



# Impact of Online Social Media Communication and Offline Geographical Distance on Elder Users' Intergenerational Isolation: From Technology Affordance Perspective

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**Abstract.** Social media technology has become an integral part in elders' daily communication. While there is an intense interest among HCI scholars to design effective function and interface to assist elder users' digital communication, a theoretical understanding to guide this design is lacking. To address this research gap, this study examines the effect of social media communication on elders' perception of intergenerational isolation. From the perspective of technology affordance (functional vs. emotional), we examine both the role of online usage behavior of social media (frequency and form) and offline intergenerational distance (geographical distance). 107 interview-based survey results show that: (1) Elders with a higher level of functional affordance are willing to try diverse social functions to communicate with their children, while emotional affordance will increase elders' intergenerational communication frequency; (2) Communication frequency can reduce elders' perceived intergenerational isolation, but diversity of communication forms cannot; (3) Unexpectedly, geographical distance significantly decreases elders' perception of intergenerational isolation, because of the mediator role of increased intergenerational communication frequency and forms in social media. Our research has profound theoretical and practical implications.

**Keywords:** Technology affordance · Intergenerational isolation · Social media  
Elder people

## 1 Introduction

With the development of social media technology, more and more elder users have begun to use the new tool to maintain social connection (Xie 2003). According to the annual report of WeChat (the most popular social media in China) in 2017, there are more than fifty million active elder users per month (Zhong 2017). Hence, both practitioners and researchers have recognized the importance of social media in elders' digital life. While there is an intense interest among HCI scholars to design effective function and interface

to assist elder users' digital communication, a theoretical understanding to guide this design is lacking. To address this research gap, we aim to unravel the underlying mechanism through which social media communications influence elder users' life feelings, in order to provide more targeted services for them.

Then, whom do elder people mainly communicate with in social media? In Chinese society, children take the role as middlemen to motivate, facilitate and help parents to learn to use social media (Zhou and Gui 2017). Thus, children always ranked first in parents' contact list. Against this backdrop, this study attempts to focus on a unique perspective: intergenerational communication between elder users and their adult children.

Based on technology affordance theory, social media provide both functional affordance and emotional affordance for its users (Hutchby 2001). Intuitively, social media facilitate intergenerational communication and reduce elders' perception of intergenerational isolation due to its functional affordance to anytime- and anyplace-communication. However, prior literature is not consistent about the belief. Although technology enables communication, it does not necessarily improve communication efficiency. Tian (2016) found that the use of social media aggravated elder people's feeling of isolation instead. Highly underestimated in prior research, emotional affordance facilitated by social media may be a possible reason for the above inconsistency. From the perspective of technological affordance, a series of questions were proposed by this study: *Will technological affordance of social media (functional and emotional affordance) reduce elder people's perception of intergenerational isolation? In specific, how does technological affordance impact intergenerational communications via social media (frequency and form), and then change elder people's feelings?*

In addition, offline factors have been largely ignored in prior research when the research interests mainly lie in digital communication within social media. Geographical distance decreases the chance for intergenerational face-to-face communication, therefore has a negative impact on their offline communication. However, how the offline geographical distance impacts digital communication through social media is still a question to be answered. Focusing on this point, we proposed the following questions. *For those family who live apart (i.e., longer geographical distance), will they have more intergenerational communications via social media (frequency and form) or not? Can elder people's perception of intergenerational isolation be reduced through the use of social media (mediator effect)?*

Overall, this study aims to examine the effect of social media communication on elders' perception of intergenerational isolation. From the perspective of technology affordance (functional vs. emotional), we examines both the role of online usage behavior of social media and offline intergenerational distance (geographical distance).

We recruited 10 confederates to conduct face-to-face survey-based interview for elder people over 55 years old, and got a final sample of 107. SmartPLS was used to analyze our data. The results show that: (1) Elders with a higher level of functional affordance are willing to try diverse social functions to communicate with their children, while emotional affordance will increase elders' intergenerational communication frequency; (2) Communication frequency can reduce elders' perceived intergenerational isolation, but diversity of communication forms cannot; (3) Unexpectedly, geographical

distance significantly decrease elders' perception of intergenerational isolation, because of the mediator role of increased intergenerational communication frequency and forms in social media. Our research has profound theoretical and practical implications for scholars, HCI practitioners, elders and their children.

The rest of the paper is organized as follows. We first review technology affordance theory, impact of social media technology and intergenerational support on elder users. Then we propose our research model and hypotheses. After that, we report on research method and data analysis. Finally, we discuss the implications and limitations of this study.

