. Free time has a negative association in Model 4. Although this suggests that busier students tend to be heavy mobile phone e-mail users because they have to rely on mobile phone e-mail to keep in touch with friends, this association is not as large or consistent as the association between bridging via mobile phone e-mail and being a heavy mobile phone e-mail user.

Table 2. Logistic regression – heavy users of mobile phone e-mail.

	Heavy mobile phone e-mail users: sending more than 50 keitai email daily (logit)			
	model 1	model 2	model 3	model 4
	Robust coef. (B)			
Gender: Female	0.36	0.33	0.35	0.11
Allowance	0.36 **	0.30 **	0.36 **	0.16
Commuting hours	-0.02	-0.06	-0.02	0.05
Free time	-0.02	0.07	-0.02	-0.11 *
Perceived network change via keitai email				
Bonding	0.24 +			0.01
Bridging		0.76 **		0.27 **
Breaking			0.04	-0.05
Constant	-3.40 **	-3.57 **	-3.40 **	2.35 **
Number of observations	435	435	434	429
R-squared	0.03	0.08	0.02	0.07

+ significant at 10% level; \* significant at 5% level; \*\* significant at 1% level

## 5. Discussion and research implications

The univariate results pertaining to Research Question 1 presented in Section 4.2.1 indicate that Japanese adolescents use mobile phone e-mail both to bond with close social ties and to bridge, forming new social ties. However, there is little evidence that using mobile phone e-mail leads them to break relationships with their weaker ties. Although these measures are based on perception of network change rather than on actual change and should be taken with caution, they nevertheless show that adolescents believe that they can actively shape their social networks using mobile phone e-mail. As shown in the results pertaining to Research Question 2 presented in Sections 4.3.4, these perceptions can go a long way in explaining why Japanese adolescents use this technology so intensely in their daily lives.

The multivariate analyses used to address Research Questions 2 and 3 presented in Sections 4.3.4 and 4.4.2 show that using mobile phone e-mail to bridge is consistently positively associated with the intensity with which adolescents use mobile phone e-mail in their everyday lives, even when taking into account the influence of other social and non-social factors. This is true both when examining all levels of mobile phone e-mail intensity, and when focusing more narrowly on heavy mobile phone e-mail users. In short, these findings indicate that the more Japanese adolescents believe that they can use mobile phone e-mail to form new relationships, the more intensely they use this technology. These findings are especially significant because most existing literature about the social uses of mobile phone e-mail focuses almost exclusively on its bonding utility.

These multivariate results also show that although bridging and bonding both have positive associations with mobile phone e-mail intensity when examined separately, the statistically significant association (at the 0.05 level) between bonding and mobile phone e-mail intensity disappears when



bridging and bonding are placed in the same model together. This finding poses at least two interpretations. One interpretation is that bridging has positive effects both on bonding via mobile phone e-mail and mobile phone e-mail intensity. This data was collected from students who transitioned from junior high school to high school just 6 months before the survey was conducted. It is possible that students first use mobile phone e-mail effectively to develop new ties, and then use mobile phone e-mail intensively to bond with these new ties. In this case, the positive relationship between bonding via mobile phone e-mail and mobile phone e-mail intensity would be spuriously caused by the bridging that occurs via mobile phones near the beginning of the school year.

The other interpretation is that bonding is a prerequisite for intensive mobile phone e-mail but not a sufficient condition. In this case, the effect of bonding via mobile phone on the intensity of mobile phone e-mail sent daily is mediated by the effect of using mobile phone e-mail to bridge. In this scenario, Japanese adolescents first use mobile phone e-mail to bond with their close ties because close ties are essential both for instrumental and emotional support (Lin, 2001; Wellman and Wortley, 1990). After these strong ties are in place, they then use mobile phone e-mail intensively to bridge and form new ties. In this scenario, the intensity of mobile phone e-mail increases only when they start to expand and bridge to new ties after having sufficiently used mobile phone e-mail to bond with their strong ties.

We cannot definitely conclude which of these two interpretations is valid using our cross-sectional survey data. However, both interpretations indicate that when both bonding and bridging via mobile phone are considered, bridging more fundamentally explains why Japanese adolescents use mobile phone e-mail so intensively. This finding calls into question the great emphasis placed on bonding in previous research, and indicates the need for future researchers to consider the role of bridging when studying the use of mobile phone e-mail among this age group.

## **6. Conclusion**

It has been well established that adolescents use mobile phone e-mail to bond with their strong ties. However, as we have shown in this article, this bonding activity does not necessarily account for the intense use of mobile phone e-mail among adolescents in Japan. Drawing on survey data collected from high school students living in Tokyo we find that adolescents use mobile phone e-mail to bridge with ties, and that this bridging activity better accounts for the intensity with which they use mobile phone e-mail than does bonding activity. This finding holds true both when examining a variety of mobile phone e-mail users and when the analysis is narrowly focused on heavy mobile phone e-mail users. The results presented in this article fit well with existing literature which shows that social networks are highly fluid during adolescence.

Because this study is not comparative we cannot say with certainty that using mobile phones to bridge is a popular activity outside of Japan. On the one hand, adolescents in other countries may use PCs to bridge rather than mobile phones. Although Japan is often thought of as being a technologically advanced country, only a relatively small percentage (<17%) of Japanese youth have regular access to PCs (Ikeda et al. 2005). This means that many of the Japanese adolescents in this study did not have the opportunity to develop new bridging relationships using PC based social software, such as internet groups, IRC, blogs, and so on. Perhaps for this reason mobile phone e-mail was the main technological means by which they developed new relationships. On the other hand, the literature reviewed in Section 2.2 shows that even though adolescents in developed countries outside of Japan often have access to PCs, they still tend to use mobile phones in ways similar to Japanese adolescents. They use mobile phones in situations when communication would be otherwise difficult, and this ability to

communicate freely with their peers is an important part of identity formation. Given that mobile phones can be used more covertly than PCs, it is quite possible that adolescents in developed countries outside of Japan use mobile phones to build new social ties. If so, researchers in these countries would do well to focus their attention on the bridging functions of mobile phones.

What does the use of mobile phone e-mail to form new bridging ties mean for Japanese adolescents in the context of their everyday lives? As discussed in our literature review, relationships are fluid during adolescence because of the transition from middle school to high school. This change of environment has traditionally structured the kinds of relationships that adolescents can maintain by limiting their opportunity to form new relationships with peers who may be in different classes, grades, or established social groups. Mobile phone e-mail offers adolescents a way of breaking these traditional physical and social barriers by providing a new means of developing relationships. Hallway encounters that were once too brief to maintain an engaging conversation are now opportunities to exchange mobile e-mail addresses. Students who would have previously been too busy playing sports, cramming for finals, or simply spending time in tightly-knit cliques, now have a way of keeping new social connections alive by exchanging messages throughout the day or perhaps arranging weekend get-togethers. Along with these new social connections may come exposure to a variety of new ideas, information, and support that will help these young people expand their cognitive horizons and cope with difficult situations (Cosser 1991; Lin 2001).

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### **Acknowledgements**

Research for this article has been supported by awards from the Social Science and Humanities Research Council of Canada and the Japanese Society of Social Psychology. We thank Ken'ichi Ikeda, Kanako Takata, and Ryoko Matsumoto, for their collaboration in the design of this survey, and Vicki Boase, Bernie Hogan, Miki Itano, and Barry Wellman for their support.