Technological Influences on Social Ties Across the Lifespan

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Abstract:

Keeping in contact with our friends and family members, which is vital for relationship maintenance, has never been easier. We can telephone, text, e-mail, instant message, comment on their Facebook wall or blog, and so forth. We know who is calling us and we can monitor the locations of those with whom we have network ties and their activities based upon their status updates on social networking sites (SNSs) and Twitter. The range of ways that we can communicate and maintain contact with our social ties has never been greater.

Keywords: information and communication technologies (ICTs) | technology | aging | friendship | social connections

Article:

INTRODUCTION

Keeping in contact with our friends and family members, which is vital for relationship maintenance, has never been easier. We can telephone, text, e-mail, instant message, comment on their Facebook wall or blog, and so forth. We know who is calling us and we can monitor the locations of those with whom we have network ties and their activities based upon their status updates on social networking sites (SNSs) and Twitter. The range of ways that we can communicate and maintain contact with our social ties has never been greater.

Over the past decade, the range of information and communication technologies (ICTs) available and people's use of them have changed dramatically. The purpose of this chapter is to synthesize the current literature on the range of ICTs that have proliferated in the past decade, examine how these ICTs vary in use across life-span groups, discuss how they are used to help individuals maintain social ties, and note areas where further research is needed. In so doing, we discuss the theoretical challenges of studying this topic, describe the range of ICTs now in use, and provide examples of research on how people of different ages use technology to maintain social ties.

We focus on ICTs as they are used most often by individuals and how they assist individuals in maintaining and enhancing their social relationships. Although the Internet has been around for 40 years and the computer for several decades longer, in the past decade or so there have been dramatic increases in a range of applications that utilize computer or Internet technologies. For instance, blogs came into existence in 1997, MySpace was created in 2003, Facebook began in 2004, and Twitter was initiated in 2006. As of 2008, 74% of households had computers and 91% of adults reported using e-mail. In 2009, 85% of adults and 75% of those between 12 and 17 years of age used mobile phones. All of these ICTs and related applications greatly enhance the ability to communicate with others and to maintain social ties. As will be discussed later in this chapter, however, their use often varies across life span groups.

KEY IDEAS IN STUDYING ICTS AND RELATIONSHIPS

Understanding technological influences on social ties across the life span is particularly challenging in the context of rapid technological and social change. Throughout the 1990s and early 2000s, researchers debated whether it was possible to form or at least to maintain "real" relationships through online interaction. Now the use of the Internet and other ICTs to form and maintain social relationships is taken for granted and the definitions of terms for various types of social ties terms have evolved. For example, the word "friend" now has different meanings given the proliferation of SNSs. Although "friends" on SNSs are often those with whom participants have strong social ties, they are increasingly casual acquaintances or friends of friends whom individuals have rarely if ever met (i.e., similar to what Granovetter [1973] called "weak ties"). Fingerman (2009) coined the term "consequential strangers" to refer to the myriad casual connections that individuals in today's society now have, some of which are a direct result of ICT use. These consequential strangers have a variety of types of impact on our lives and our relationships, in ways that we often do not even consider. The terms "friend," "family member," "coworker," "romantic partner," and "neighbor" no longer capture all possible types of social ties and knowing how far one person lives from his or her relationship partner is no longer a good predictor of how frequently they interact. The use of ICTs allows individuals to mitigate distance and to be in constant interaction or at least to be continuously available (Baron, 2008).

A Framework for Studying ICTs and Relationships

Adams and Stevenson (2004) introduced a synthetic dynamic framework for the study of a lifetime of relationships mediated by technology based on four social theories, including two that address aging (i.e., individual development and life course theories) and two that address group development and change (i.e., family development and network change theories). This synthetic model was developed to guide and encourage studies designed to answer the questions: "'How do changes in the life course and developmental stages of individuals affect their use of technology?' and 'How, in turn, does the use of this technology change the structure and development of individuals?' (p. 383)." The model distinguishes between the sociological and psychological aspects of age (Blieszner & Adams, 1992) and between individual change and group change and, in their chapter, Adams and Stevenson outline research questions accordingly.

Although as is illustrated by the examples of studies described in the remainder of this chapter, research on how people of different ages use technologies to mediate their social ties has become

more plentiful since Adams and Stevenson developed this synthetic model and outlined some research questions derived from it, most of this recent research is not designed to distinguish between the effects of the sociological and psychological aspects of aging or between individual change and changes to groups. Furthermore, because cohorts defined by their access to technological innovations span shorter time periods than they did previously (Adams, 1998), developmental differences between adjacent cohorts are not as large as they once were and the methodological challenge of separating out age, period, and cohort effects is even greater than in the past. Often by the time a carefully designed study has been conceived and executed, the technological context has altered and a new cohort has been defined. So although the framework Adams and Stevenson outlined in 2004 raises important and interesting theoretical questions, it is not surprising that apparently no one has developed studies inspired by it because of the practical challenges doing so would pose.

At the time Adams and Stevenson (2004) developed this model, they attributed the relative lack of theoretically driven scholarship on how people of different ages use technologies to mediate their social ties, not only to the lack of the application of dynamic theories of aging and group development and change, but also to the state of theory on the formation and maintenance of social relationships. They describe how despite the recognition that intimacy can exist at a distance (e.g., Litwak & Szelenyi, 1969; Rosenmayr, 1977), some interest in communities based on beliefs and interests rather than on shared territory (e.g., Craven & Wellman, 1974; Effrat, 1974; Webber, 1973), and some interest in long-distance and virtual relationships (e.g., Cuba & Hummon, 1993; Rohlfi ng, 1995), most quantitative and qualitative research on social ties was based on the assumption that they were formed and maintained primarily, if not exclusively, through face-to-face interaction. From the perspective of these early personal relationship theories, the main questions were not how technology supported relationship development or supplemented face-to-face interaction, but whether it was possible for relationships to be formed and maintained without the latter and how inferior computer-mediated communication was in comparison with it (Adams, 1998).

As of this writing, scholars are beginning to revisit theories and concepts and to revise them to reflect current technological possibilities for long-distance relationships. For example, as Johnson, Haigh, Craig, and Becker (2009, p. 631) observe, “previous research on relational closeness has either presupposed or privileged face-to-face contact (e.g., Berscheid, Snyder, & Omoto, 1989) or has not distinguished between long-distance and geographically-close relationships (e.g., Fehr, 2004; Monsour, 1992).” In their research, they explore the concept of relational closeness by comparing how geographically close and long-distance friends define closeness in their relationships and assess prior methods of defining and measuring relational closeness in light of these differences.

Similarly, in another reconsideration of an existing concept in light of recent technological developments, Quan-Haase and Wellman (2004) discuss the concept of social capital. They point out that there are two complementary uses of the “social capital” concept: social contact and civic engagement. Both of these uses of the term are relevant to our understanding of personal relationships, the first as a direct measure of relationship process and the second as an indicator of opportunities to develop social ties. In a similar vein, Shah, Kwak, and Holbert (2001) explore the relationship between Internet use and the individual-level production of social capital.

