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**Does Online Technology Make Us More or Less Sociable? A Preliminary Review and Call
for Research**

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Acknowledgments: We thank Sherry Turkle, Paul Bloom, Ed O'Brien, Chloe Keywell, and Nicholas Ortiz for their assistance and feedback.

Abstract

How does online technology impact sociability? Emerging evidence—much of it inconclusive—suggests a nuanced relationship between online technology (the internet, social media, and virtual reality) and sociability (emotion recognition, empathy, perspective-taking, and emotional intelligence). While online technology can facilitate purely positive (e.g., charitable giving) or negative behavior (e.g., cyberbullying), it appears to impact sociability in three ways, depending on whether it allows a deeper understanding of people's thoughts and feelings: (1) It benefits sociability when it complements already-deep offline engagement with others. (2) It impairs sociability when it supplants deeper offline engagement for superficial online engagement. (3) It enhances sociability when deep offline engagement is otherwise difficult to attain. We suggest potential implications and moderators of technology's effects on sociability, and call for additional causal research.

Does Online Technology Make Us More or Less Sociable? A Preliminary Review and Call for Research

Two prominent competing views over modern technology come from two unlikely sources: the two most recent popes. Pope Benedict XVI (Lazar, 2010), voiced concern about mobile technology in stating that young people “establish forms of communication that do not increase humaneness but instead risk increasing a sense of solitude and disorientation.” Pope Francis (May, 2016), on the other hand, has called the internet a “gift from God,” stating, “The networks of human communication have made unprecedented advances... The Internet, in particular, offers immense possibilities for encounter and solidarity.”

These two opposing viewpoints are also echoed by less pious sources. In *Alone Together* (2012) renowned media scholar Sherry Turkle presents a starkly pessimistic view of technology’s effect on humans, suggesting that “We seem determined to give human qualities to objects and content to treat each other as things.” In contrast to Turkle’s pessimism, leading media theorist Keith N. Hampton (2015) states, “What has changed is that communication technologies have made many of our relationships more persistent and pervasive. This, in turn, is transforming how we relate to those around us, in what are mostly positive ways.”

More recently, an *Atlantic* article by Jean Twenge (2017a) titled “Have Smartphones Destroyed a Generation?” sifts through longitudinal studies of mental health to argue that online technology is harming our social lives. Twenge writes, “Social-networking sites like Facebook promise to connect us to friends. But the portrait of iGen teens emerging from the data is one of a lonely, dislocated generation.” Yet Twenge’s own book, *iGen* (2017b) also argues that online technology makes this “dislocated” generation more inclusive and empathic toward others of

dissimilar sexual identities, races, and ethnicities: “They’re exquisitely tolerant and have brought a new awareness of equality, mental health, and LGBT rights (p. 612).”

These dueling perspectives—Pope Benedict XVI versus Pope Francis, Turkle versus Hampton, and Twenge’s positive versus negative views—seem to be reflected in the scientific record. One large-scale study analyzed self-reported empathy from 72 samples of American college students ($N = 13,737$) and found that empathy decreased from 1979 to 2009—which was partially attributed to increasing internet use (Konrath, O’Brien, & Hsing, 2010). Of course, decreasing empathy could also be tied to increases in narcissism (Twenge & Foster, 2010) and political partisanship (Andris et al., 2015), and perhaps also to changing parenting practices and societal expectations for success (Konrath et al., 2013). However, the negative relationship between internet use and empathy is consistent with research showing that people who connect to others via technology are more likely to live alone and neglect civic institutions (Lofland, 1998; Putnam, 2000; Hampton, Sessions, & Ja Her, 2011; Klinenberg, 2012). Given that some of the work cited here was conducted when online technology use was not universal, it is important to note that these patterns seem to persist in more recent years when online technology has become widespread.

In contrast, other scholarly work presents a more optimistic view. Research demonstrates that frequent internet use is associated with higher trust because it allows for open information exchange and community development (Beaudoin, 2010; Shah, McLeod, & Yoon, 2001), and more community participation (Hampton & Wellman, 2003; Wellman, Haase, Witte, & Hampton, 2001). Frequent use of specific certain mobile applications designed with psychiatric treatment in mind may also help improve mental health disorders through enhanced online social support and connection (Dobbs, 2017).

These contradictory findings—that internet use functions as both social connector and separator—are further muddled by research that reveals a more complex relationship between online technology and sociability. To unravel this complexity, we systematically explore the emerging science of online technology’s effects on social understanding and social sensitivity.

Exploring sociability

Most research on the psychological effects of technology has focused on social connection, and its inverse, social isolation (Kraut, Patterson, Lundmark, Kiesler, Mukophadhyay, & Scherlis, 1998; Kraut, Kiesler, Boneva, Cummings, Hegelson, & Crawford, 2002; Amichai-Hamburger & Benartzi, 2003; Morahan-Martin & Schumacher, 2003). Although social connection is undoubtedly important as it predicts health and longevity (Cacioppo & Patrick, 2008), technology may also impact *sociability*. Sociability is defined as people’s capacity and tendency to be sociable—to recognize and respond positively to others’ mental states (thoughts, feelings, beliefs, intentions, desires).

Sociability includes diverse psychological processes: empathy, an “other-oriented emotion elicited by and congruent with the perceived welfare of someone in need” (Batson, 2009, p. 11) that includes mentalizing (considering others’ mental states), experience-sharing (vicariously sharing one’s mental states), and prosocial concern (expressing motivation to improve others’ mental experiences) (Zaki & Ochsner, 2012); emotional intelligence (the general capacity to understand others’ emotions, assimilate one’s emotions into thought, and to express and regulate one’s own emotions; Mayer, Salovey, Caruso, & Cherkasskiy, 2011); perspective-taking (akin to mentalizing, the capacity to read and infer others’ mental states; Frith & Frith, 2006); and emotion recognition (the accurate identification of others’ emotions from facial expressions or vocal tone; Elfenbein & Ambady, 2002). While we acknowledge that these

processes are sometimes distinct (e.g., self-reported empathy and accurate emotion recognition can diverge from each other; Zaki, Bolger, & Ochsner, 2008), all these processes have a common essential attribute—each involves the perception of others’ minds (Waytz, Gray, Epley, & Wegner, 2010; Wegner & Gray, 2016). Colloquially, sociability involves appreciating the mental depth of others, looking beyond the words and actions of superficial interaction to accurately intuit others’ thoughts and feelings.