## 2 Literature Review

### 2.1 Technology Affordance Theory

In 1986, Gibson defined affordances as “possibilities of action” provided to the animal or the individual by the environment. This theory was soon adopted by IS researchers and a similar new term “technology affordance” appeared, which means the opportunities for action provided to a user by a computerized system (Markus and Silver 2008; Bloomfield et al. 2010). In other words, technology affordance is mainly helpful for examining what a specific technology can do to users (Argyris and Monu 2015).

As such, Hutchby (2001) identified two types of affordances: functional affordance and relational affordance. Similarly, Mesgari and Faraj (2012) distinguished technology affordance into materiality and sociality ones. An official report from Chinese Academy of Social Sciences also proposed that technology affordance of social media can be classified into functional affordance, emotional affordance, social participation affordance, and identity affordance (CASS 2017). Based on the above literatures, we summarized and categorized technology affordance into two groups. (1) *Functional affordance* comes from the relationship between technology and user, which reflects the possibilities for actions brought to the user by the technical features (Markus and Silver 2008). (2) *Emotional affordance* refers to the emotional relationship between users realized by technology (Hutchby 2001), which reflects the relational and sociality nature of affordance.

In this paper, we attempt to adopt technology affordance theory to explain how and why elder people begin to use social media, especially the different role of functional and emotional affordances.

### 2.2 Impact of Social Media Technology on Elder Users

With the development of technological and social change, many transformations are underway in terms of how elder people communicate with the aid of social media. Although elder people are with lower technical capability compared with younger ones, they are taking a more positive attitude about social media, and gradually learn to use this new technology (Xie 2003).

Summarized from previous literatures, social media technology provides two aspects of impact on elder users: functional impact and emotional impact. First, social media

facilitate online communications for elder people, which can be an alternative to conventional communication channels in providing low-cost, synchronous talks and other easy to access service (McCormack 2010). In other words, elder users can obtain practical or technical benefits when using social media. Taking mobile instant messaging service (MIM) as an example, older adults can use various functions of MIM, such as sending messages, voice chatting, updating status, browsing news, and so on (Deng et al. 2010). Second, Harley and Fitzpatrick (2009) addressed the “social, cultural and spiritual impact” of social media to elder users. Social media makes their life meaningful and colorful, because they can share life stories and have frequent communications with friends, relatives, and especially their children. More deeply, their mental or psychological needs can be satisfied with the help of social media (Deng et al. 2010).

Therefore, in consistent with technology affordance theory, social media have both functional and emotional impacts on elder users. However, except for “what” impact social media have on older adults, a more important question is “why” and “how” elders use social media. We are among the first to fill the research gap in this field.

### 2.3 Impact of Intergenerational Support on Elder People

The primary responsibility of adult children is to care for and provide support on their elder parents (Silverstein et al. 2006). Silverstein and Bengtson (1997) proposed several types of intergenerational support for elder people, including financial, practical, and emotional support. Among them, financial support is exchanges of money and materials, practical support is exchanges of instrumental assistance (e.g., daily care), while emotional support means exchanges of heart-to-heart communications. In previous research, all of the intergenerational supports are proved to be helpful to elder people’s health and happiness (Zunzunegui et al. 2001).

With the development of technology, social media become the mediators to help form a “distant but close” family relationship (Zhou and Gui 2017). Intergenerational communications can not only happen in face-to-face circumstances, but also in online context. Then, a new question appears: what is the relationship between online and offline emotional support? Are they complementary or exclusive on elders’ psychological feelings? Relevant literatures mainly reported positive results. Elder people who use social media communicate almost twice than those who don’t, and have a stronger feeling of emotional satisfaction (CASS 2017).

However, several gaps remain in previous research about online emotional support. First, they only focus on communication frequency but not communication form. Second, as an important component in intergenerational support, the impact of online emotional support should not only be limited to traditional factors like loneliness and health, but also be extended to elders’ intergenerational feelings like isolation. Third, although our purpose is to investigate the role of online emotional communication, offline factors should also be paid attention to, especially those objective offline factors which can reflect intergenerational relationship. We attempt to solve the above problems in this study.

### 3 Research Model and Hypotheses

#### 3.1 Research Model

Our research model is shown in Fig. 1. Elders’ perception of technological affordance impacts the way they use social media, and then changes their perception of intergenerational isolation. Meanwhile, since online intergenerational support usually happens when elders and children live apart, offline geographical distance would also play an important role during the process.