Although the size of associations they report is generally small, their data suggest that informational uses of the Internet are positively related to individual differences in the production of social capital, whereas social-recreational uses are negatively related to these civic indicators. Their research thus suggests that social-recreational use of the Internet might lead to fewer opportunities to establish new social ties through civic engagement. These studies represent just a few of those adding to our theoretical understanding of how technology is changing not only personal relationships but the relevant theories and concepts useful in studying them.

Although some early studies examining the social impacts of Internet use reported negative effects on various aspects of relationships and well-being, such as increased loneliness and social isolation, Internet addiction, stress, and depression (Griffiths, 1999; Kandel, 1998; Kraut et al., 1998; Nie & Erbring, 2000; Scherer, 1996) and, as recently as 2005, Nie and colleagues continued to suggest that the use of ICTs was associated with declines in social interaction and engagement, the majority of more recent research reveals positive social effects. These studies show that use of the Internet decreases loneliness, feelings of isolation, and depression among individuals by allowing them to seek new relationships or continue existing relationships (Cotten, 2008; Morgan & Cotten, 2003; Parks & Floyd, 1996). Some of this change from negative to positive perspectives and findings is probably because technology is less mediated now than it was in the recent past. Now that ICTs do not restrict users to communication mainly by typed text, richer and more complex communication is possible and computer-mediated exchanges are more similar to face-to-face ones.

Weaknesses in Existing Literature on ICTs and Relationships

The dynamic and dramatic nature of these technology developments over the past decade has resulted in a discrepancy between the rate of social change and the amount of time needed to produce scholarship. In particular, lags exist in research examining the impacts of particular technologies, the effects of technology on certain types of relationships, and oftentimes reliance on small studies and atheoretical research designs to study relevant phenomena quickly before they evolve into new forms or cease their current functions. As noted earlier, weaknesses also exist in three specific areas: (1) an overemphasis on the importance of face-to-face contact for maintaining social relationships; (2) a lack of a detailed examination of how the interrelationships among geographical proximity, emotional closeness, and ICT usage help maintain relationships; and (3) an abundance of studies focusing on the use of ICTs to enhance social capital, without clear conceptualization and operationalization of social capital. Finally, we note that the majority of work in this area examining differences across the life span in ICT usage has been primarily descriptive in nature and has focused on young adults and adults. Although the Pew Internet & American Life Project reports are common standards for noting the latest usage statistics, they are almost exclusively descriptive in nature and they often do not include youth, especially those younger than 12 years of age, in their surveys. Although it is important to know the percentages of different age groups that use specific ICTs, this does not help us to determine the specific processes through which ICT usage impacts social relationships and network ties. Further explanatory research in this area is clearly warranted.

We turn now to a discussion of the range of ICTs currently available and used in significant numbers by different groups across the life span. In this section, we note key differences in usage by different age groups.

RANGE OF ICTs

There is no doubt that the use of technology, and ICTs more specifically, has resulted in a transformation in our society. Adams and Stevenson (2004) outlined the developments in transportation and communication technologies during the past 200 years, describing how the barriers to the formation and maintenance of social ties had gradually been lowered, first with the development of the Pony Express, the postal system, the telegraph, and telephones; then with the invention of steamships, locomotives, automobiles, and airplanes; and finally with the growth of the Internet. The rate of change in technologies, specifically ICTs, and individuals using them has escalated in the past decade.

Individuals are using ICTs to find information and keep in contact with others in ways that were not envisioned even a few decades ago. Over the past 40 years since the Internet began in 1969 as ARPANET, there has been explosive growth in individuals using computers, the Internet, and associated technologies (Castells, 2001). Although individuals often use the terms Internet and World Wide Web (WWW) interchangeably, they are actually two different entities. The Internet is the large infrastructure that contains the WWW and allows individuals to connect to the WWW, whereas the WWW is the compilation of all the Web sites around the world taken together.

COMPUTERS AND THE INTERNET

In 1985, less than 9% of U.S. households had computers; by 2001, this percentage had escalated to 57%. As of 2008, 73.7% of individuals reported using computers (Hale, Cotten, Drentea, & Goldner, 2010). Among youth aged between 8 and 18 years, 93% reported having a computer at home (Rideout, Foehr, & Roberts, 2010). Laptops are increasing in use, particularly among youth, with netbooks (a type of mini-laptop) surging in popularity in 2009. A third of youth aged 8‑18 years report owning their own laptop, with the percentages rising among older youth age groups (Rideout et al., 2010). Though individuals use computers for a variety of purposes, accessing the Internet is a main reason they do so.

The Internet was originally invented to facilitate the exchange of information between government scientists in the United States during the Cold War; however, it is now used extensively by a majority of individuals in the United States. Recent reports indicate that 74% of individuals have “gone online” and this rate is even higher among younger aged persons (Table 1; Jones & Fox, 2009). More than 80% of those aged 44 years or younger report going online. Approximately 84% of those between the ages of 8 and 18 years report having Internet access at home (vs. only 59% having high-speed wireless Internet access at home), whereas 70% of those between the ages of 8 and 18 years go online on a typical day (Rideout et al., 2010). Over 90% of those 12‑17 and 18‑29 years old go online (Lenhart, Purcell, Smith, & Zickuhr, 2010). Children 10 years old and younger spend less time using computers than do older-aged youth

(Rideout et al., 2010). For many, "the Internet is a central and indispensable element" in their lives (Lenhart et al., 2010, p. 5).

Table 1. ICT Usage by Age Group

Age Group[a]	ICT Usage (%)				
	Go Online	Email[b]	Instant Messaging[b]	Social Networking Sites[b]	Read Blogs[b]
12–17	93	73	68	65	49
18–32	87	94	59	67	43
33–44	82	93	38	36	34
45–54	79	90	28	20	27
55–63	70	90	23	29	25
64–72	56	91	25	11	23
73+	31	79	18	4	15

[a] To date, Pew has not collected data on ICT usage among those younger than 12 years of age.
[b] Percentages are for those who go online only.
ICT, information and communication technology.
Source: Data from Jones & Fox, 2009; www.pewinternet.org

ICT APPLICATIONS

Applications that allow individuals to communicate online have seen tremendous growth in popularity and usage. Research (Jones & Fox, 2009; Morgan & Cotten, 2003; Palfrey & Gasser, 2008) shows that communication is a main use of the Internet. An asynchronous form of communication, e-mail has been used extensively by individuals to maintain contact with others and disseminate information. Among Internet users, 91% of adults in the United States report using e-mail (Jones & Fox, 2009). Individuals aged 12‑17 years are least likely to use e-mail (see Table 1). Youth aged 8‑18 years spend fewer than 10 minutes per day, and children aged 8‑10 years spend only 2 minutes per day using e-mail (Rideout et al., 2010).

In contrast to e-mail, instant messaging (IM), another form of electronic communication, is synchronous in that individuals involved in the exchanges are both online and present simultaneously during the exchanges. Thus, the textual exchanges occur more in "real time," in contrast to someone retrieving their e-mail and at some later time deciding to respond to it. IM operates within other software programs as a feature of those programs, allows individuals to see which of their network members are online, and affords users the opportunity to send private messages instantly from one person to another via computer. Fewer than 40% of online adults report using IM (Jones & Fox, 2009). Sixty-eight percent of online teens aged 12‑17 years report using IM; however, fewer than 25% of those online aged 64 years and older use IM (see Table 1; Jones & Fox, 2009). Among youth 11‑18 years old, most report spending about 14 minutes per day using IM, although the levels among those 8‑10 years old are much lower (Rideout et al., 2010). Youth use IM more frequently, though increasingly this use is integrated in SNSs and other ICTs.