Initial inconclusive empirical investigations

To investigate the link between online technology use and sociability, we attempted to examine several existing data sources. First, we constructed a broad, global dataset using 2016 internet penetration rates per country (percentage of internet users per population of a country; <http://internetlivestats.com>, 2016) as a proxy for online technology use. To capture empathy, we obtained country-level empathy scores from a massive study of self-reported empathic concern (using the subscale from the interpersonal reactivity index; Davis, 1983) from 104,365 participants online in 63 countries (Chopik, O’Brien, & Konrath, 2017)¹. There was a significant negative correlation between internet penetration and empathy, $r(60)=-.31, p=.016$ (See Figure 1), suggesting that people in countries with higher internet availability have lower levels of empathy—although we note that respondents were not necessarily nationally representative and sample size varied across country.

Figure 1 about here

¹ Internet penetration rate for South Korea was used for what the authors of the empathy study indicated simply as “Korea,” and Taiwan was excluded from analysis because no Internet penetration score was available. In the secondary analyses, “Korea” was indicated for the GDP data and “South Korea” was used for individualism

We then submitted this data to several robustness checks. First, we examined two additional variables that could account for this relationship, gross domestic product (GDP) and individualism. We took country-level GDP (in billions) for 2016 from the International Monetary Fund's (2017) World Economic Outlook Database and individualism scores from Geert Hofstede's (2017) research database that has used large-scale data to calculate each country's individualistic versus collectivistic tendencies (i.e., the extent to which the self-concept is defined in terms of "I" rather than "we"). GDP was not correlated significantly with either internet penetration or empathy ($p > .17$) and in a regression in which internet penetration and GDP were entered as simultaneous predictors of empathy, internet penetration predicted empathy, $\beta = -.32$, $t(59) = 2.61$, $p = .011$, but GDP did not ($p > .11$). Results were the same when excluding the United States and China, which exhibited GDP 3 *SDs* beyond the mean.

Individualism was correlated with both internet penetration, $r(60) = .64$, $p < .001$, and empathy, $r(60) = -.34$, $p = .007$. A regression in which internet penetration and individualism were entered as simultaneous predictors of empathy revealed that neither predicted empathy ($p > .12$). This finding suggests that individualism does not predict empathy over and above internet penetration when accounting for both variables. In addition, although we consider empathy to be the "outcome variable" in our analyses, for exploratory purposes, we also examined a regression predicting internet penetration using individualism and empathy as predictors. Here, individualism, $\beta = .60$, $t(59) = 5.72$, $p < .001$, but not empathy ($p = .34$) predicted internet penetration, which suggests a stronger relationship between individualism and internet penetration than between empathy and internet penetration.

We also examined the correlation between empathic concern and internet penetration after excluding Ecuador, a country whose empathy score (4.12) fell just outside 3 *SDs* of the

mean (4.08). We found this correlation remained nearly significant, $r(59)=-.25, p=.0509$, suggesting that this result is not meaningfully driven by one outlier, although ultimately our sample size is smaller than is desirable to produce a stable estimate (Schönbrodt & Perugini, 2013). Overall, these analyses suggest a negative relationship between empathy and internet penetration, but one that is ultimately inconclusive and potentially dependent on other variables.

To address issues of sample size, third variables, and representativeness of sample, we also sought additional data, specifically from the US. The only appropriate data were the 2002 and 2004 versions of the General Social Survey (GSS) (Davis, Smith, & Marsden, 2007), which asked a nationally representative American sample seven questions about empathic concern (items rated from 1=*does not describe me very well*; 5=*describes very well*, e.g., “I often have tender, concerned feelings for people less fortunate than me”). Reverse-scoring appropriate items, coding “don’t know”/NA/no answer responses as blank, and averaging these items produced an empathy composite ($\alpha>.71$).

To assess online technology, we identified two measures of online technology use, one assessing how much time per week respondents spent using email and one assessing time spent using the internet (not including email). The 2002 survey also asked how much time was spent on the web was spent chatting online (e.g., in discussion forums). Notably, these items screen out people who report no computer use or access to internet through WebTV, and come from a time prior to the proliferation of online technology and social media. Nevertheless, they capture prevailing practices of online technology use at the time.

In 2002, empathy did not significantly correlate with chatting online, $r(310)=.005, p=.93$, but negatively correlated with time spent emailing, $r(911)=-.07, p=.047$. Amongst those using the internet for purposes other than email, empathy was marginally negatively correlated with

time spent using it, $r(754)=-.06, p=.076$. We acknowledge that these correlations are small given the large sample sizes, and the correlation between empathy. In addition, the correlation between empathy and non-emailing internet use becomes nonsignificant when controlling for respondents' age and gender ($r=-.03, p=.34$), although the negative correlation between empathy and emailing remained significant controlling for age and gender ($r=-.07, p=.049$). In 2004, the only correlation we could compute was time spent on the web and empathy, which was not significant, $r(828)=-.04, p=.30$. Thus, results from the GSS again hint at a negative relationship between online technology use and empathy, but are largely inconclusive.

The inconclusive patterns revealed in these three datasets (our internet penetration analysis, and the two GSS samples) suggest a more nuanced relationship between sociability and online technology use. In this paper, we synthesize the existing literature on online technology and sociability and reveal that—among existing evidence—there is support for both positive and negative effects of technology on sociability. Despite some clear cases of online technology being good or bad for sociability, we suggest that its impact depends mostly upon how it is used—on whether it allows a deeper understanding of other minds.

Online technology and sociability: A question of allowing interpersonal depth

As we introduced above, sociability is about understanding the thoughts and feelings of others: divining motivations that drive actions, seeing emotions that define experiences, and being able to share someone's perspective. Research examining offline interactions reveals that sociability is increased through experiencing interpersonal depth, which is the type of engagement one experiences with a partner in a socially close relationship: personal exchanges that are frequent and rich, enabling people to know others' thoughts, feelings, and desires. Deep (vs. superficial) engagement in offline interactions builds many capacities of sociability

including emotion recognition (Elfenbein & Ambady, 2003), empathy (Beeney, Franklin, Levy, & Adams, 2011), perspective-taking (McPherson-Frantz & Janoff-Bulman, 2000), and emotional intelligence (Schutte, Malouff et al., 2001), and the same is likely true for online interactions. Online technology use should increase sociability when it provides interpersonal depth and gives a clearer sense of other people's minds. Conversely, online technology should decrease sociability when it provides only superficial interactions and prevents a deeper understanding of other people.

