DIGITAL DIVIDE AND INTERNET CONNECTEDNESS AFTER THE GREAT EAST JAPAN EARTHQUAKE

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Abstract: This paper examines the issue of digital divide in the context of the Great East Japan Earthquake that occurred on March 11, 2011. Based on a conceptual model of double barrier to internet connectedness and utilization, disparities in utilizing the internet after the disaster are explored. A survey research of 544 randomly sampled respondents in the Tokyo area reveals that although a majority of Japanese people own mobile phones and have access to the internet, their internet use via personal computers and mobile phones differed according to socioeconomic and demographic factors. Moreover, people's previous connectedness to the internet influenced the extent to which people utilized the internet after the earthquake. Those who employed a wider variety of online activities before the earthquake were more likely to increase their use of the internet after the disaster. The study also finds that people's internet connectedness has a positive effect on the likelihood of their engaging in related, post earthquake civic activities. The study results indicate that a second-level digital divide beyond technological access exists and influences the centrality of the internet in a disaster situation.

Key Words: digital divide, inequality, internet connectedness, internet use, earthquake, disaster, civic engagement, Japan

INTRODUCTION

A magnitude 9.0 earthquake hit East Japan at 2:46pm on March 11th, 2011. It was the strongest earthquake to hit Japan in modern history (USGS, 2011). The earthquake was followed by a tsunami and the nuclear meltdown of Fukushima nuclear plants. Communication technologies and the media played a key role in how people coped with the disaster. In particular, the use of new communication technologies such as mobile phones and social media during and after the disaster shaped new ways in which people act in a disaster situation. Based on survey research, this paper examines the ways in which people utilized new communication technologies after the disaster. Although a majority of Japanese people own mobile phones and have access to the internet, the extent to which people utilized mobile phones and the internet differed according to socioeconomic and demographic factors and previous use of the technologies. The implications of the internet connectedness for the digital divide and civic engagement is examined.

THE DIGITAL DIVIDE

The definition of the term 'digital divide' varies. The expression first entered public discourse when personal computers started to diffuse. In the late 1980s, digital divide referred to the gap between those who own a personal computer and those who do not (Dutton, 1999). However, the introduction of the World Wide Web brought the digital divide into the public domain. In particular, the policy direction of the Clinton/Gore

administration to connect the whole nation in a "national information superhighway" brought public and academic resources to bear on the study, improvement and amelioration of inequality in the uses and utilization of the Internet. Al Gore, former Vice-President of the United States, viewed the internet as necessary technology for every individual in order to survive in the contemporary world. Due to the positioning of the internet as a communication technology aimed at achieving universal access, the gap between those with access to the internet and those without became a social problem. The digital divide issue gained considerable public and academic attention in the late 1990s (Hoffman & Novak, 2000; US Department of Commerce, 1999).

As more people gained access to the internet, however, different opinions emerged on whether the digital divide still remained a social problem. One perspective argued that the digital divide was over because the majority of American people were online (US Department of Commerce, 2002). Whether those remaining without access to the internet gain access or not was considered a matter of individual preference rather than a problem of inequality. For example, the Chairman of Federal Communications Commission in the United States, Michael Powell, compared the digital divide to the "Mercedes divide," characterizing internet access as an individual preference rather than a necessary resource (C-Span, 2001). The statement of Powell signaled that digital divide was no longer to be treated as a social problem by the US government.

Many academicians and organizations argue against the dismissal of the argument that the digital divide is a social issue. Vindication lies in the real disparity in internet access and an association with income, education, age and ethnicity (e.g., Pew Internet and American Project). Another rationale for the persistence of the digital divide relates to the definition itself. A group of researchers argue that digital divide does not end when people gain access to the internet (Hargittai, 2002; Jung et al., 2001). After people gain access, there is another level of digital divide in the ways in which people use the internet. Hargittai (2002) examined disparities in people's online skills, and proposed that a "second-level digital divide" exists. By assigning search tasks to a random sample of internet users, she found a considerable difference in whether people could locate various types of content on the internet and how long it took.