A variety of technology applications besides e-mail and IM, such as social networking and video-sharing sites, online communities, Skype, virtual worlds, dating sites, blogs, and Twitter (a micro-blogging platform), have been developed and seen record growth in recent years. One of the most discussed ICTs in recent years has been SNSs. According to recent research, approximately 35% of those who are online use SNSs. Usage levels, however, are much higher

among those aged 32 years and younger (see Table 1; Jones & Fox, 2009). Almost three fourths of online teens and those aged 18–29 years report using SNSs, whereas only 47% of online adults report using these sites (Lenhart et al., 2010). In a recent study of those aged 8–18 years, 18% of those 8–10 years old, 42% of those 11–14 years old, and 53% of those 15–18 years old reported using SNSs on a typical day; although SNS usage represents the largest proportion of recreational time spent online among these groups, average time spent for each group was fewer than 30 minutes per day (Rideout et al., 2010).

Although there are hundreds of SNSs and more being created every day, the two that have received the most attention and the most research to date are MySpace and Facebook. MySpace started as a way for bands and musicians to expand their networks of appeal. Although both Facebook and MySpace were originally developed for younger age cohorts, both have now proliferated across the age spectrum. In particular, the fastest growing group going on Facebook currently is individuals aged 55 years and older (Inside Facebook, 2009a). The median age of Facebook users is 33 years (Fox, Zickuhr, & Smith, 2009).

MySpace was founded in 2003 and Facebook was initiated a year later. Both SNSs allow users to make connections with others online, post materials on the sites, and easily communicate with their friends. MySpace saw tremendous growth in its early years; however, in 2008 Facebook became the most popular SNS when measured by the number of members (Inside Facebook, 2009a). As of late 2009, there were 98.1 million Facebook users, the slight majority of whom were females (56.1%; Inside Facebook, 2009b), and Facebook was the most often used SNS among online adults (Lenhart et al., 2010). Although almost one third of individuals living in the United States are Facebook participants, there are still those nonusers who are either disenfranchised, essentially lacking Internet access, or are conscientious objectors (Boyd, 2007). At any rate, SNSs have had a profound impact on civil society in that regardless of whether they participate, almost everyone knows about them (Boyd, 2007).

Although not as interactive as SNSs, video-sharing sites, such as YouTube and Hulu, have also become popular in recent years. These sites allow individuals to upload/post, comment, and rate videos. Users typically have to register on the sites before they can post to the site. According to data from comScore (comScore, 2010), 86.5% of Internet users in the United States viewed videos online in December 2009, Google accounted for almost 40% of videos watched (and this was a result of them owning YouTube), and the average length of videos watched was 4 minutes.

In 2009, video sharing was more popular among adults than was SNS usage. Sixty-two percent of adults watched videos online compared with only 46% who used SNSs (Madden, 2009). Almost all young adults (18–29 years old) watch content on these sites, with more than a third doing so on a typical day. Among those 8–18 years old, 81% report that they have watch a video online at some point; however, the average time spent on a typical day for this activity is low—fewer than 20 minutes (Rideout et al., 2010). It is anticipated that online video sharing and video viewing will continue to increase as more and more content is becoming available for viewing via these sites and others.

Blogs are another type of ICT that facilitate the exchange of information, opinions, and communication in today's society. John Barger coined the term web log in 1997 to refer to an

online Web site where individuals could post links and comments about things (Blood, 2000). Web logs, referred to as blogs since 1999, were originally likely to be primarily a list of links with commentary and personal asides by individuals (Blood, 2000). They have now become much more interactive and journalistic in design and are often updated frequently by the blog owner and those who read the blog. Blogs became more common once *Blogger* was released in 1999, as this free form interface allowed users to create blogs without having to know how to program a webpage (www.blogger.com). There are over 100 million blogs and over 100,000 new blogs being created each day around the world (Sifry, 2007; Technorati, 2009). Approximately a third of online adults report reading blogs, but far fewer (11%) report creating them (Jones & Fox, 2009). About 10% of adults who use the Internet maintain a blog or online journal (Lenhart et al., 2010). Although the differences between age groups are not equal, there is a monotonic decrease in reports of reading and creating blogs across cohorts as they age. Among students in 7th‑12th grade, 49% report having read a blog, but only 28% have written a blog (Rideout et al., 2010). Recent data suggest that the rates of teens and young adults who blog has been declining since 2006, yet has been increasing among older age groups (Lenhart et al., 2010).

A specific form of blogging, known as micro-blogging, has developed in the past few years. Microblogs allow users to post short postings and encourages users to post frequently. Twitter, the most recognized and most discussed of the microblogs, began in 2006 but the number of its users increased dramatically in 2008‑2009 (www.twitter.com). The developers of Twitter began the site as a way for people to stay in touch with others but it is currently more often used for professional purposes (www.twitter.com; Miller, 2009). Individuals can post messages of up to 140 characters in length, which are known as tweets; they can "follow" others and be "followed" by others who are on Twitter. Following allows participants to see the micro-blog postings of those whom they follow. In essence, Twitter allows for the creation of a social network of people who are interested in hearing what individuals think is useful or interesting to post. Some would suggest that this occurs in almost real time, as new tweets are constantly posted and available to view. Twitter can be accessed by the main Web site or through a variety of applications designed to link tweets with posts on SNSs, blogs, and so on.

When Twitter began, many people simply reported what they were doing rather than posting specific information that others might find useful. The types of posts are much more diverse currently and many are using Twitter to promote themselves or their organizations and to relay information that they find useful in specific domains (Miller, 2009).

Unlike SNSs, Twitter initially became popular with middle-aged groups. Individuals aged between 35 and 54 years represented the largest group on Twitter as of July 2009. However, a Pew Internet & American Life Project report (Lenhart et al., 2010) found that those 18‑24 years old were more likely to report using Twitter or another status-updating site than were older age groups. This finding is likely due to the question wording, as they asked about Twitter or "another status-updating site"; youth are more likely to use Facebook and other SNSs as status-updating sites, thus inflating this response level. ComScore reports that those aged between 12 and 17 years and between 18 and 24 years are the fastest growing age groups on Twitter (Lipsman, 2009), which is in contrast to recent media reports that suggest that "teens don't tweet" (Miller, 2009). September 2009 data reveal that only 8% of 12‑17 years old report using

Twitter, with use being higher as youth age and among females (Lenhart et al., 2010). Growth in Twitter usage has been dramatic in the past year: usage has increased 27-fold (Lipsman, 2009). Fox et al. (2009) report that 19% of individuals in the United States use Twitter or another status-updating service currently, with SNS users, Internet-enabled mobile phone users, and individuals younger than 44 years leading the growth in status updating.