Importantly, online interactions differ from offline interactions. In many cases, online technology seems specifically designed to obscure mental depth by providing anonymity and increasing social distance. As the old cartoon goes, "On the internet nobody knows you're a dog;" online technology obscures not only people's identity but also their underlying thoughts and emotions. Consider the amount of social and affective information conveyed in an offline conversation versus an online twitter post. An offline conversation relies upon unbounded speaking, which communicates emotion and confidence (or lack thereof) via tone, pitch changes, and pauses (Gobl & Ni Chasaide, 2003; Kraus, 2017). In contrast, an online tweet relies upon a mere 140 written characters, which strip away nuance and only conveys emotional experience via exclamations points or trite emojis. Even email, which allows for unlimited writing, is often misinterpreted because it lacks clear cues to people's underlying mental processes (Byron, 2008). We are quick to acknowledge that online interactions do sometimes allow for deep interpersonal connection, as some people find their spouses in chatrooms and online game rooms (Dutton, Helsper, Whitty, Li, Buckwalter, & Lee, 2009). However, we suggest that there is at least a relative asymmetry, such that others' minds are more obscured online than offline.

Even if online technology is more distancing than offline interactions, it still likely allows for increased interpersonal understanding when people already have a deep offline connection. Compare reading the tweet of your best friend or a stranger. With your best friend, you already understand their typical thoughts and feelings (see Stinson & Ickes, 1992), giving the tweet both context and an emotional richness that further deepens your understanding of your friend's mental processes—thereby building sociability. In contrast, the tweet of a stranger lacks any underlying context, yielding less information about underlying mental states and undermining sociability. Of course, for people who lack any deep offline relationships, then even the relatively superficial insight into other minds provided by online technology may be better than nothing.

More concretely, we suggest three relationships between online technology and sociability. One, online technology should build sociability when it complements already deep offline engagement—in which people already have access to other's thoughts and feelings (Figure 2; Arrow 1). Two, online technology should impair sociability when it pulls people away from this deep offline engagement, redirecting them to relatively superficial relationships—in which people lack access to other's thoughts and feelings (Figure 2; Arrow 2). Three, online technology should improve sociability—even when relatively superficial—for people who otherwise lack deep offline social engagement with others (Figure 2; Arrow 3). For example, someone suffering from severe autism or social anxiety may only have access to others' thoughts and feelings via online technology (Kandalaf, Didehbani, Krawczyk, Allen, & Chapman, 2013).

Figure 2 about here

This model therefore suggests that the consequences of online technology depend upon whether it encourages or inhibits interpersonal depth. This relationship depends not only on the characteristics of the user—the scope and depth of their offline networks—but also upon the specific kind of online technology used. Facebook, with its ability to share volumes of family pictures, likely provides more of an insight into people’s feelings than does reading the comments section of an online pornography video. Although the term “online technology” is vague, we define it as technical means used to connect people to a platform not physically present, which includes the internet, mobile applications, and virtual reality. While virtual reality does not always require internet connectivity, it falls under our definition because it transports people beyond their current offline physical reality—it involves creating a proxy presence for oneself to interact with others. We recognize that virtual reality involves interacting with less proximal (and more fictive) others compared to other online technologies, but given the relative dearth of literature on technology and sociability we erred toward over-including relevant research.

Our literature review identified all papers we could find that examined associations between the specific technologies identified here and the specific sociability capacities identified above—empathy, emotional intelligence, perspective-taking, and emotion recognition. We therefore did not include literature on outcomes and correlates of sociability, such as social anxiety, homophily, and intimacy, although we do address them in our general discussion. Table 1 sorts the empirical literature reviewed here in terms of technology type and sociability dimension, and also reveals the limited or non-existent nature of certain literatures, which we revisit in the general discussion.

Good or Bad?

An outlet for pro-sociality

Online technology can promote sociability when it brings people together to raise money and awareness for social issues. Consider the “Ice Bucket Challenge,” in which people posted online videos of themselves dumping buckets of ice water over their heads and asking friends to either do the same or donate to amyotrophic lateral sclerosis (A.L.S.) research. Despite the arguably frivolous premise, this movement raised over \$115 million for the A.L.S. Association (Rogers, 2016). Online social media enabled the Ice Bucket Challenge to propagate easily through social networks and provided visible “social proof” of others’ participation, raising money more effectively than had this event took place only offline (Koohy & Koohy, 2014; Sutherland, 2016).

Empirical research also reveals that online technology provides a pathway for people to express empathy offline. In a 2011 Pew Survey (Rainie, Purcell, & Smith, 2011) Americans reported feeling that the internet helped them to donate money, volunteer, and provide emotional support to others. The internet has also given rise to new forms of activism that increase participation in various offline social movements and causes (Earl, Kimport, Prieto, Rush, & Reynoso, 2010). Open questions remain whether this online participation translates into offline behavior (Earl & Kimport, 2011; Gladwell, 2010). For example, one large scale analysis of Facebook “causes” found that while many people “like” a charitable cause, this seldom translates into actual donations (Lewis, Gray, & Meierhenrich, 2014). Nevertheless, technology makes activism easier by providing a low-cost platform for outreach and organization, and provides a public forum to display commitment. At least one study found that signing an online petition increases people’s donations to a related charity, supporting a possible link between online and

offline activism (Lee & Hsieh, 2013). In sum, evidence suggests the possibility for online technology—and the internet in particular—to facilitate sociability by easily allowing people to express prosocial concern for others.

An outlet for anti-sociality

Of course, online technology can also be used specifically for anti-social means. Social communities can form online specifically for the purposes of criticizing, harming, and exposing others in embarrassing ways, such as some forums on discussion website, Reddit. The “dark web” (a set of networks inaccessible by traditional search engines) enables people to coordinate in illegal activities such as distributing child pornography or recruiting people for terrorist activities.

The ease with which (mis)information circulates broadly, anonymously, and quickly on the internet also creates new opportunities to harm people personally. In 2012, Amanda Todd posted a video on YouTube describing how she was blackmailed and cyberbullied by a stranger she met online. This cyberbully circulated a nude photo of Todd that he had pressured her to take, eventually creating a fake Facebook profile and contacting her real-life classmates, who ridiculed Todd. The day after posting this video, Todd committed suicide, clearly illustrating the potentially destructive outcomes of cyberbullying.