Castells (1999) argues that diffusion is not sufficient to reverse information inequality. He articulates that "informationalization" — the reliance of economy, politics and culture on information processing in global networks via information and communication technology — and "dualization" — the divide between "high-value making group" and devalued group—are intertwined in contemporary society (p.28). In order to resolve the disparities, Castells argues that information technology should serve as an access to jobs and income generation by enhancing those social and political resources with which to educate people to make use of the technology in contemporary society (p.35). Van Dijk (1997) suggests four possible obstacles to information society access: no access to computers and networks; lack of basic skills and computer fear; insufficient user-friendliness of the resources available on the Internet; insufficient and unevenly distributed usage opportunities of software and services available in computers and the internet (pp.2-6). He argues that these obstacles magnify the effects of socio-cultural, material, and political disparity on information inequality.

Patterson and Wilson (2000) and Bonfadelli (2002) both cautioned against the possibility of the internet exacerbating society's already existing inequality. Patterson and Wilson (2000) argue that inequalities exist in two types of interface between individuals and information technologies, the "upstream interface" and "downstream interface" (p.85). At the upstream interface, researchers ask how individuals with certain demographic characteristics do or do not gain access to hardware and information technology services. At the downstream interface, subsequent patterns of societal stratification in education, health, wealth and income intersect with asymmetric access patterns in the upstream interface so as to create further inequality in technology deployment (p.85). Therefore, the authors argue, even equal access to technology does not resolve social equality. Bonfadelli (2002) likewise argues that the "double digital divide" exists in current internet access and usage pattern in Europe (p. 65). In addition to gaps in access, further gaps exist in the internet's content-specific use. People with a higher educational level use the internet more actively and more for information-oriented purposes, while those with lower educational levels mainly use the internet for entertainment-related functions. This pattern was also found in other studies (Jung et al., 2001; Shah, Kwak & Holbert, 2001).

In agreement with scholars who propose post-access digital divides, the author proposes a double-barrier model of internet connectedness and utilization (Figure 1) (Jung, 2003). The first barrier concerns inequality in accessing various resources on the internet. After people gain access to the internet, the types of resources that people connect to differ according to socioeconomic and demographic factors. Whether people engage in a narrow or broad range of activities is likely to be affected by existing socioeconomic factors. For example, Newhagen and Bucy (2004) define internet use as involving not only physical access to the internet but having adequate connection to internet resources as well as user's social capital and cognitive ability. They argue that what is available on the internet becomes information when it has meaning to the users. Therefore, true access to the Internet implies access to content, rather than simply gaining access to the technology.

The disparities in connecting to different types of resources online are likely to bring about the second barrier in utilizing the resources. In order for the internet to reduce social inequality, the utilization of the internet cannot end online but must have an impact on social practice, such as career development, political/civic participation, and socialization. The impact of the internet in improving people's social practices is likely to be influenced by

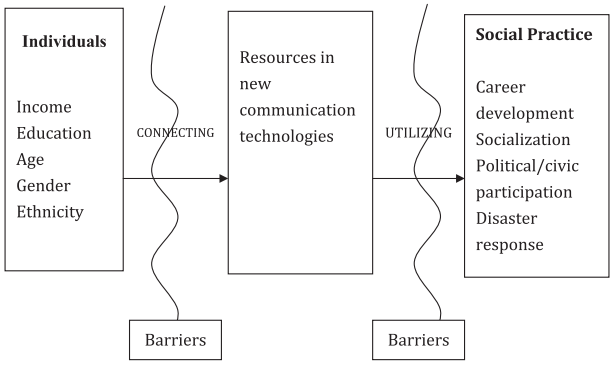

Figure 1. Double barriers to internet connectedness and utilization*
*Modified from Jung (2003)

the ways in which people are able to utilize internet resources. People's human, social and political capital is likely to shape how much they can apply resources for their wellbeing (Lievrouw, 2000). The current study focuses on disparities in utilizing internet and mobile resources in the context of the massive earthquake that occurred on March 11, 2011.

Based on the double-barrier model, the author and her colleagues developed a concept termed 'internet connectedness', to operationalize disparities in the use of the internet (Jung et al., 2001; Jung, 2008). Jung et al. (2001) conceptualized internet connectedness along three dimensions: context and history, scope and intensity and centrality. The authors showed that internet connectedness index (ICI) captured post-access inequality which followed the existing inequality pattern based on income and education levels (Jung et al., 2001). Jung (2008) later modified ICI to include five items (scope of internet use, intensity of internet use, time spent on the internet, centrality of internet and centrality of computers) and found that socioeconomic and demographic variables and internet-related goals influenced people's ICI scores. Internet connectedness has been applied to measure different levels of internet use and to assess the quality digital divide beyond access (Jung et al., 2005; Kim et al., 2004; Leung, 2010).