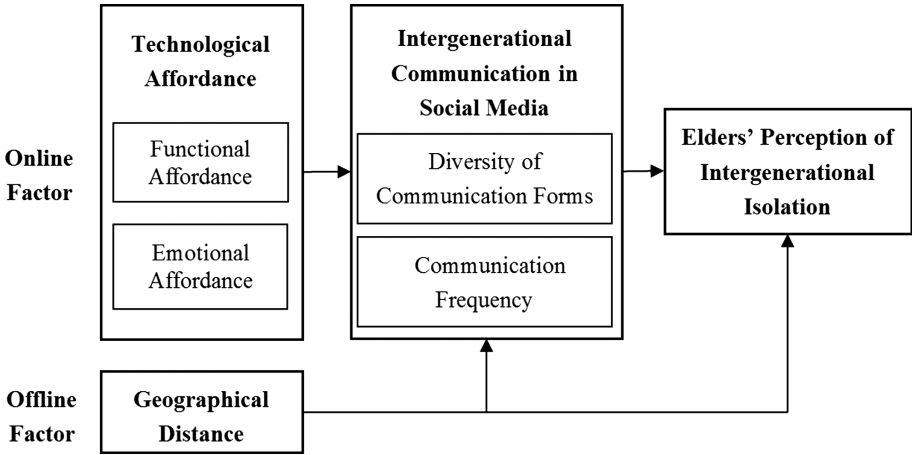


Fig. 1. Research model

#### 3.2 Online Factors: Technological Affordance, Intergenerational Communication in Social Media, and Elders’ Perception of Intergenerational Isolation

From the technology affordance perspective, social media, as one of the most popular technology, provide both functional affordance and emotional affordance for its users (Hutchby 2001; Mesgari and Faraj 2012). In this paper, we apply this dyadic classification to a special group: elder people. First, with multiple functions (e.g., voice chat, friend cycle, et al.), social media have gradually involved into older adults’ daily life. Elder people can communicate with their children through text, voice or video format conveniently without limitation of time and space. They can also share picture, videos, or essays to adult children and have a deep discussion with them. Therefore, functional affordance of social media increases both the intergenerational communication frequency and form for elder people, we hypothesize H1a and H1b:

*H1a: When elder people perceive higher functional affordance of social media, they are more likely to use more communication forms (e.g., text, video, friend cycle, et al.) when they communicate with their adult children in social media.*

***H1b: When elder people perceive higher functional affordance of social media, they will communicate more with their adult children in social media.***

Different from functional affordance, emotional affordance of social media satisfies the psychological needs of elder people. Through the communications in social media, older adults can feel the care from and show the care for their children (CASS 2017). Therefore, to obtain more emotional happiness, elders are willing to have more frequent and diversified intergenerational communications. We propose H2a and H2b:

***H2a: When elder people perceive higher emotional affordance of social media, they are more likely to use more communication forms when they communicate with their adult children in social media.***

***H2b: When elder people perceive higher emotional affordance of social media, they will communicate more with their adult children in social media.***

With the development of social media, intergenerational communication becomes more convenient to be realized. Just as Zhou and Gui (2017) argued, social media is the mediator to help form a “distant but close” family relationship. Parents are more likely to feel happy and satisfactory about their intergenerational connection (CASS 2017). Therefore, online communications in social media shorten the distance between parents and children, and bring a lower feeling of intergenerational isolation, we propose H3 and H4:

***H3: When elder people use more communication forms when they communicate with their adult children in social media, they will have a lower perception of intergenerational isolation.***

***H4: When elder people communicate more with their adult children in social media, they will have a lower perception of intergenerational isolation.***

### **3.3 Offline Factors: Geographical Distance, Intergenerational Communication in Social Media, and Elders’ Perception of Intergenerational Isolation**

It is very important to maintain family connections with the help of human-computer interaction technology (Ling 2008). Especially for family members who live apart, social media help them to communicate more and feel the “virtual co-presence” or “connected presence”, which overcome long geographical distance to some extent (Baldassar 2008). In other words, “long-distance” families have more frequency and forms of intergenerational communications to maintain their intimacy (Kang 2012). So, we propose H5a and H5b:

***H5a: When elder people live further from their adult children, they are more likely to use more communication forms when they communicate with their children in social media.***

***H5b: When elder people live further from their adult children, they will communicate more with their adult children in social media.***