Cyberbullying, like many of the behaviors described in this section, represent augmented versions of behaviors that can be performed offline as well (i.e., traditional bullying). Online technology enables people to perform these behaviors more anonymously and often more efficiently, exacerbating consequences for sociability. Many studies reveal an association between cyberbullying—aggressive online behavior—and declines in empathy (Steffgen, König, Pfetsch, Melzer, 2011; Topcu & Erdur-Baker, 2012; Kowalski, Giumetti, Schroeder, Lattanner,

2014; Brewer & Kerslake, 2015). In one large-scale study (Steffgen et al., 2011), researchers assessed over 2000 secondary school students in Luxembourg, examining their *lack* of empathy (i.e., whether they believed that victims of online harassment deserved it) and their frequency of cyberbullying, through social media and direct online communication. Students who reported engaging in more cyberbullying possessed less empathy, suggesting two possible causal associations: reduced empathy can contribute to cyberbullying, and also engaging in cyberbullying can reduce empathy.

Sociability is also likely impacted by playing violent video games, which often occurs online and through virtual reality technology. One meta-analysis demonstrates that online violent video games reduces empathy and increases anti-social behavior (Anderson, Shibuya et al., 2010), and another demonstrates that, whereas playing prosocial video games reduces aggression, playing violent video games increases aggression (Greitemeyer & Mugge, 2014). Despite the strength of these effects, most empirical research examining video games and sociability typically uses correlational analyses with self-reports (Funk, Buchman, Jenks, & Becholdt, 2003; Wei, 2007; Zhen, Xie, Zhang, Wang, & Li, 2011). As with cyberbullying, the relationship between violent video game play and low sociability might be bidirectional. However, the use of longitudinal analyses (Krahé, Busching, Möller, 2012), experiments (Bartholow, Sestir, & Davis, 2005), and the meta-analytic techniques noted here (Anderson et al., 2010; Greitemeyer & Mugge, 2014) can better provide causal evidence.

Beyond cyberbullying and violent video game play, excessive online pornography consumption may also reduce sociability. The internet makes it easy to access to varied forms of pornography including violent pornography (Short, Black, Smith, Wetterneck, & Wells, 2011), which is associated with reduced empathy for victims of sexual assault (Foubert, Brosi, &

Bannon, 2011). Other work finds that addictive internet use, which includes pornography consumption, is tied to lower emotional intelligence (Parker, Taylor, Eastabrook, Schell, & Wood, 2008). The conclusions of these studies are tentative because they rely largely upon the self-reports of self-selected participants and do not establish causality; nevertheless, research generally supports the idea that antisocial online behavior reduces sociability, just as antisocial offline behavior spurs further disregard for others (Martens, Kosloff, Greenberg, Landau, & Schmader, 2007; Martens, Kosloff, Jackson, 2010).

Online Technology: Beyond Good or Bad

Although online technology can directly facilitate pro- and anti-sociality, links between technology and sociability are likely more nuanced. Just as research finds digital screen use to have neither inherently negative nor positive effects on mental well-being (Przybylski & Weinstein, 2017), so too does online technology likely both help and harm sociability. Again, we suggest that online technology use can improve sociability when it reinforces otherwise deep offline relationships, and can hinder sociability when it detracts from these deeper offline relationships in favor of superficial online-only relationships. While superficial online-only interactions can detract from sociability, we acknowledge it can improve sociability if it is someone's only means of social engagement. In other words, online technology enhances sociability when people use it to bolster or create relationships with prospective or existing offline friends, but is associated with diminished sociability when used excessively—unless face-to-face social engagement does not come easily.

Deepening pre-existing offline interactions

Existing research suggests that communicating with one's friends online has a positive relationship with overall perceptions of friendship quality (Davis, 2013) and relationship quality

with offline friends (Valkenburg & Peter, 2007). The one comprehensive longitudinal study of online technology and sociability found a positive relationship between social media use and empathy in 942 Dutch adolescents (Vossen & Valkenburg, 2016). This study measured self-reported use of instant messaging applications and social network websites, empathic concern (termed “sympathy” by the authors), cognitive empathy (understanding others’ feelings), and affective empathy (sharing others’ feelings). Increased social media use predicted increased cognitive and affective empathy (although it did not affect empathic concern) across two time points, demonstrating a potential causal pathway: Social media use *increased* empathic processes. Importantly, most users of technology used only a moderate amount (e.g., on average people used social media for 11 hours per week at Time 1 and 17 hours per week at Time 2).

Although less capable of establishing causal links, three cross-sectional studies have also measured social media use and social skills. Two of them showed similar positive relationships—using Facebook to chat with friends (many of whom constitute offline friends as well) corresponded to higher self-reported perspective-taking for males (Alloway, Runac, Quershi, & Kemp, 2014) and to increased empathic concern for both males and females (Collins, 2014). The other cross-sectional study showed an inconsistent relationship between online activity and empathy partially because online activity was operationalized to include watching television (Carrier, Spradlin, Bunce, Rosen, & 2015). However, this study did show that online activities that increased face-to-face interaction enhanced empathy for females.

Together, these studies reveal the benefits of using online technology to complement offline relationships. One study suggests that Facebook functions primarily as a tool for staying connected and the chat function offers opportunities for some users to practice their social skills (Alloway et al., 2014). Another suggests that Facebook gives people more opportunities than

they otherwise would have to engage with others and to empathize (Collins, 2014). Overall, online technology enables people to maintain relationships, strengthen empathy, and improve perspective-taking when used to supplement off-line communication. As we describe next, despite its benefits as a supplement to social engagement, online technology is a poor replacement for offline communication.

Replacing offline interactions with superficial online interactions

People often use social media primarily because they desire social connection (Gangadharbatla, 2008; Sheldon, Abad, Hinsch, 2011). However, online connection does not sufficiently substitute for face-to-face connection in providing social support (Lee, Leung, Lo, Xiong, & Wu, 2011)—or in enhancing social skills (Kruger, Epley, Parker, & Ng, 2005).