DIGITAL DIVIDE AND DISASTER RESPONSE

In considering the role of media in society, media system dependency (MSD) theory (Ball-Rokeach, 1985, 1998; Ball-Rokeach & DeFleur, 1976) proposes that people's dependency on media increases when there is high ambiguity in personal and social environments. The theory conceptualizes the mass media as an information system that is an essential part of a society. When the intensity of goals for *understanding* what is going on and *orienting* themselves how to act increases, people's dependency on the media is likely to intensify (Ball-Rokeach, 1985). The Great East Japan Earthquake and the subsequent nuclear accident was a major disaster that created intense levels of ambiguity in people's lives. Studies that surveyed media use after March 11 earthquake report that people's dependency on television increased (e.g., Nomura Research Institute, 2011); consistent with MSD theory and past studies (Hirschburg et al., 1986). At the same time, these studies report that the internet was another main tool for finding out what was going on and for communicating with others (Survey Research Center, 2011). Many newspaper articles report that social media, such as Facebook and Twitter, were important channels for people to share information, check the safety of others and organize activities (Preston, 2011; Wallop. 2011).

Reviewing past studies on disaster and media, numerous studies and reports discuss technical readiness for disaster situations (e.g., Junkus, 2005; Samarajiva, 2005) while fewer studies focus on the content of disaster information online (e.g., Paul, 2001; Tanner, 2009). There is a striking paucity of studies, however, that focus on the issue of the digital divide in utilizing internet resources during a disaster situation. Kim and his colleagues' work (2004) is notable among the few that have examined the influence of high and low internet connectedness on other media use and civic engagement following the September 11th terrorist attack in New York, in 2001. The authors coincidentally had access to people's internet use before and after September 11th because they were in the middle of collecting survey data when the terrorist attack occurred. The authors interrupted their survey on September 11th and went back to the field, 10 days later, with disaster-related questions

added. The authors divided respondents into internet high-, low- and non-connectors, and compared the internet connectedness of pre-9/11 and post-9/11 samples. Kim et al. found that internet high-connectors increased their time on the internet while internet low-connectors decreased the time. Also, the relative importance of the internet, in relation to other mass media, increased among the high-connectors while it decreased among the low-connectors. Low-connectors and non-connectors were more likely to increase their time with television, newspapers and radio than the high-connectors. The result indicates that when the disaster occurred, those who had high internet connectedness were able to utilize the internet to cope with the situation while the low connectors were less able to, and had to rely on other types of media. The internet became a more central medium for the high-connectors and less central for the low-connectors.

THE TOKYO SURVEY: Research Questions and Method

This study applies the internet connectedness concept to examine how the disparities in internet use before the earthquake influenced utilization of the internet after the earthquake. The study also examines the influence of internet connectedness on civic engagement after the earthquake. The study includes the following:

> Research Question 1 (RQ1): Which communication technology did people connect to immediately after the earthquake?
> Research Question 2 (RQ2): Which online activities did people engage in before the earthquake? How does the engagement differ by socioeconomic and demographic factors?
> Research Question 3 (RQ3): How does the scope of internet activities influence the likelihood of increasing or decreasing online activities after the earthquake?
> Research Question 4 (RQ4): Do types of internet activities and scope of activities have positive or negative effects on civic engagement?

This study is based on survey research conducted in Bunkyo-ku, a centrally located district and one of the 23 wards of metropolitan Tokyo, as part of an ongoing research project titled Media Exprimo (mediaexprimo.jp). A survey research firm administered the survey by employing an area interval sampling method. First, based on the address list obtained from Bunkyo-ku, interval sampling of areas was conducted to select 60 small block areas in Bunkyo-ku. Second, 50 households were randomly selected in each block area and the survey questionnaire was inserted in the mailbox of each household with a return envelope. In total, 3,000 questionnaires were distributed and 544 were returned by postal mail. The 18.1% response rate is higher than the average rate for a mail-out survey (Wimmer & Dominick, 2006). The average household income of respondents is 5 - 7 million yen, and the average educational level is college graduate. The average age range is 50-54, and 57% of the respondents are females.