An additional outgrowth of the increased use of the Internet is the proliferation of online dating sites. Although personal advertisements have been in existence for hundreds of years, online personals and dating sites expedite meetings for dating and mating. There are an estimated 1,400 online dating sites operating in North America (Homer, 2009). A 2006 Pew Internet & American Life Project report (Madden & Lenhart, 2006) found that almost a third of U.S. adults reported that they knew someone who had used a dating Web site at some point, and 15% reported knowing someone who had been in a long-term relationship with someone they met online. Madden and Lenhart (2006) also reported that 11% of all Internet users and 37% of singles who are looking for someone to date have utilized online dating sites. New research finds that individuals who have known others who have used online dating sites are more likely to use them to find potential mates (Sautter, Tippett, & Morgan, 2010). This same study reports that those who are Internet daters are more likely to have higher computer literacy, have others in their social networks who have used online dating sites, and view Internet dating in more positive terms than are single Internet users in general (Sautter et al., 2010).

Online dating sites typically request that individuals post the following information describing themselves and what they desire in a dating or mating partner when completing a profile: location, age, race, gender, physical characteristics, smoking and drinking status, and other descriptive information about themselves or desired others (Fiore, 2004). These sites also typically include a messaging system so that members can contact others who appear to match their desired qualifications.

Online mating and dating sites are often different than other types of SNSs in that they typically do not have common forums where individuals can make posts for large numbers of people to read or see. As Fiore (2004, p. 26) notes, “Most traditional online dating sites facilitate narrow-purpose community. They offer tools for finding people to date and communicating with them, but they tend not to provide tools for communicating in a broader context or establishing ties outside of a dating context.” Even with this caveat, Madden and Lenhart (2006) note that most U.S. adults who are Internet users who are looking for others to date have used the Internet to help them find others for dating and mating. Given the increasing percentage of individuals utilizing ICTs and the decreasing stigma of online dating sites, we anticipate that the use of these sites will continue to proliferate in the coming years.

Playing games online has also increased in popularity in recent years (Rideout et al., 2010). In particular, massively multiplayer online games (MMOGs), such as World of Warcraft, have become highly popular among young people (Palfrey & Gasser, 2008). Approximately 38% of all adults, 74% of adult gamers, and 76% of teen-aged gamers play games on desktop or laptop computers (Lenhart, Jones, & Macgill, 2008). Among those 8‑18 years old, over half of all gaming occurs on portable devices (Rideout et al., 2010). The numbers are smaller for those who play games on mobile phones, Blackberries, and other handheld devices (13% of all adults, 25%

of adult gamers, 62% of teen-aged gamers; Lenhart et al., 2008); and, middle school students are similar to teen-aged gamers (64% report playing games on their mobile phones at least every few months; Cotten, Anderson, & Tufekci, 2009). Youth aged 8–18 years report spending an average of 1 hour and 13 minutes playing video games on a typical day; however, boys spent significantly more time playing games than did girls (Rideout et al., 2010). These numbers are expected to rise as mobile devices are increasingly becoming integrated with gaming and Internet systems (Cotten et al., 2009; Rideout et al., 2010).

Free online phone calling software has also been developed in the past few years; this software allows users to talk to others via computers and some gaming systems, and has increased access to long-distance communication. Skype, the most popular of these types of software, became available in 2002 (www.skype.com; About Skype, 2009) and accounts for 8% of global international telephone calls being made. According to the Skype Web site, up to 20 million users have been online at the same time during peak hours.

MOBILE OR CELL PHONE USAGE

In addition to the ICTs and related applications noted earlier, mobile or cell phone usage has proliferated in the past few years. Although telephones were initially developed to facilitate organization efficiency and reduce isolation among rural families (Goggin, 2006), telephones of today are more advanced and provide a range of options for individuals. Many mobile phones in today's society allow users to do things that previously could only be done with computers and access to the Internet. In particular, wireless technology, miniaturization, ability to access the Internet, and more affordable pricing plans have led to a majority of individuals in the United States having access to and using mobile or cell phones (Cotten et al., 2009).

The percentage of adults who own mobile phones has increased in recent years, from 65% in 2004 to 85% in 2009 (Lenhart, 2009b). Harris Interactive (2008) estimates slightly higher percentages of adults who have a mobile phone (i.e., 89%). Thirty-one percent of 8- to 10-year-olds, 69% of 11- to 14-year-olds, and 85% of 15- to 18-year-olds report owning a mobile phone (Rideout et al., 2010). In another study, among 12- to 17-year-olds, 75% report owning mobile phones, whereas the rate is even higher among those 18–29 years (93%) (Lenhart et al., 2010). Cotten and colleagues (2009) found in a study of middle school students that mobile phone use and ownership was also high. Nearly 61% of middle school students reported owning mobile phones, whereas around three fourths reported using a mobile phone. Seventy-one percent of those between the ages of 12 and 17 years reported owning a mobile phone, ranging from a low of 52% for those between 12 and13 years old to a high of 84% for those 17 years old (Lenhart, 2009b). Research suggests that increasing percentages of U.S. adults report that they only own mobile phones (thus, no landlines). As of 2008, 14% of U.S. adults had mobile phones only and this is more common among younger age cohorts as the statistics for the following age ranges show: 18–29 years−49%; 30–39 years−22%; 40–49 years−13%; 50–64 years−11%; 65 years and older−6% (Harris Interactive, 2008).

Goggin (2006) notes that the most prominent feature of new mobile phones is text messaging. Text messaging, also known as short message service (SMS), has become increasingly popular among younger age cohorts. Recent studies show that 71% of those aged between 12 and 17

years, 85% of those aged between 18 and 29 years, 65% of those aged between 30 and 49 years, 38% of those aged between 50 and 64 years, and 11% of those aged 65 years and older report sending text messages (Horrigan, 2008; Lenhart, 2009b). Among middle school students, 54% report using text messaging at least every few months (Cotten et al., 2009). Among those 8‐18 years old, 46% report texting on a typical day, and among 7th‐12th graders, most spend on average an hour and a half per day sending and receiving texts (Rideout et al., 2010). Of those between 12 and 17 years old, older teens are more likely to use mobile phones and to use text messaging (Lenhart, 2009). Some research suggests that college students prefer text messaging over e-mail communication (Junco & Cole-Avent, 2008).

As the prior two sections have illustrated, there are a range of ICTs and related applications. This review has not been exhaustive but has merely tried to highlight the research that is most discussed and relevant for understanding social ties and social relationships. In sum, the range of ICTs and related applications has increased dramatically in recent years, as has the number of people using them. The availability of these ICTs and applications greatly enhances the ability for those on the right side of the digital divide to communicate with others, find information, acquire a variety of social and professional resources, and maintain social ties.

USE OF TECHNOLOGY IN RELATIONSHIPS ACROSS THE LIFE SPAN

Despite the difficulty in documenting how the use of technology to form and maintain social ties varies across social and developmental age, let alone by period and cohort, people at different stages of the life course (social ages) and at different levels of maturity (developmental ages) do indeed use technology in different ways, use different types of technologies, and use technology to mediate relationships in different ways. Much literature exists documenting the digital divide between socioeconomic groups, with the less advantaged having less access to ICTs and access to less variety of ICTs (Davison & Cotten, 2009; DiMaggio, Hargittai, Celeste, & Shafer, 2004; Hargittai & Shafer, 2006). As is documented in the review of the literature that follows, however, studies comparing the use of technology by different age groups are less common and are mostly descriptive in nature. Later we describe the literature on how people of different ages use technology to form and maintain relationships and thereby provide some insight into how developmental and age-related social structural barriers might create an age-based digital divide.