At least one study shows that people crave who online connectivity and depend obsessively on their mobile phones have less emotional intelligence, particularly in terms of emotion regulation (Beranuy, Oberst, Carbonell, Chamarro, 2009, but see van Deursen, Bolle, Hegner, & Kommers, 2015). An Iranian study of medical students showed that internet addiction was correlated with lowered emotional intelligence (Hamissi, Babaie, Hosseini, & Babaie, 2013). Similarly, a study of Korean nursing students found that smartphone addiction was related to experiences of personal distress—rather than empathic concern—in response to others' suffering (Jeong & Lee, 2015), consistent with surveys from China and Germany showing that internet overuse corresponds to lower self-reported empathy (Melchers, Li, Chen, Zhang, & Montag, 2015). Other research examining 1,051 American and European videogame players measured emotional intelligence and showed that lower emotional intelligence is related to frequently playing massively the top-selling multiplayer online role-playing game, *World of Warcraft* (Herodotou, Kambouri, & Winters, 2011).

Two experiments also provide suggestive *causal* evidence that overreliance on online technology can reduce social skills. The first examined 51 students who spent five days at an overnight camp where computers, mobile phones, and television were banned. These students were avid technology users, spending on average almost one hour per day texting, more than two hours per day watching TV, and over one hour per day playing video games (Uhls, Michikyan et al., 2014). Compared to a matched control group that continued using online technology, the technology-deprived group showed improved emotion recognition. Of course, it is unclear whether the absence of technology or some other aspect of the camp accounted for this effect, but it is likely that increased opportunities for offline social interaction can enhance sociability. It is also possible that reducing technology use has the greatest benefits for the most avid users.

A second experiment suggests the mere presence of mobile technology can diminish sociability (Przybylski & Weinstein, 2013). Researchers randomly assigned people to communicate about an important or unimportant topic while sitting next to a mobile phone or not. When the phone was present, participants who discussed important issues reported less connection with their conversation partner, less trust, worse perceived relationship quality, and less perceived empathy from their partner. Although this study does not assess participants' own empathy—or their baseline use of online technology—it also provides the possibility for a negative relationship between online technology and sociability, given the relationship between empathy and trust (Batson & Moran, 1999; Singer, Seymour, O'Doherty, Stephan, Dolan, & Frith, 2006).

Notably, existing research does not suggest a tradeoff between mere time spent online and time spent offline in social activities, as some research on adolescents indicates a positive relationship between internet use and participation in real-world sports and clubs (Romer,

Bagdasarov, & More, 2013). Other work has shown that internet use supports “neighboring” behavior, communicating with one’s neighbors both on and offline (Hampton & Wellman, 2003). Rather than suggesting a hydraulic relationship between time spent online and offline, we suggest that the *way* people interact socially through online technology can compromise the ability to exhibit sociability more broadly.

Providing interaction for those who lack in-depth offline interactions

Even if online technology is a lower-quality substitute for in-person relationships, it may benefit those who lack opportunity or capacity for extensive offline social connection and interaction. Several lines of research in offline contexts show how interventions can improve sociability in those with related deficits. For example, one study showed that administering oxytocin, a hormone implicated in social bonding, improved empathic accuracy in individuals who are high on the autism spectrum but not individuals low on the autism spectrum (Bartz, Zaki, et al., 2010). Another study showed that explicit perspective-taking instructions increased empathic concern for people high in maladaptive narcissism but not for people low in maladaptive narcissism (Hepper, Hart, & Sedikides, 2014). Similarly, a study showed that when psychopaths viewed emotion-laden videos of others, they generally showed less empathy-related brain activation, but showed normal levels of empathy when explicitly instructed to empathize with the people in the videos (Meffert, Gazzola, den Boer, Bartels, & Keysers, 2013).

Consistent with this work, research reveals that online technology can improve sociability for those with autism. Autistic individuals can learn sociability online because this setting offers greater flexibility in pace of communication and reduced stress in decoding nonverbal signals (Benford & Standen, 2009; Burke, Kraut, & Williams, 2010). Numerous studies have used computer mediated virtual environments to enhance the social competence of those with autism

(Beardon, Parsons, & Neale, 2001; Cheng, Moore, McGrath & Fan, 2005; Mitchell, Parsons, & Leonard, 2007; Moore, Cheng, McGrath, & Powell, 2005; Cheng & Fan, 2008), with some tangible benefits to sociability.

In one study, three children (8-10 years of age) on the autism spectrum represented themselves with a 3D avatar and interacted with other avatars in various social situations, such as someone cutting the queue in a restaurant line (Cheng, Chiang, Ye, & Cheng, 2010). They were then asked questions tapping empathy (e.g., “How do you feel when someone suddenly cuts in line in front of you?”) with appropriate responses rewarded by an expressive avatar and inappropriate responses corrected. Empathy, measured at baseline and after this intervention, was operationalized in terms of responses of tolerance, respect, and kindness towards others’ misfortune. All three participants showed gains in empathy because of this virtual environment intervention. A similar study of four children (9-10 years of age) simulated social interaction through virtual reality and showed gains in correctly interpreting bodily gestures and facial expressions (Ke & Im, 2013)

Other studies using technology have revealed similar gains in sociability with neurodivergent individuals, but many use small samples. In one study with 49 participants, avatar-based virtual environments successfully trained autistic individuals on facial recognition and emotion recognition (Hopkins, Gower, et al., 2011). A similar study with only eight autistic young adults, found improvements and emotion recognition resulting from a 5-week training that used virtual reality to engage participants in various social tasks (Kandalaf et al., 2013). In another study with 12 participants, a similar avatar-based virtual reality program enhanced emotion perception amongst schizophrenic individuals (Rus-Calafell, Gutiérrez-Maldonado, & Ribas-Sabaté, 2014). Another study with 49 participants employed a computerized detective

game that generated marked improvements in general social competence (including capacities that require empathy) for autistic children (Beaumont & Sofronoff, 2008).

Other simulation-based technology can help enhance sociability in these populations as well. One study used multi-touch tablets that included music, puzzle-solving, photography, and drawing applications to train individuals on emotion recognition, understanding others' interests, and predicting others' emotions. Over a two-week period, use of these apps lead to higher observer ratings of sociability in 26 autistic children (Hourcade, Bullock-Rest, & Hansen, 2012). In another study, three autistic individuals observed videos in which a model performed a target behavior to be imitated; these participants showed gains in communication skills and understanding of others' emotions (Sansosti & Powell-Smith, 2008). Taken all together, these studies complement work suggesting that online technology can improve the sociability of the socially impaired.

Of course, performance on lab-based sociability tasks does not always predict real-world behavior (particularly for autistic individuals; see Fombonne, Siddons, Achard, Frith, Happe, 1994) and only some of these studies (e.g., Beaumont & Sofronoff, 2008; Kandalaf et al., 2013; Rus-Calafell et al., 2014) examine and demonstrate gains in real world social functioning. Nonetheless, these studies show that by providing a naturalistic environment for socially impaired individuals to learn social skills, online technologies appear to enable individuals to compensate for social deficits, and in some cases, *correct* for these deficits to produce improvements over time.