Measures

Scope of internet activities

Respondents were asked whether they have participated in any of the fourteen online activities before the March 11th earthquake. Fourteen activities are (percentages of PC internet & mobile internet, respectively): email (68.8 & 72.3), chat/instant messaging (20.3

& 12), obtain information (traffic, weather) (69.6 & 54.2), read news (65.7 & 41.9), check local/community information (e.g., homepage of the local government)(38.7 & 11.1), social media (Mixi, Facebook, Twitter, etc.) (30.1 & 20.3), game (24.7 & 18.5), work-related (55.4 & 27.9), listen/download music (39.3 & 19), watch TV/movies/video (42.3 & 18.3), buy/sell products (48.2 & 11.4), maintain a homepage/blog (21.8 & 7.9), visit others' homepages/blogs (48 & 19.9), and internet phones (Skype, etc.) (17.9).[i] Respondents' participation in these activities via personal computers and mobile phones were asked separately in a yes or no format. The scope of internet activities was calculated by adding respondents' scores (yes: 1, no: 0) of 28 activities (14 each for personal computers and mobile phones). The variable ranges from 0 to 28 (M=9.87, SD=7.38).

Change in internet activities after the earthquake

To inquire whether people changed their internet use after the earthquake, we asked, "Compared to your internet use before the earthquake, did you increase, decrease or did not change the use of following internet activities via PC and mobile phones after the earthquake?" Ten internet activities (email, chat, get information, read news, get community information, social media, maintain a blog/homepage, visit others' blogs/homepages, internet phones, and view/listen to television/radio) were provided for PC and mobile phone separately with three response categories: increased, decreased and did not change. For statistics analysis, "decreased" and "did not change" categories were merged, to be compared with "increased" category.

Scope of civic activities

Respondents were asked to choose which civic activities they participated in following the earthquake. Nine activities were presented and respondents were allowed to choose all that applied. The nine activities listed were donated money or goods (81.4%); talked with neighbors about the earthquake (58.6%); checked the damage in buildings around the neighborhood (52.2%); participated in neighborhood organizations' meetings or volunteer activities (6.4%); participated in PTA or school meetings or volunteer activities organized by schools (4.3%); sent out information related to the neighborhood on the internet (e.g., mailing list, BBS, social media) (5.3%); sent out information related to the neighborhood in print (e.g., newsletters, community newspapers) (2.4%); sent out information related to school or work on the internet (e.g., mailing list, BBS, social media) (4.9%); sent out information related to school or work in print (e.g., newsletters, community newspapers) (0.8%). Respondents' answers (yes=1 or no=0) were added to create a scope of civic activities variable that ranges from 0 to 9 (M=2.16, SD=1.18).

RESULTS

With regard to research question 1, we inquired about which media people used on the day of the earthquake to find out about the magnitude of the earthquake. Consistent with media system dependency theory and past studies, television was accessed by the majority of the respondents (83.5%). The second and third most accessed media were computers (32.5%) and mobile phone calls and email (14.2%). About 12% of respondents accessed radio, and 9.4% used the internet (excluding mobile emails) via their mobile phones. The result indicates that television still occupies a central position in disaster situation, but new communication technologies such as mobile phones and computers have become important ways for people to understand what was going on after the earthquake.

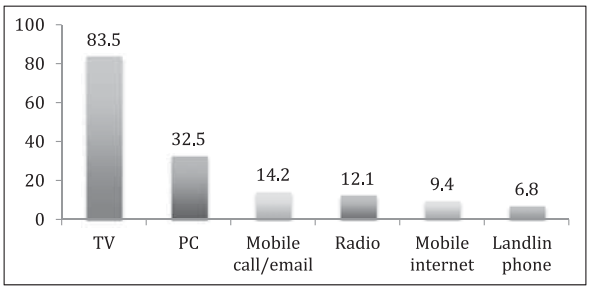

Figure 2. Media used on March 11 to find out about the earthquake (%)

With regard to research question 2, people's engagement in online activities via personal computers and mobile phones before the earthquake was examined. The top five internet activities via personal computers are obtaining information (traffic or weather) (69.6%), email (68.8%), reading news (65.7%), work related tasks (55.4%) and shopping/selling (48.2%). The top five internet activities via mobile phones are email (72.3%), obtaining information (54.2%), reading news (41.9%), work related tasks (27.9%) and social media (20.3%).