Childhood

When babies are born their digital lives have already begun. They are exposed to digital information in at least four places: their parental home, obstetrician’s office, hospital (if born at a hospital or mother is cared for in hospital), and pediatrician or health care provider’s office (Palfrey & Gasser, 2008). They are already inter acting with technology or being integrated into society through the use of technology (e.g., by ultrasounds, monitoring devices), and also through their parents’ use of ICTs to distribute ultrasound pictures, latest reports on prenatal visits, birth announcements, birth pictures, and so on.

Children also live rich digital lives and, unlike babies, use ICTs themselves to form and maintain social ties (Livingstone, 2003). The worlds of play for children have become much more digitized during the past 10 years. A plethora of organizations (e.g., governmental, nonprofits,

museums, educational) have developed Web sites that now offer preschoolers (and older youth too) opportunities to play games, watch videos, and interact with cartoon characters and other children (see, e.g., www.disney.com; www.pbskids.org; Marsh et al., 2005; Montgomery, 2000). In addition, the American Library Association hosts a Web site that provides links to hundreds of Web sites that have been reviewed and been deemed appropriate for children (see: http://www.ala.org/greatsites). Montgomery (2000) suggests, however, that commercially oriented Web sites tend to overshadow the educational ones. Children's television shows routinely encourage children and parents to visit the shows' Web sites to find out more about the shows and for other activities associated with the television shows. In addition, marketers target parents of preschoolers with laptops, cell phones, MP3 players, and so on, which are toys but sometimes also educational in nature.

Unfortunately, however, we know little about how children of preschool age and younger use ICTs and how the use of them affects their social relationships. Most of the research examining children has focused on those school-aged and older. A recent Kaiser Family Foundation study (Rideout et al., 2010) reports that those 8‑10 years old are exposed to close to 8 hours of media per day on average, and they spend over 5 hours per day using media. Although most of this time is spent watching television (3:41 hours), 46 minutes is spent with computers and an hour with video games. On average, those between the ages of 8 and 10 years spend approximately 5 minutes per day using SNSs, 17 minutes playing games, 8 minutes watching videos on Web sites, 3 minutes IM, 2 minutes on e-mail, and 3 minutes with graphics or photos on the computer (Rideout et al., 2010). We are aware of no data that document blog usage among children. Over 60% of those 8‑10 years old report owning an iPod/MP3 player, 65% a handheld video game player, 31% a mobile phone, and 17% a laptop computer (Rideout et al., 2010). As these percentages illustrate, the ICTs owned most often by this age group are those primarily for entertainment purposes, rather than for communication and relationship enhancement.

Although they are technically "digital natives" because of the time period in which they were born and the pervasive nature of technology in their environments, children of preschool age are still being socialized as to what is socially appropriate and how to exist in structured environments. As Livingstone (2003) concludes, the body of research on children's use of the Internet, and we would add on ICTs in general, is still small and mainly addresses potential opportunities and dangers of technology use. In addition, the majority of this research is descriptive in nature and does not examine the effects of this ICT use on social relationships. Although we recognize that babies and especially children are affected by ICTs through their own use and use by their elders, their worlds are more geographically constrained and perhaps as a result most of the research on how technology mediates social ties focuses on adolescents and adults.

Adolescence and Young Adulthood

Researchers and media personnel often refer to youth of today as digital natives, born into a digital world where ICTs are already pervasive. Most researchers consider youth born around 1980 and afterwards to be part of the digital-native generation (Palfrey & Gasser, 2008). When the average digital native was born, e-mail had been around for 22 years, personal computers were 15 years old, video games had been around for more than 40 years, commercial cell phones

had been in existence for over a decade, and the WWW had already been created by Tim Berners-Lee (Rainie, 2009).

Among digital natives, most use a variety of ICTs, they are constantly connected, and they have the skills to effectively utilize and navigate these technologies. They did not have to relearn how to do things with ICTs, as did digital immigrants and older generations. Youth are comfortable with technology and use many ICTs and related applications at very high levels compared with older age groups (Cotten et al., 2009; Ito et al., 2008; Jones & Fox, 2009; Lenhart et al., 2010; Smith, Salaway, & Caruso, 2009).

Digital natives are different than are older cohorts in that they do almost everything differently than do older age cohorts, including writing, studying, interacting, maintaining social networks and relationships, and working (Palfrey & Gasser, 2008). Each of these activities is mediated by digital natives' use of ICTs and related applications. For digital natives, they have never known another way to interact, study, work, and so forth because these technologies existed in their world when they entered it (Ito et al., 2008; Montgomery, 2007; Palfrey & Gasser, 2008).

"They are joined by a set of common practices, including the amount of time they spend using digital technologies, their tendency to multitask, their tendency to express themselves and relate to one another in ways mediated by digital technologies, and their pattern of using the technologies to access and use information and create new knowledge and art forms" (Palfrey & Gasser, 2008, p. 4). Online communities, SNSs, and other ICTs that facilitate online interactions represent areas where youth are socialized as to what is appropriate behavior and how to act in different situations, as well as being a space where their identity can develop (Ito et al., 2008; Montgomery, 2007; Palfrey & Gasser, 2008). They can experiment with their status, develop identities, and learn how to interpret social cues.

The majority of research on youth and ICTs has focused on ICT usage patterns and how this varies by different sociodemographic groups (Cotten et al., 2009; Jones & Fox, 2009; Lenhart, 2009b; Lenhart, Arafeh, Smith, & Macgill, 2008; Lenhart et al., 2010; Ling & Yttri, 2006; Roberts & Foher, 2008). Increasingly, research is also focusing on SNS usage among youth (Ellison, Steinfeld, & Lampe, 2007; Hargittai, 2007; Tufekci, 2008). Less research has examined the effects of ICT usage on social relationships, social capital, health outcomes, and education (for exceptions, see Cotten, 2008; Ito et al., 2008; Pasek, More, & Hargittai, 2009; Quan-Haase, 2007).

The lives of digital natives are intertwined with technologies. Most have never known a life without them (Ito et al., 2008; Palfrey & Gasser, 2008). Digital natives use a multitude of ICTs and ICT applications to help them maintain social ties. Few youth use ICTs and applications to form new relationships; rather they use them to maintain their existing ties and relationships (Ito et al., 2008). Given that they often do not differentiate between online and offline worlds (Palfrey & Gasser, 2008), they do not think of one key technology as being critical to maintaining social ties. Rather, they utilize the milieu of ICTs and applications that are pervasive in their social worlds. For younger youth, these tend to be IM and e-mail, with increasing numbers using mobile phones and texting as they move into the teenage years, particularly the high school years (Jones & Fox, 2009; Lenhart, 2009b). SNS usage is also high among these

groups, although teens have shown a slight decline in their likelihood of using SNSs to connect with friends (Lenhart et al., 2010). Teens and young adults' use of blogs has been declining in recent years (Lenhart et al., 2010), perhaps as a result of their increasing use of SNSs and mobile phones and their desire for more immediate forms of contact and communication.