Online technology can also provide a “better than nothing” substitute for people for whom face-to-face social interactions are challenging or difficult to find. Studies with hearing-impaired individuals (Barak & Sadovsky, 2008), elderly individuals who are physically restricted

(Delello & McWhorter, 2015; Shillair, Rikard, Cotten, & Tsai, 2015), and breast cancer patients (Fogel, Albert, Schnabel, Ditkoff, & Neugut 2002), all reveal that online technology use is positively associated with social support, and possibly with sociability.

Some recent studies also suggest that virtual reality can improve sociability in a different context where offline engagement is difficult or lacking: empathizing with socially distant, typically disliked, or stigmatized targets. That is, virtual reality can enhance empathy toward groups or individuals toward which people are not naturally inclined to empathize. One study demonstrated that young people who were made to feel economically threatened by the elderly reported less antagonism and more empathy towards them after engaging in an immersive virtual reality exercise in which they embodied an elderly person (Oh, Bailenson, Weisz, & Zaki, 2016). Virtual reality can also be used to increase empathy toward individuals with schizophrenia. This study used virtual reality to allow participants to experience schizophrenia symptoms (i.e., hallucinations) during a pharmacy visit. Participants who experienced this simulation later reported more positive attitudes and more empathy toward people with schizophrenia compared to those in control conditions (Kalyanaraman, Penn, Ivory, & Judge, 2010). Other work showed that simulating red-green colorblindness using a virtual reality experience produced more feelings of oneness and helping behavior toward colorblind people compared to a condition where participants were asked to imagine being colorblind (Ahn, Le, & Bailenson, 2013). These measures represent close proxies to the experience-sharing and prosocial concern components of empathy.

Another study examined the effect of virtual reality simulation in a negotiation context, and found that participants who experience the perspective of one's negotiation opponent through the virtual simulation developed greater trust with the opponent and made greater

concessions in the negotiation than participants simply provided information about the opponent's perspective (Gehlbach et al., 2015). Online technology may therefore hold promise in improving situational sociability and can improve relationships with socially distant others *if* it produces engagement with these individuals and their mental experiences.

General Discussion

This paper synthesizes existing work on the relationship between using online technology (the internet, mobile applications, virtual reality) and sociability (empathy, perspective-taking, emotional intelligence, emotion recognition). Although we have attempted to provide a nuanced picture of this relationship, we acknowledge that our conclusions sometime hinge on limited data (see Table 1), which is unavoidable given this nascent literature. Because work on this topic is still emerging, we devote the rest of our review to identifying important areas of future research.

Moderating factors: development, generation, and socioeconomic status

The research we have reviewed covers studies involving a wide range of ages from young children to older adults. Given developmental differences in sociability as well as developmental differences in technology use, age is likely a critical moderator of the effects described here. For example, research on adolescents suggests that social media use has double-edged effects on social connection, identity development, and general psychological well-being—similar to what we describe here for sociability. Social media enables adolescents to join social communities, but also exposes them to opportunities for ostracism and alienation (Allen, Ryan, Gray, McInerney, & Waters, 2014; see also, Valkenburg & Peter, 2009). This pattern likely extends to sociability as well, as Facebook use in adolescents is associated with both narcissism *and* virtual empathy (Rosen, 2011). On the other hand, online technology use may have a uniformly negative effect on younger children in supplanting their still-developing sociability capacities (Blakemore &

Choudhury, 2006), and a uniformly positive effect on older adults, who—lacking mobility—may have fewer opportunities for offline social engagement (Rosso, Taylor, Tabb, & Michael, 2013). Some research suggests some negative effects for children (Isik & Alkaya, 2017) and positive effects for elderly adults (Bradley & Poppen, 2003) for general psychosocial health and social interaction, but does not examine sociability *per se*. Future work can examine the role of development more definitively.

Similar to age, generation likely moderates the relationship between online technology use and sociability. Comprehensive studies reveal much higher use of online technology in more recent generations compared to previous ones (Perrin, 2015, Rideout, Foehr, & Roberts, 2010). This increase could influence the effects of technology use on sociability in several ways. Psychologist and technology expert, Larry D. Rosen (2010), who calls today's children the "iGeneration," suggests that these technology-steeped children are more selfish and less sociable. On the other hand, increased experience with online technology might mean that this generation is more capable of using technology to complement offline social interaction, thereby boosting sociability. Cross-generational comparisons can examine these patterns further.

Socioeconomic status (SES) is another variable that likely moderates the relationship between online technology use and sociability. Those with higher SES have more access to the internet (Fox, 2005; Hargittai, 2010; Wellman, 2001) and use this access for "capital-enhancing" online activities where they gain access to useful information (Zillien & Hargittai, 2009), sometimes resulting in improved health (Wangberg, Andreassen, Prokosch, Santana, Sorensen, & Chronaki, 2007). This kind of online technology use may help those higher in SES to develop sociability, despite research suggesting more broadly that the rich (compared to the poor) are generally less concerned with the emotions and perspectives of others (Kraus, Piff, Mendoza-

Denton, Rheinschmidt & Keltner, 2012). Again, we urge future research on the role of SES in moderating the effects of online technology on sociability.

Implications for related phenomena: social anxiety and intimacy

Our literature review focused on sociability, but has implications for two closely related phenomena. One is social anxiety, the tendency to experience distress in social situations (La Greca, Dandes, Wick, Shaw, & Stone, 1988), which seems to interact both positively and negatively with online technology use. Some research shows that high social anxiety is related to problematic social media use, for example using Facebook out of fear of being disliked (Lee-Won, Herzog, & Park, 2015). Another study showed that, for high social anxiety individuals, first exposing them to a person's Facebook profile prior to meeting the person offline increased physiological arousal (Rauch, Strobel, Bella, Odachowski, & Bloom, 2014). Conversely, other work has shown that for adolescent boys high in social anxiety, chatting with others online relates to higher perceived friendship quality (Desjarlais & Willoughby, 2010). Thus, consistent with our model, work on social anxiety suggests online technology can both complement and supplant offline interaction.