The relationship between participation in internet activities and socioeconomic (income and education) and demographic (gender and age) factors was examined. According to logistic regression analysis for each internet activity, *age* was found to be significantly related to all 28 internet activities. Younger persons are more likely to engage in every internet activity included in the study than those in older age groups. With regard to *education*, 8 PC activities (email, chatting/IM, get information, read news, work-related tasks, watch TV/movies, shopping/selling, and internet calls) were significantly influenced by educational level but none of mobile phone internet activities were influenced by educational level.[ii] With regard to *income*, 7 PC internet activities (email, get information, read news, get community information, work-related tasks, shopping/selling, and visit others' blogs/homepages) and 5 mobile internet activities (email, get information, read news, shopping/selling, and visit others' blogs/homepages) were significantly related to income level. Regarding *gender*, males were more likely to engage in 6 PC internet activities (read news, social media, games, work-related tasks, listen/download music, and watch TV/movies) and 2 mobile phone internet activities (read news and work-related tasks).

Research question 3 inquires how the scope of internet activities (see the research method section for the measurement) influence the likelihood of people increasing or decreasing their online activities after the earthquake. We asked whether people increased, decreased or did not change the use of ten internet activities after the earthquake. Figure 3 and 4 display the percentage of people who increased the use of each activity via personal computers and mobile phones. On PCs, people increased news and information the most. This indicates that the internet was an important source of news and information for people. Twelve percent of respondents increased video/radio. Following the earthquake, online video sharing sites such as YouTube, Ustream and Nico Nico Douga streamed broadcast news. Individuals also uploaded video clips from affected areas. The availability of both macro-level mass media news and micro-level news uploaded by individuals made video/radio sites on the internet a useful resource for people after the earthquake. About 10% of respondents increased access to community information online. Immediately

after the earthquake, many local governments and community organizations uploaded information on their homepages and also set up an account on Twitter to reach residents (Nihon Shinbun Kyokai, 2011). Social media (7.3%), represented by Facebook and Twitter, are a relatively new activity online but were utilized widely after the earthquake. The versatility and multi-level functionality of social media allowed the platform to be utilized for different purposes (Jung and Moro, 2012). On mobile internet (Figure 4), information search was the most increased activity followed by news. While only 6% of the respondents increased the use of email on PC, 13.6% increased email use on the mobile phone. This reflects the centrality of mobile email in Japan (Ishii, 2004).

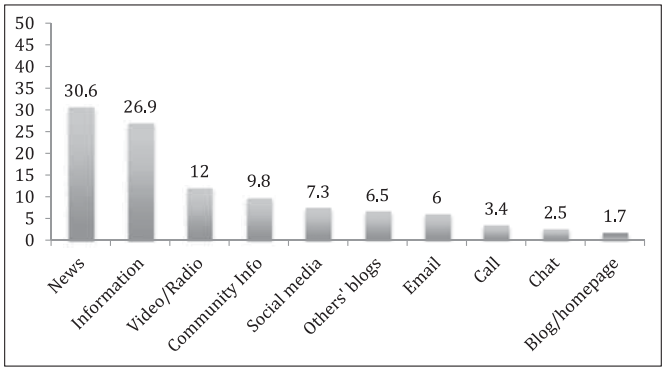

Figure 3. Increased PC internet activities after the earthquake (%)

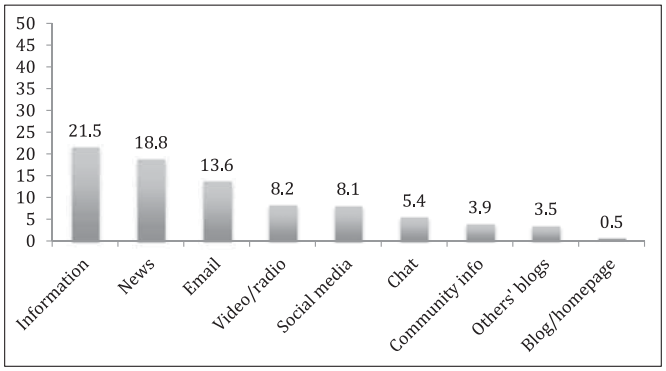

Figure 4. Increased mobile internet activities after the earthquake (%)