However, although social media supplement traditional face-to-face communications to help family members living apart connect (Lam 2013), elder people’s feeling

of loneliness and intergenerational isolation can only be released to some degree. The role of online emotional support is supposed to be weaker than direct offline cares. For instance, when children live away from their parents, they cannot accompany and help the elders immediately when they are sick, sad or boring. In other words, geographical distance constrains the interaction between family members, and increases the perception of intergenerational isolation (Crimmins and Ingegneri 1990), just as H6 hypothesizes:

*H6: When elder people live further from their adult children, they will have a higher perception of intergenerational isolation.*

## 4 Research Method and Data Analysis

### 4.1 Data Collection

Considering the difficulty in collecting data from elder population, 10 confederates were recruited and trained to conduct face-to-face survey-based interview. The target subjects of our investigation are Chinese elders above 55 years old who use social media for daily communication. This study chose WeChat as our target social media technique as it is widely adopted among Chinese elders.

As we aim to examine intergenerational communication, our interview subjects need to have at least one child. In the investigation, four parts of questions were designed. (1) Subjects' basic information including their demographic information, economic state and family; (2) Subjects' perceived functional affordance and emotional affordance that are facilitated by WeChat; (3) Subjects were asked to nominate one of their children. Then they answer questions that were specified to their relationship with the nominated child. These questions included their intergenerational online communication through WeChat, how far their children live apart, economic support and daily care from the child; (4) Subjects' subjective perception of intergenerational isolation.

At this stage, valid data from 107 elder social media users were collected. Among them, 47 were male (44%) and 60 were female (56%). Average age of subjects was 61.

### 4.2 Instrument Development

An important step in data collection is to develop an instrument (e.g., questionnaire) to measure each latent constructs in the model (Xu and Chen 2006). To ensure the validity of the instrument, we adopted existing quality questions whenever possible. We also made necessary adaption of adopted items to our research context. In addition to research constructs, several control variables were also designed and tested. Demographic information such as gender and age are controlled. We also asked and controlled subjects' communication frequency with their nominated child via other channels, such as telephone call, email, short message or offline contact. Drawing on prior literature, we add economic support and daily care into our research model as control variables because they are found to be critical components in intergenerational support (Silverstein and Bengtson 1997).

Items for subjective constructs were measured based on a seven-point scale. In the survey-based interview, functional affordance was measured as multi-item formative construct, while emotional affordance and intergenerational isolation were measured as multi-item reflective constructs. For objective constructs, that is, diversity of communication forms, communication frequency, geographic distance, daily care, economic support and communication frequency through other channels, only one item was used. For example, geographic distance was measured as five levels (Living together, does not live under the same roof but in the same city, living in different cities but in the same province, living in different province and living abroad). Items for elder's perception of intergenerational isolation comes from PSI (parenting stress index) proposed by Abidin (1995).

### 4.3 Evaluating the Measurement Model

Although our research model only contains two multi-item reflective constructs, we still first checked the validity of the measurement model before hypothesis testing. Confirmatory factor analysis (CFA) is the conventional statistical method to test the convergent validity of a measurement model. The set of criteria includes (1) loading of each item is significant, (2) the average variance extracted (AVE) for each item should be greater than 0.5, and (3) the composite factor reliability (CFR) and Cronbach's alpha are greater than 0.7. Table 1 reports the results of convergent validity for our sample. All criteria were satisfied.

To satisfy discriminant validity, inter-construct correlation is required to be less than the square root of AVE. The underlying rationale is that an item should be better explained by its intended construct than by other constructs. Results indicate satisfactory discriminant validity. In summary, our measurement model confirmed both convergent validity and discriminant validity. With that, we could proceed to test the causal relationships among all factors.

**Table 1.** The convergent validity of the measurement model

Construct	Item	Std loading	T-value	AVE	CFR	$\alpha$
EA	EA1	0.924	34.35	0.836	0.953	0.934
	EA2	0.963	89.49			
	EA3	0.908	34.53			
	EA4	0.859	29.68			
II	II1	0.875	20.14	0.767	0.930	0.899
	II2	0.875	19.32			
	II3	0.883	22.02			
	II4	0.870	17.20			

EA: Emotional Affordance; II: Intergenerational Isolation



### 4.4 Hypothesis Testing

Due to there is one formative construct (FA) in our research model, PLS was used for data analysis. We first fitted the full model to test our proposed hypotheses. Then we conducted examined the mediator role of intergenerational communication via social media when controlling for geographical distance.