Intimacy is another related phenomenon influenced by online technology. Although dating applications and websites have dramatically expanded people's ability to find close relationships, these relationships may not be of high quality (Finkel, Eastwick, Karney, Reis, & Sprecher, 2012). People are often dishonest in their online profiles (Guadagno, Okdie, & Kruse, 2011; Toma, Hancock, & Ellison, 2008)—or at least unrealistically optimistic about themselves—which leads to unfulfilled expectations when people meet offline. People also strategically represent themselves on social media (e.g., Facebook; Gil-Or, Belz, & Turel, 2015), which suggests an interesting paradox: Online technology provides opportunities for people to

consider other perspectives, but the perspectives that people offer online might not reflect their true beliefs and feelings.

Geopolitical consequences

The work we have examined here largely involves the effect of online technology use on sociability for individuals. Yet, given that societies—and their political systems—emerge from the interaction of individuals, it is worth exploring the effects of online technology on a broader scale.

In the wake of recent elections, some have suggested that online technology contributes to homophily by creating “echo chambers” in which people are exposed only to the ideas they already endorse (Boutyline & Willer, 2017). Consistent with this idea, considerable research suggests that internet use—especially social media use—facilitates the formation of ideologically homogeneous groups that shield people from dissenting ideas (Colleoni, Rozza, & Arviddson, 2014; Garrett, 2009; Quattrociocchi, Scala, & Sunstein, 2016; Zuckerman, 2013, but see Flaxman, Goel, & Rao, 2016). As substantial research demonstrates that homogeneity and tightness within an ingroup is associated with greater outgroup antagonism (Braun & Koopmans, 2010; Choi & Bowles, 2007; Cohen, Montoya, & Insko, 2006), the echo chambers created by online media may help explain the increasing political polarization (Prior, 2007) and perhaps even the rise of online hate groups (Sunstein, 2009).

However, counter to the echo chamber idea, recent work suggests that using the internet in an undirected fashion incidentally *increases* exposure to views from one’s ideological outgroups (Fletcher & Nielsen, 2017; see also Flaxman et al., 2016). This research showed that across multiple countries (Australia, Italy, the UK, and the US), people who use YouTube,

Facebook, and Twitter encounter a more ideologically diverse set of news sources than people who do not use social media.

Whether such exposure to the ideas of outgroup actually enhances sociability toward outgroup members is an open question though. Indeed, online technology may in fact decrease tolerance toward outgroups. As Figure 2 suggests, online technology can complement already-deep offline relationships—with people who likely share your ideological views—but does not naturally reveal the deeper thoughts and feelings of outgroup members who are met only online. Therefore, superficial exposure to the minds of outgroup members (Arrow 2) makes it easy for people to caricature and deride them and their ideas to ingroup members (Arrow 1). This dynamic seems to characterize Twitter (where Fletcher and Nielsen found particularly high incidental exposure to ideologically dissimilar views): people are often only exposed to tweets of “the other side” embedded—and ridiculed—within tweets of people they already follow.

Beyond the polarization of groups of individuals, there may be even more macro-level effects of online technology on sociability. Consider the finding that individuals’ mood states expressed on Twitter predict the “mood” (success or failure) of national stock markets (Bollen, Mao, & Xheng, 2011), which hints that individual effects may translate to societal phenomena.

As with individuals, we suggest that the societal effects of online technology are multifold. Governments ranging from Mexico to Russia have used the internet for antisocial means, including spying or sabotaging their perceived opponents both within and outside their countries. China monitors its own citizens and thwarts anti-government sentiments through social media applications such as WeChat (Ruan, Knockel, Ng, & Crete-Nishihata, 2016). The United States engages in considerable surveillance of its citizens through online channels as well, the extensive nature of which we know because of whistleblower, Edward Snowden’s testimony.

Although online technology can undermine free expression, access to online technology also appears to make societies more respectful and tolerant of others. Analyses of country-level values over multi-year periods (using the World Values Survey) has demonstrated that a country's technological advancement (which includes advancement of internet and communicative technologies) is positively associated with a country's endorsement of emancipative values, which include equality, desire for universal freedom, and acceptance of homosexuality (Welzel, 2013).

Online technology seems to—perhaps paradoxically—facilitate open and democratic citizenships, while aiding closed and authoritarian governments. Future research is certainly needed to explore whether this tension truly exists—and if it does—how these two trajectories may be reconciled.

Methodological opportunities

Research on technology and sociability is relatively sparse and rapidly changing. Not only does Table 1 reveals entire gaps in the literature, but this work is also limited because it (a) often relies on correlational studies that do not permit for causal claims, (b) frequently compares online technology use to no online technology, rather than to some comparable “control” activity, and (c) usually focuses on specific populations or technology-related activities (that therefore limits its generalizability). Future research, therefore, must address these shortcomings.

Most critically, research on the relationship between online technology use and social skills needs experiments that randomly assign people to online technology use before measuring sociability. This research should also better isolate the “online” element of online technology versus technology in general. For example, research that compares chatting online to not chatting

at all confounds the specific activity (chatting) with extent of online technology use. Future research can disentangle these variables by providing tightly controlled comparison conditions.

Future experimental research should also compare different types of technology use and social skills. Online technology encompasses diverse forms ranging from Facebook messaging to virtual reality environments, which likely have different effects upon social skills. Moreover, different online technology types may have specific effects upon specific social skills—perhaps Facebook messaging deepens empathic concern for old friends, whereas virtual reality enhances the ability to take new perspectives of individuals one would not normally encounter. Different technology types also enable different methods of use—Facebook messaging can be used for aggressive stalking or bullying and virtual reality can be used to simulate violence, both of which might diminish empathy. In addition, different technologies can be employed for the same type of use—for example, one could attempt to experience what it is like to be a dissimilar other through a virtual reality experience or through going online and accessing YouTube videos of people unlike oneself. Ultimately, we believe that *type of use* (i.e., how online technology is used) a more significant impact on sociability than the type of technology itself, but investigating these interactions between type, method, and user characteristics would provide a more nuanced picture of the impact of online technology.

Research should also examine different social populations because impairments in social functioning are not uniform. Although both those with autism and those with psychopathy have deficits in empathy, technological interventions may help these groups to differing degrees. For example, compared to those with psychopathy, activating empathy for those with autism relies more on establishing social connection (Gillespie, McCleery, & Oberman, 2014), and technology may be able to help establish this connection. Future research might also examine not only the

impact of online technology upon those with social deficits, but also test its effects upon those with above-average social skills.