In order to test research question 3, the relationship between the scope of internet connectedness and the likelihood of increasing the use of a particular activity was examined. The difference between people in high and low internet scope categories was compared with regard to the increased use of a specific activity. According to an independent samples t-test, those who had higher scope of internet connectedness were more likely to increase the use of different activities after the earthquake than those who had lower internet scope. That is, with regard to participation in PC internet activities, the higher internet scope group was significantly more likely than the lower internet scope group to increase their usage of news ($t=3.10$, $p<.05$), information ($t=3.01$, $p<.05$), TV/radio online ($t=2.23$, $p<.05$), social media ($t=5.25$, $p<.05$), and read others' blogs/homepages ($t=2.61$, $p<.05$) (figure 5). For mobile internet activities, people in the higher scope group was more likely than those in the lower scope group to increase the use of information ($t=5.40$, $p<.05$), news ($t=4.50$, $p<.05$), email

(t=1.99, p<.05), social media (t=4.38, p<.05), TV/radio online (t=2.81, p<.05), read others' blogs/homepages (t=3.34, p<.05) and community information (t=2.46, p<.05) (figure 6).

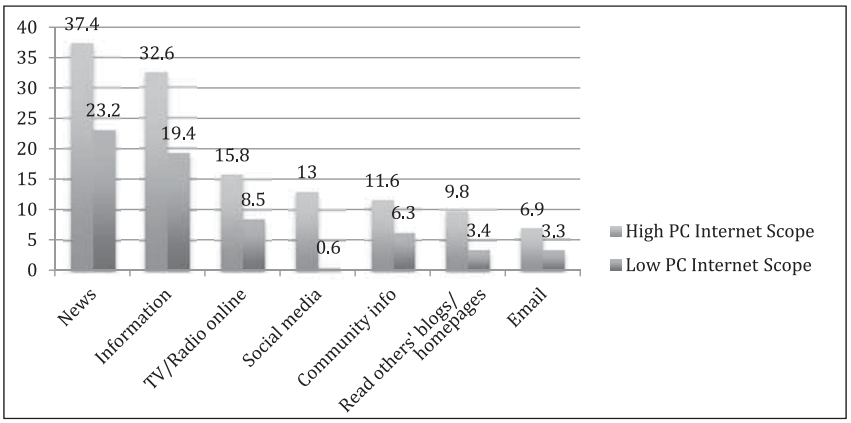

Figure 5. Increase in PC internet activities after the earthquake: Comparison of high and low PC internet scope (%)

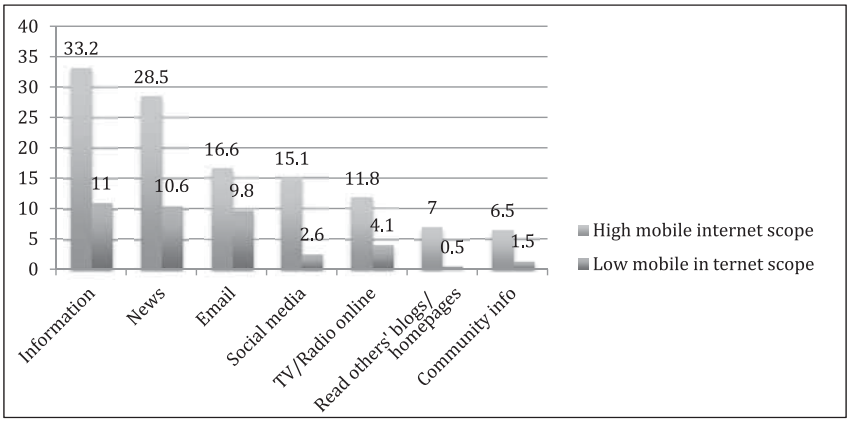

Figure 6. Increase in mobile internet activities after the earthquake: Comparison of high and low mobile internet scope (%)

Finally, research question 4 concerns whether different levels of internet use influence people's participation in civic activities after the earthquake. To test the effect of the internet scope on civic engagement, a multiple regression analysis was conducted controlling for income, education, age and gender. Internet scope is found to have a positive effect on the scope of civic activities (b=.287, p<.01) and it explains 7% of the scope of civic activities (R^2=7) (Table 1).