**Table 2.** Analysis results

	DCF	CF	II	
	DCF	Model 2	Model 3	Model 4
FA	0.472** (2.446)	0.064 (0.305)	-0.056 (0.904)	-0.052 (0.764)
EA	-0.070 (0.541)	0.283* (1.936)	-0.039 (1.038)	-0.048 (1.145)
GD	0.196** (2.551)	0.280*** (3.532)	-0.148 (1.33)	-0.102 (0.840)
DCF			-0.097 (0.913)	-0.085 (0.800)
CF			-0.162* (1.711)	-0.190* (1.672)
CF-O				-0.005 (0.048)
ES				0.051 (0.448)
DC				0.053 (0.397)
GENDER				-0.114 (1.141)
AGE				0.099 (0.942)
R-Square	<b>0.243</b>	<b>0.235</b>	<b>0.062</b>	<b>0.084</b>

\*p < 0.10, \*\*p < 0.05, \*\*\*p < 0.01. Values in parentheses are t-statistics. FA: Functional Affordance; EA: Emotional Affordance; GD: Geographic Distance; DCF: Diversity of Communication Forms; CF: Communication Frequency; CF-O: Offline communication Frequency; ES: Economic Support; DC: Daily Care

Table 2 showed the model fitting results. Results suggested that elder users’ high level of perceived functional affordance of WeChat increased the diversity of communication forms. Thus H1a was supported. This result may suggest that functional affordance is closely associated with elder users’ explorative behavior in technology usage. However, the effect of functional affordance on communication frequency was insignificant. Thus H1b was not supported. The effect of emotional affordance was exactly opposite. Emotional affordance imposed an insignificant effect on the diversity of communication forms, but its effect on communication frequency was significantly positive. Thus H2a was not supported while H2b was supported. Compared to functional affordance that addresses the human-technology interaction, emotional affordance is more about the human-human communication. Thus a high level of emotional affordance motivates elder users to use social media more frequently in order to maintain their social relationship, no matter which communication form is used.

Communication frequency showed a significant effect in reducing elders’ perceived intergenerational isolation. However, the expected effect of diversity of communication forms was not detected. Thus, H4 was supported but H3 was not supported. Therefore, whichever communication form is used, elder’s perception of intergenerational isolation can be only impacted by communication frequency.

Then, we focus on how offline factors impacts elders’ online behaviors. The effect of geographic distance on the diversity of communication forms and communication

frequency was both significantly positive. This result indicated that the more distance elder parents were apart from their children, the more they rely on social media to strengthen their connection. Thus H5a and H5b were both supported.

After controlling the effect of intergenerational communication via social media technology, the direct effect of geographic distance on intergenerational isolation was insignificant. However, from Table 3, we see that geographic distance and intergenerational isolation are significantly related. So, we test their relationship without adding in variables about social media communications, and find a significant negative effect between them ( $\beta = -0.181^*$ ,  $p < 0.1$ ), which is contrary to Hypothesis 6.

**Table 3.** Mediator effect of communication frequency

Mediator	Test procedure	Path	Unstandardized B	SE B	Mediator effect (Sobel Test)
CF	II = f(GD)	(c)	-0.181	0.108	Supported
	CF = f(GD)	(a)	0.370	0.092	
	II = f(GD, CF)	(c')	-0.111	0.115	
		(b)	-0.190	0.114	

A possible reason for the unexpected result may be that the effect of geographic distance was mediated by communication frequency. The positive effect of geographic distance on communication frequency and the negative effect of communication frequency on intergenerational isolation combined to lead to its direct negative influence. Following the well-recognized mediator testing procedure (Baron and Kenny 1986), we tested the mediator effect of communication frequency for the main effect of geographic distance. The results in Table 3 indicated that communication frequency significantly mediated the effect of geographic distance ( $ab/s(ab) = |-1.66| > 1.64$ ), thus support our explanation.

## 5 Discussion and Implications

### 5.1 Discussion of Findings

Our results reflect interesting findings. First, while prior research emphasized the importance of functional affordance, our finding suggested that its effect in elders' technology-supported intergenerational communication is limited. Indeed, elders with a higher level of functional affordance are willing to try diverse social functions to communicate with their children. However, the increased communication diversity does not reduce their perceived intergenerational isolation.