With this constant connectivity we see the nature of relationships being changed. "Online friendships are based on many of the same things as traditional friendships−shared interests, frequent interactions−but they nonetheless have a very different tenor: They are often fleeting; they are easy to enter into and easy to leave, without so much as a goodbye; and they are also perhaps enduring in ways we have yet to understand" (Palfrey & Gasser, 2008, p. 5). Digital natives don't remember a time when individuals wrote letters out by hand and mailed them to others. They live most of their lives online and often don't distinguish between interactions mediated by technology and those that are not (Ito et al., 2008). The changing nature of social relationships is second nature to digital natives.

As noted earlier, youth use ICTs at extremely high levels compared with other age groups (Cotten et al., 2009; Ito et al., 2008; Jones & Fox, 2009; Smith et al., 2009). Technology is such a part of their lives that for many they could not fathom an existence without its use. They utilize it to form, maintain, and end social relationships with both strong and weak social network ties (Ito et al., 2008; Palfrey & Gasser, 2008).

Family

Although youth are digital natives, the majority of their older adult family members do not use technology as much as they do and are not as proficient or as technologically savvy as they are. Thus, though it would be easier for youth to manage their relationships with their family members through the use of a range of ICTs that they commonly use, for many this possibility is not an option. This is particularly the case for SNS usage as older age groups are less likely to participate in these sites (Jones & Fox, 2009).

Many family members, however, are using mobile phones, which represents an important way that youth maintain relationships with these family members. Phone calls are more often used than are text messages (a preferred means of communication for youth) with older family members, as older age groups are less likely to use text messaging than are youth (Horrigan, 2008; Lenhart, 2009b).

Friends and Romantic Partners

Youth live much of their lives online; thus, for them it is natural to form, maintain, and change relationships via technological mechanisms (Palfrey and Gasser, 2008). For youth, maintaining and even ending relationships are done primarily through the use of ICTs whether it is via SNSs, texting, calls, e-mails, or other ICT applications. For younger youth, the ICTs most frequently used tend to be IM and e-mail, with increasing numbers using mobile phones and texting as they move into the teenage years, particularly the high school years (Jones & Fox, 2009; Lenhart, 2009; Lenhart et al., 2010). Texting for high school and young adults is a key way they maintain contact with their friends and romantic partners (Ito et al., 2008; Lenhart, 2009). SNSs are also

used by online teens to maintain contact with friends (91%), make plans (72%), and make new friends (49%) (Lenhart, 2009a).

Some researchers suggest that the nature of online friendships is similar to traditional friendships; however, they tend to be less long-lasting and easier to enter and exit than offline friendships (Palfrey and Gasser, 2008). Although they at times form relationships online first, most research suggests that youth use ICTs to help them maintain existing relationships with friends rather than as a mechanism to meet new friends (Ito et al., 2008).

As we have noted earlier, for digital natives the world isn't divided into "online" and "offline" segments. Youth constantly use the tools at hand, whether they are ICTs or others, to help them maintain their relationships with their friends and romantic partners.

Gaps in Literature on Youth, Social Ties, and Technology

Ito and colleagues note that in the United States there is a lack of research on how youth ICT practices are "embedded in a broader social and cultural ecology" (2008, p. 6). We suggest that additional research is needed which follows youth over time as they more fully integrate different aspects of ICTs into their lives, education, and work experiences. Research is also needed that examines the interrelationships among ICT use, social ties, and social and health effects of ICT usage. We know little about the psychological and physiological aspects of such high levels of technology usage and what happens when ways of interacting change because of changing technologies. Is Google really making us stupid, as one highly circulated media report recently suggested (Carr, 2008)? Only studies that follow youth from very early ages will be able to distinguish how this usage affects these outcomes.

In addition, we know little about how ICT use changes over time as individuals move into and out of specific social roles. For example, what happens when the 22-year-old college graduate enters his or her first full-time job and the norms of ICT use are different? What are the effects on self-concept, social relationships, and perceptions of self-efficacy when companies have a "no texting" policy and youth can no longer be "constantly available" or when companies monitor Facebook, e-mail, and other ICT usage?

We must also not ignore that there are multiple layers of the digital divide (Davison & Cotten, 2009; Hargittai & Hinnant, 2008) that affect how youth use ICTs and their effects. Although youth are most often thought of as digital natives, there are important segments of youth who have minimal access to ICTs, or if they do have access they do not have the skills and abilities to use the ICTs to enhance their social ties.

As ICTs and related applications continue to evolve, so must our study of these technologies. Although it is important to illustrate changing trends in use and sociodemographic variation over time, we must go beyond simply documenting patterns so that we can begin to better understand the variety of effects of ICTs across the life course.

Midlife

Researchers typically refer to those who are currently in midlife as "digital immigrants" (Palfrey & Gasser, 2008). Unlike their children, who were born into digital culture, middle-aged ICT users were adults before ICTs became pervasive in our society. Nonetheless, out of necessity, they have learned new technologies as adults—first e-mail, chat rooms, cell phones, and text messaging and more recently SNSs and Twitter. They are recognizable by "the lame jokes and warnings about urban myths that they still forward to large cc: lists" (Palfrey & Gasser, 2008, p. 4). Like immigrants from one country to another, they sometimes feel like strangers in a strange land.

The literature relevant to understanding the role of ICTs in shaping personal relationships during midlife does not comprise a coherent whole. Rather than defining midlife in terms of the responsibilities facing people (committed relationship, children, or a steady job) or in terms of their maturity (approach to generativity, depth of personal insights, feelings of competence) researchers of midlife have arbitrarily focused on people of a certain age, typically some subset of people between the ages of 18 and 64 years (Adams & Blieszner, 1996). This vast age span includes young adults and those in the early stages of old age as well as middle-aged ones, all of whom are likely to have differing responsibilities and developmental characteristics. Even defining this period of life more narrowly to include only those between the ages of 33 years and 64 years means that three of the cohorts included in Table 1 would comprise midlife—Gen Xers, younger boomers, and older boomers. We know these three cohorts have had very different experiences with technology over their life courses. As reported in this table, their varying experiences result in different usage rates, with monotonic decreases in going online (from 87% among those 33-44 years old to 79% among those 55-63 years old), e-mailing (from 94% among those 33-44 years old to 90% among those 55-63 years old), IM (from 38% among those 33-44 years old to 23% among those 55-63 years old), and blogging (from 34% among those 33-44 years old to 25% among those 55-63 years old) across these three "midlife" cohorts. The one exception to this monotonic pattern is that 29% of those between 55 and 63 years old use SNSs whereas only 20% of those between the ages of 45 and 54 years do.