Table 1. Internet scope and civic engagement

	Standardized Coefficients
Control variables	
Income	.059
Education	-.115*
Age	.133
Gender (male)	-.150**
Internet scope	.287**
R^2 (%)	7
	F=6.688**

N=447, *p<.05, **p<.01

In addition to the effect of internet scope on civic engagement, the effect of a specific internet activity on civic engagement was examined. Analysis of covariance (ANCOVA) test was conducted to examine the effect of each internet activity on the scope of civic engagement, controlling for income, education, age and gender. Internet activities engaged via personal computers to use email ($F=9.09$, $p<.05$), to get information (traffic, weather) ($F=13.59$, $p<.05$), to read news ($F=6.44$, $p<.05$), to obtain community information ($F=7.34$, $p<.05$), to use social media ($F=3.92$, $p<.05$), to use for work-related tasks ($F=6.98$, $p<.05$), to watch TV/videos ($F=10.1$, $p<.05$), to maintain a blog/homepage ($F=4.92$, $p<.05$) and to visit others' blogs/homepages ($F=10.43$, $p<.05$) had a significant effect on civic engagement (Table 2). With respect to mobile phone internet, to obtain information ($F=6.48$, $p<.05$), to read news ($F=5.91$, $p<.05$), to get community information ($F=7.27$, $p<.05$), to use social media ($F=6.78$, $p<.05$), to use for work-related tasks ($F=7.34$, $p<.05$), to maintain a blog/homepage ($F=10.14$, $p<.05$) and to visit others' blogs/homepages ($F=6.80$, $p<.05$) had significant effects on civic engagement (Table 3). Activities such as shopping, game, and listening to music did not have a significant effect on civic engagement.

Table 2. Analysis of Covariance of PC internet activities and the scope of civic activities (mean and standard deviation)

Source	Email	Info	News	Community info	Social media	Work-related	Watch TV/Video	Maintain a blog/ homepage	Visit others' blogs/ homepages
Use									
M	2.27	2.28	2.25	2.37	2.31	2.37	2.34	2.39	2.35
SD	(1.23)	(1.20)	(1.19)	(1.21)	(1.28)	(1.23)	(1.19)	(1.24)	(1.26)
Not Use									
M	1.91	1.85	1.97	2.02	2.10	2.01	2.02	2.09	2.00
SD	(1.10)	(1.13)	(1.21)	(1.18)	(1.16)	(1.15)	(1.20)	(1.18)	(1.12)
F	9.09*	13.59**	6.44*	7.34**	3.92*	6.98**	F=10.10**	F=4.92*	F=10.43**

Covariates: income, education, age and gender
*p<.05, **p<.01

Table 3. Analysis of Covariance of mobile internet activities and the scope of civic activities (mean and standard deviation)

Source	Info	News	Community info	Social media	Work-related	Maintain a blog/ homepage	Visit others' blogs/ homepages
Yes M	2.31	2.33	2.65	2.45	2.39	2.79	2.45
SD	(1.19)	(1.22)	(1.32)	(1.32)	(1.30)	(1.23)	(1.29)
No M	2.00	2.04	2.10	2.09	2.07	2.11	2.09
SD	(1.20)	(1.18)	(1.17)	(1.16)	(1.15)	(1.18)	(1.17)
F	6.48*	6.44*	7.27**	3.92*	7.34**	F=10.14**	F=6.80**

Covariates: income, education, age and gender
*p<.05, **p<.01

DISCUSSION

The current paper examined the disparity in the use of internet activities and how these disparities shaped the ways in which people communicated immediately after the Great East Japan Earthquake that occurred on March 11, 2011. Double barriers to the internet

connectedness and utilization model (figure 1) were proposed in order to conceptualize the digital divide that exists beyond access to the internet. First, among those with access to the internet, their ability to utilize internet resources broadly is likely to vary, dependent upon socioeconomic and demographic factors. A second barrier affects how the internet resources are used once people gain them online. The extent to which people can utilize internet resources in their offline lives is likely to be affected by their social position, including their human, financial and social capital.