Second, instead of functional affordance, we find that it is elder users' emotional affordance with social media technique that influences their intergenerational relationship. Emotional affordance is found to increase elders' intergenerational communication frequency, which significantly reduces their perceived intergenerational isolation. While

prior research paid attention to functional affordance, this study suggests that the importance of emotional affordance in elder users' technological usage has long been underestimated.

Third, the anytime- and anyplace-feature of social media breaks through the barrier of geographic distance in intergenerational communication. Geographic distance decreased face-to-face communication. In the traditional offline world, the decrease of face-to-face communication may have a negative impact on intergenerational affection. With the help of social media technique, however, elders have an alternative and more convenient way to keep contact with their children, and might even strengthen their intergenerational relationship. We found that an increase of geographic distance motivates elders to resort to social media techniques, resulting in significant increase of both social media communication frequency and diversity. Afterwards, communication frequency further decrease elders' perception of intergenerational isolation. We summarized our research findings in Fig. 2, all significant relationships are marked in red dotted line.

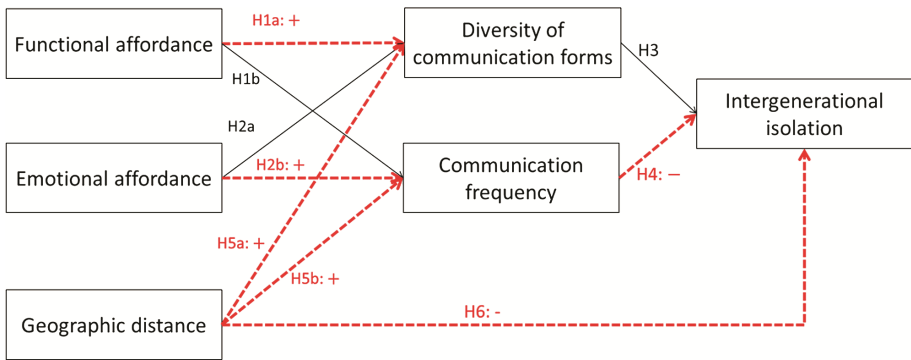


Fig. 2. Data analysis results (Color figure online)

## 5.2 Theoretical and Practical Implications

This study has profound theoretical and practical implications. Theoretically, this research improves our understanding of elder users' intergenerational communication in social media. First, through the perspective of technological affordance, we propose the dual effect of social media in its functional and emotional affordance to enhance intergenerational communication. Second, we are among the first to integrate offline intergenerational distance with online intergenerational communication, and proved that geographic distance doesn't always increase intergenerational isolation, which provides a different finding with previous literatures.

In practice, this study offers practical guidance of social media design for elder users and alerts people to pay more attention to elders' feeling of intergenerational isolation. For instance, social media should enable the "priority" feature that allows elder users to put their chat box with children at the top of the interface. This feature is used to help elder users to communicate more with their children (increase communication

frequency). Besides, except for promoting technical functions, HCI practitioners should pay more attention to elder users' emotional need. An elder-friendly interface is thus in call for social media design. Content providers are also called to offer more content that fits elders' interest. For adult children, especially those who live far away from their parents, should take advantage of technique-mediated communication tool, and have more heart-to-heart intergenerational talk which shortens the objective geographic distance. For elder people, except for trying diverse forms of communication in social media, communicating more with their children is more important for them to release their feeling of isolation.

### 5.3 Limitations and Future Research

First, our cross-sectional investigation only reflects a static state of elders' social media usage. To have a better understanding of the evolution of elders' digital usage and their technique-supported intergenerational interaction, long-term follow-up surveys are necessary in the future.

Second, while the diversity of communication forms is positively influenced by both functional affordance and geographic distance, its effect on intergenerational isolation is unfortunately insignificant. A series of questions emerge here. (1) Does communication diversity means nothing for elder users? (2) If multiple communication forms are useless for elders, should HCI practitioners reduce communication options to make the interface simpler? The answer for the above questions may depend on whom elder users are communicating with. Although the diversity of communication forms shows no influence in reducing intergenerational isolation, it may benefit elders' peer communication with their friends of the same age. Future research will be conducted to examine elders' peer communication through social media.

Last, communicating more does not mean communicating better. In this research, we only focus on communication frequency, but did not further investigate the content of communication, which should be considered in future research.

**Acknowledgement.** This work was supported by the Fundamental Research Funds for the Central Universities, 30918013104; National Science Foundation of China (grant #71702103); Research Foundation in Nanjing University of Science & Technology (grant #AE89955), and the China Ministry of Education-China Mobile research grant (#MCM20150402).

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