As Adams and Stevenson stated in 2004, what reports they could find on research on the impact of ICTs on midlife personal relationships were in the various literatures on the types of activities in which adults are involved such as education, work, and leisure rather than in the literatures on different types of relationships such as family, friend, and romantic ones. With a few exceptions (e.g., Ellison, Heino, & Gibbs, 2006), we found this statement remains true and, furthermore as discussed earlier, this type of research does not treat midlife conceptually but happens to focus on activities in which middle-aged people (and others) are involved. For example, Kamarade and Burchell (2004) recently studied whether telecommuting was a friendly or isolating form of work and Yardi, Golder, and Brzozowski (2009) examined blogging at work. Similarly, Kavanaugh, and Patternson (2001) studied the impact of computer use on community involvement, and Boase, Horrigan, Wellman, and Rainie (2006) reported that people use the Internet to put their networks into motion when they need help with important issues in their lives and those who use the Internet are more likely to get the help they need than non-Internet users. Although the studies of how ICTs shape family, friend, and romantic relationships often include midlife adults in the samples, the reports on the data do not often compare findings across age groups. For these reasons, we know very little about the impact of ICTs on midlife social ties and there are therefore virtually unlimited opportunities for research on this age group.

Older Adulthood

Just as the terms “digital natives” and “digital immigrants” have been used to describe younger and middle-aged ICT users, respectively, there are also nicknames describing older adults’ use of technology. Internet users within this cohort have been referred to as “cyberseniors” (McMellon & Schiffman, 2000, 2002), “mature users” (Fox, 2004), and “silver surfers” (Selwyn, 2004). Conversely, those who do not participate in Internet use have been deemed members of the “gray gap” (Fox et al., 2001) and the “informational blackhole” (Norris, 2001). Regardless of which label is most apt, it is more accurate to think of older adults’ relationships to ICTs as along a continuum, in that this cohort is not simply made up of users versus nonusers (Selwyn, 2004). There are varying degrees of use of specific ICTs among older adults, as is also the case among younger cohorts. As Czaja and Barr predicted two decades ago (1989), the technological revolution and the graying of the population have ushered in a need for society to take the relationship of older adults and technology into careful consideration.

Although the use of technology among older adults has risen within the past decade, there is still a smaller percentage of seniors using the Internet as compared with younger age groups (see Table 1; Fox, 2004; Jones & Fox, 2009; Millward, 2003). Even within their own cohort, there are age differences in rates of use, with those in advanced years reporting that they hardly ever use the Internet (33%) more frequently than do their younger counterparts (Millward, 2003). This age group is the least likely to use ICTs, despite their great potential to become ICT users and to gain from using these technologies (Blit-Cohen & Litwin, 2004; Cotten, 2009).

Many older adults report no interest in going online (Fox, 2004), although this “lack of interest” might more accurately be a fear of technology (Millward, 2003). Rather than reporting a lack of computer skills, many seniors portray an ambivalent attitude toward Internet technology, choosing to opt out of online participation altogether (Millward, 2003). Other nonusers do not see the relevance of Internet technology for their day to day lives (Selwyn, 2004) and feel as if they are not missing out on anything in choosing to abstain from its use (Fox et al., 2001).

A senior’s desire to become technologically capable is not necessarily enough, however, to transition the individual into becoming a proficient cyber-participant. Barriers to ICT usage among older adults relate to physical and cognitive factors, personal factors (including technology attitudes, such as computer anxiety), ICT usability factors (such as small fonts, color choices, graphics, etc.), organizational factors (such as access and assistance), and environmental factors related to where individuals use the technology (Becker, 2004; Fox, 2004; Laguna & Babcock, 1997; Morrell, Dailey, Feldman, Mayhorn, & Echt, 2004; Namazi & McClintic, 2003).

In a small study of Alabama older adults, Cotten and Anderson (2006) found that barriers to ICT use include the following: perceptions of the technologies being too complicated for them, no perceived need for them, and concerns about scams and identity theft. Melenhorst, Rogers, and Bouwhuis (2006) note that older adults are willing to learn and to use technologies if the benefits of using the technologies are made clear to them. Barriers such as a lack of IT knowledge and physical or cognitive impairments continue to prevent seniors from becoming users (Fox, 2004). Access to Internet technology is becoming less of a barrier for senior users, whereas usability is a

more critical issue for the older adult (Millward, 2003). Providing computer and Internet training is absolutely necessary in integrating the oldest cohort into a technologically advanced society (Blit-Cohen & Litwin, 2004; Cotten, 2009; Fox, 2004; Millward, 2003). After receiving adequate training, older adults' negative perceptions of ICTs often change as they begin to embrace the online world; they often become just as enthusiastic and devoted as younger ICT users (Fox et al., 2001; Fox, 2004; White, McConnell, Clipp, Bynum, & Teague, 1999). Research does suggest, however, that although the lag in older adults' adaptation of technology is sure to lessen in future generations, it will not altogether disappear (Charness & Boot, 2009).

Older adults are typically motivated to become Internet users because they associate ICTs with modern society and realize their usefulness (Cotten, 2009; White & Weatherall, 2000). The Internet allows this cohort to adapt to old age by providing them an opportunity to interact with the world outside their homes without ever having to exit through the front door (McMellon & Schiffman, 2000, 2002). Some of the negative effects of aging, such as decreased social interactions and increased loneliness, can be mediated through the use of technology (McMellon & Schiffman, 2000). Essentially, older adults' participation in cyberspace can enable them to maintain a sense of continuity in personal relationships, social activity (Cody, Dunn, Hoppin, & Wendt, 1999; McMellon & Schiffman, 2002), information seeking, and mental stimulation (Millward, 2003).

Cognitive and physical impairments as well as overall frailty often prohibit older adults from becoming proficient computer and Internet users (Hutchinson, Eastman, & Tirrito, 1997). As Charness and Boot (2009) point out, the model of older adult-friendly technology is one that provides training while allowing for impaired cognitive or physical abilities. Time constraints as a result of caregiving responsibilities are another cited reason for lower rates of usage among seniors (White et al., 2002). This population, however, is more likely to become involved with ICTs if provided with proper training (Bradley & Poppen, 2003; Cotten, 2009; McConatha, McConatha, & Dermigny, 1994; Morrell, Mayhorn, & Bennett, 2000; Swindell, 2001; White et al., 2002) and modifi ed equipment (Czaja & Barr, 1989; Hutchinson et al., 1997; White et al., 1999). Computer and technology manufacturers need to consider this population when designing products (Czaja & Barr, 1989; White et al., 1999), especially considering that many older adults are interested in becoming users (Hutchinson et al., 1997).

Seniors who are isolated and homebound often become less lonely over time after becoming involved in online activity (Barnett & Adkins, 2001; Blit-Cohen & Litwin, 2004; Bradley & Poppen, 2003; McMellon & Schiffman, 2002; Swindell, 2001; White et al., 1999; White et al., 2002). Overall, the Internet has the potential to enrich older adults' lives, allowing them to build and maintain social networks, and enabling them to extend their lives past the confines of their homes or care domiciles (Barnett & Adkins, 2001; Blit-Cohen & Litwin, 2004; McConatha et al., 1994; McMellon & Schiffman, 2002; Swindell, 2001).