The first barrier to internet connectedness was found in the current study (RQ2). Income and education levels have positive effects on using the internet for email, obtaining information and reading news. That is, among the internet users, those with higher income and education were more likely to engage in information gathering and communication activities than others. Shopping and selling activity was also found to be higher among higher income and education groups, indicating the disparities in utilizing the internet for commercial transactions. Gender disparity was found for reading news, social media, work-related tasks, music and TV/movies, with men more likely to engage in these activities. Despite the general research finding that the gender difference is disappearing, the current study finds that a meaningful difference still exists in certain activities. Gender disparity in social media draws particular attention in light of a recent report by Wikipedia that only 13% of the contributors of Wikipedia are females (Cohen, 2011). The most prominent disparity was found in connection with age. Logistic regression analysis revealed that age was the strongest variable influencing internet use in all 28 activities. Age difference in internet use is also found in the majority of other internet studies (Loges & Jung, 2001; Wellman & Haythornthwaite, 2003). Types of communication media that people utilize to obtain information and to communicate with other people show clear age distinctions: younger age groups are more likely to use the internet and mobile texting while older generation are more likely to use mass media (television and newspapers) and voice calls (Xenos & Foot, 2008). How the media landscape evolves in the next few decades as the current young generation becomes the older generation will be an interesting social transformation to observe.

The second barrier to internet connectedness was found in the current study. The scope of internet connectedness, that is the breadth of activities in which people participate online, was found to have a positive effect on the likelihood of increasing internet use after the earthquake. In other words, those who engaged in a wider variety of internet activities before the earthquake used the internet as a more central medium in coping with the disaster. On the other hand, those who engaged in a narrower range of internet activities maintained or reduced their internet use after the earthquake. In other words, those who had richer internet connectedness relied more on the internet, while those who had narrower internet connectedness relied less. The result is consistent with the Kim et al. (2004) study after the September 11th terrorist attack, which also found the Matthew effect: the rich get richer and the poor get poorer. The gap between high connectors and low connectors became visible in the disaster situation in both studies.

Another finding related to the second barrier is the effect of internet scope on civic engagement. Those with a wider scope of internet activities were more likely to engage in civic activities after the earthquake. The effect of the internet on civic engagement is an area of debate. It is argued that the internet has a negative effect on civic engagement,

particularly when it involves civic engagement in one's neighborhood or community organizations (Kraut et al., 1998). Conversely, new ways and venues for civic engagement may be observed either on the internet or by utilizing the internet to connect to one another (Bennett & Entman, 2001). The current study finds that those who engage in a wider variety of internet activities are more likely to engage in more diverse civic activities than their counterparts, supporting the latter opinion in the debate. Not only the scope, but particular internet activities had correlations to civic engagement. Of the fourteen activities on PC internet, communication and information related activities had significant effects on civic engagement. On the other hand, entertainment activities, such as game, chatting, listen/download music, and shopping/selling did not. Similarly on mobile phones, those who participated in activities such as information gathering, news, community information, social media, work-related tasks, and maintaining and visiting blogs/homepages were significantly more likely to engage in civic activities. In sum, not only the breadth but also the type of activities has implications for civic engagement.

LIMITATIONS AND FUTURE IMPLICATIONS OF THE STUDY

Several limitations of the current study need to be addressed. First, the study collected data from only Bunkyo-ku in Tokyo and the result does not represent the general residents of Tokyo. Second, the scope of internet activities before the earthquake was asked retrospectively. This limitation was inevitable because the earthquake happened unexpectedly and a pre-earthquake survey could not be conducted. The cross-sectional nature of the current research should be considered when interpreting the relationship between independent and dependent variables. Despite these limitations, the current study is one of the few to examine the influence of the digital divide in utilizing internet resources and participating in civic activities in a disaster situation. Further studies on new media and disaster should examine the influence of the digital divide on coping strategies in a disaster situation. Merely having a technology does not make the technology useful. Proper interventions and educational programs should be developed for the internet and mobile technologies to be helpful in disaster situations.

NOTES

i Internet calls (e.g., Skype) for mobile phones are excluded because many respondents seemed to have been confused between internet phone calls and regular calls on their mobile phones.

ii This result, that education is not found to be a significant factor for any of mobile phone activities, is noteworthy. Although further analysis is required, the result indicates that the gap between different educational levels is less prominent for mobile phone internet use.

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