Family

Some older adults report online activity as being a means through which they can become closer to their families (Karavidas, Lim, & Katsikas, 2005; McMellon & Schiffman, 2002). Communicating with family often ranks as being of the highest benefit for online participation

for older adults (Fox et al., 2001). Having geographically distant adult children often acts as a motivator for seniors to get online. As Climo (2001) reported, dispersed families often use the Internet as a primary vehicle through which they sustain generational bonds.

Friends

Older adults often use ICTs to maintain friendships that have extended over the life course. The Internet enables this population to maintain a friendship network through the use of e-mail, IM, and chatting online (Karavidas et al., 2005). For those with limited mobility, the online world may become a crucial aspect of their environment (McMellon & Schiffman, 2002), enabling them to stay connected to life-long friends via e-mail (Barnett & Adkins, 2001). Cody and others (1999) found that having satisfying contacts with friends prompted a greater use of e-mail. Furthermore, there is a gender effect in using the Internet to maintain social ties, with older women being more likely than older men to use the Internet to connect with friends (Millward, 2003).

Not only do older adults use ICTs to maintain existing friendships, but they also use them to develop new ties. Older adults involved in a computer training program in China found supportive peer relationships they had not formerly had as a result of their involvement (Xie, 2007). Similarly, Czaja and Barr (1989) reported that older adults were able to form new friendships through the use of e-mail networks and support groups. As shown with a group of previously unacquainted quilters (Barnett & Adkins, 2001), a common interest may be a catalyst by which a large online network is formed. Friendships that are formed online may eventually go offline as well (Kanayama, 2003; McMellon & Schiffman, 2002). Overall, ICTs can help older adults build supportive friendships that provide companionship (Kanayama, 2003) at a time when decreased social engagement is a normative experience.

Gaps in Literature on Older Adults, Social Ties, and Technology

Over 5 years ago, Adams and Stevenson (2004) documented a lack of literature on older adults' use of technology. Since that time, there have been multiple studies conducted on the topic, with some even documenting how technology mediates older adults' personal relationships, but there are still gaps in the literature. For instance, little is known about how older adults might use technology to develop and maintain romantic relationships. Research tells us that older adults primarily use ICTs for e-mail and information seeking (Fox, 2004); however, there is still more to learn about seniors' online dating patterns. Are "silver surfers" open to exploring the online world for this domain of life? And if so, what are the outcomes? Might older adults capitalize on a wider pool of potential romantic partners if they use ICTs?

Although Jones and Fox (2009; see Table 1) found that 15% of those 64 years and older used SNSs, much still remains to be learned about how this age group interacts with ICTs to mediate their personal relationships. Is this demographic group beginning to use these sites as a way to connect with family and friends? We simply do not know, because only sparse data are available, as evidenced by those 65 and older not even being represented on Facebook's recent graph on the site's usage (Inside Facebook, 2009b). Likewise, little is known about older adults' use of blogging. Although we do know that almost 40% of those 64 and older who go online are blog

readers, and that 12% are bloggers, we know little of how these usage trends might impact older adults' social relationships.

We also know little about how ICT use helps mediate the effects of social isolation and isolation from place among older adults. Because of declining mobility, older adults are less likely to be able to travel as extensively as perhaps they did in their younger years. Using the Internet, in particular, offers the potential for individuals to "visit" places through the computer that they are no longer physically capable of visiting in person (Cotten, 2009). How these activities affect older adults' social connections, sense of isolation, and quality of life remains to be determined.

Lastly, there is still more conclusive research needed on the relationship of ICTs to older adults' well-being. Although multiple studies have documented a connection between the two (Cody et al., 1999; Karavidas et al., 2005; McConatha et al., 1994; McMellon & Schiffman, 2002; White et al., 1999; Wright, 2000; Xie, 2007), at least one has demonstrated the contrary (Dickinson & Gregor, 2006). Barriers to consistent findings on the topic include the lack of a systematic definition of well-being and a misattribution of the effects of computer-training programs to computer use itself rather than to the social connections and interactions that are a result of the training programs (Cotten, 2009; Dickinson & Gregor, 2006). In sum, we need to continue to explore how older adults use ICTs and how this might influence their well-being.

THE FUTURE OF RESEARCH ON THE IMPACT OF TECHNOLOGY ON CLOSE RELATIONSHIPS ACROSS THE LIFE SPAN

Studying the impact of technology on social ties across the life span represents theoretical and methodological challenges. These challenges include the need to revisit concepts developed when scholars assumed that face-to-face contact was necessary for the formation and maintenance of social ties (Adams, 1998) and to apply theories of aging, group development, and network change to content (Adams & Stevenson, 2004) that is changing so quickly it is almost impossible to study. Longitudinal studies are needed that simultaneously follow multiple cohorts of individuals as they make transitions from one stage of the life course to another or achieve a new phase of developmental maturity. Such studies would be an improvement over current cross-sectional studies, especially those that do not compare findings across age groups, and would allow for the development of an understanding of both social and developmental age, period, and cohort effects on the ways in which the use of technology mediates the formation, maintenance, and erosion of personal relationships. New approaches to study design and implementation will be necessary to allow researchers to capture a sufficient number of cross-sectional snapshots of the social landscape to illustrate the complexities of its evolution.

As in most bodies of literature, the focus of research on the use of the technology and the establishment and evolution of social ties in specific age groups is dictated by the particular developmental and social challenges facing them. As discussed in this chapter, the research on children's use of ICTs focuses on its dangers; the comparable work on adolescents addresses their experimentation regarding their status, identity, and the interpretation of social cues; the sparse examinations of ICT use in midlife are conducted in the context of work, education, and leisure activities; and the literature on later adulthood focuses on the developmental and physical challenges the use of ICTs pose and the ways their use can reduce loneliness and improve quality

of life. In-depth studies of these topics and others across all age groups would allow for a more meaningful assessment of how the relationships between technology use and the constellation of social ties change over the life course.

As we noted in earlier sections of this chapter, there are inherent digital divide issues that must also be considered when one is studying the impacts of technology usage on social ties across the life course. Within each of the groups discussed in this chapter, there are those who are on the wrong side of the digital divide. Research shows that those with lower levels of education and income are less likely to have ICT access and to be skilled in the effective use of ICTs (Davison & Cotten, 2009; DiMaggio et al., 2004). As our review of the literature on ICT use by people of different ages shows, developmental and age-based social factors can also inhibit or facilitate patterns of usage. As Table 1 illustrates, just as different levels of use occur across socioeconomic groups, different levels of use occur across age groups. Researchers must also consider how age factors into digital divide issues, as usage patterns (and probably effects) vary dramatically depending upon the specific type of ICT and the age group being examined.

When Adams and Stevenson wrote their 2004 chapter, the importance of ICTs for personal relationships was just beginning to be apparent. Some still viewed the topic as trivial or merely of transitory importance. Considering the current pervasiveness of ICT use, it should now be clear that studying ICT use is central to understanding not only personal relationships, but everyday life as a whole, not only now, but for the foreseeable future. One can only imagine what life will be like when digital natives comprise the entire population and cohorts are defined by when they first have access to as-yet-to-be-imagined innovations in ICTs. Between now and then, researchers will need to be vigilant and work quickly if they are to record the evolution of the ways we relate to each other as ICTs change.

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