Future research should also better distinguish between sociability as an ability versus a tendency. Most research on online technology use cannot distinguish between these types, and in many cases, we believe technology affects both similarly. For example, virtual reality training seems to build sociability as a skill for individuals with autism (Kandalaf et al., 2013), but it might do so by increasing the tendency for them to interact with others. For other populations with intact skills but with limited opportunities for face-to-face interaction (e.g., the elderly), technology use may specifically increase the tendency for sociability.

Finally, future research can also explore whether engaging with online technology changes people's opportunities to engage in the socio-emotional processes that define sociability, such as empathy and perspective-taking. In her 2015 book, *Reclaiming Conversation*, Sherry Turkle (2015, p. 20) suggests that increased engagement with technology may lead people to immerse themselves in idealized online identities that help them to avoid those in-person and in-depth conversations in which we "allow ourselves to be fully present and vulnerable... where empathy and intimacy flourish and social action gains strength." Future research can explore whether online technology not only alters their capacity for sociability, but also alters people's selection of situations in which they might employ this capacity.

Concluding remarks

Technology can help us be more angelic, providing a low-cost way to reach out to others and lift them up. However, by distancing us from tangible emotional signals of others' suffering, it can also unleash the worst of our demons. Although online technology can offer help and harm, it is not inherently good or evil, and instead likely reinforces pre-existing tendencies

towards pro- and anti-sociality. Research suggests that technology can supplement sociability in offline interactions—as long as it doesn't replace face-to-face interaction. Perhaps the greatest promise for online technology is for those with impaired social skills: many studies reveal how the sociability of those with autism is improved through online and virtual interventions.

Online technology is still in its infancy. But as famed futurist Ray Kurzweil (2003) writes, we may soon have “full-immersion visual-auditory environments” and “will be able to enter [them]...either by ourselves or with other ‘real’ people.” Will these powerful online environments make us more in tune with other people's emotions or less? Our review suggests that the impact of online technology on sociability may depend upon whether online technology enables altruism or spite, and whether the interactions it affords enable or disable deeper interactions with others. But most of all, this review suggests that more research—especially more conclusive research—is needed to truly reveal whether online technology makes us kind or cruel.

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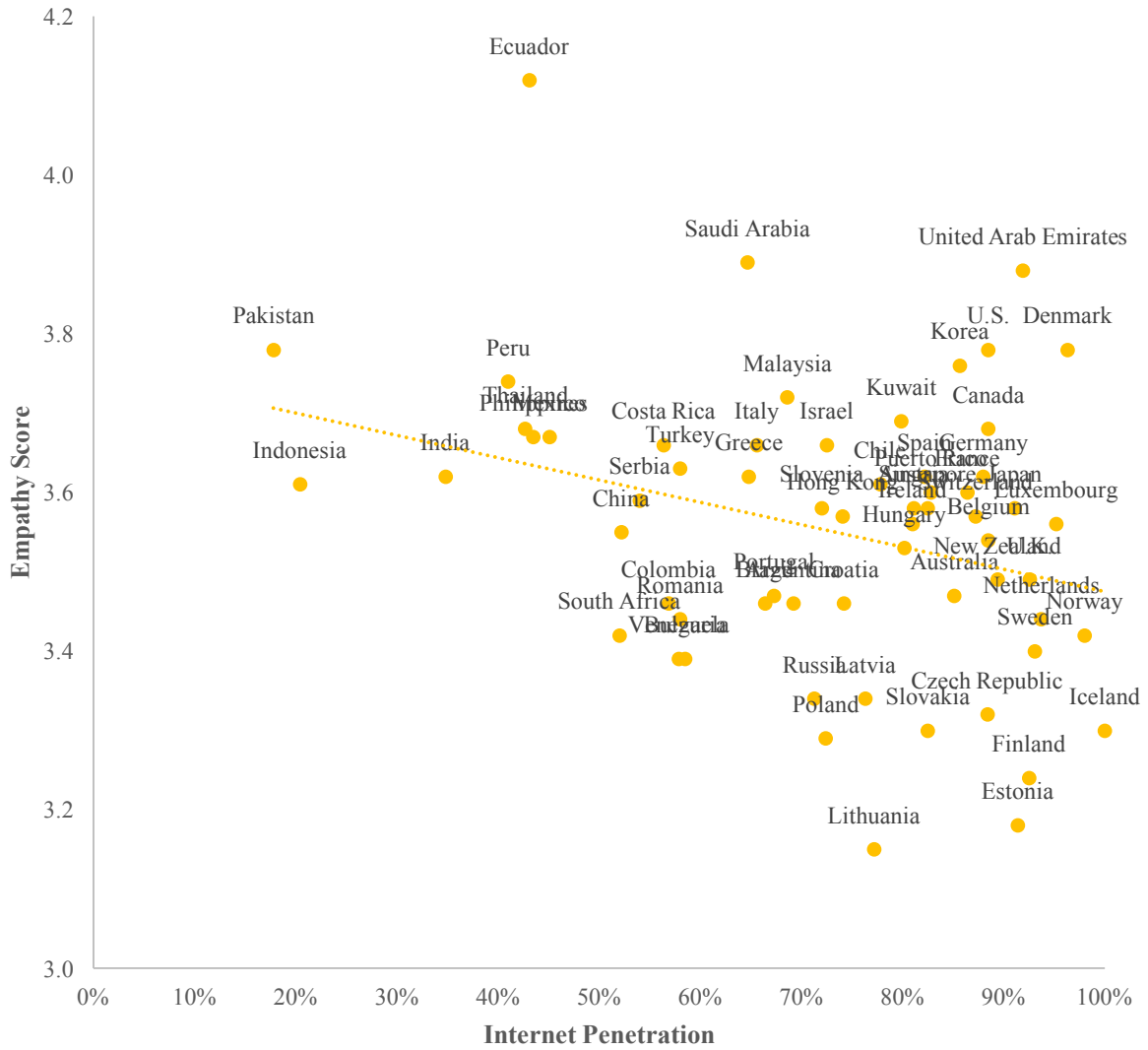
Tables

Table 1. Matrix of empirical articles exploring the relationship between different kinds of online technology (columns) and sociability (rows).

	Internet	Mobile Applications	Virtual Reality
Empathy	<ul style="list-style-type: none"> ▪ Steffgen, König, Pfetsch, Melzer (2011) ▪ Topcu & Erdur-Baker, (2012) ▪ Brewer & Kerslake (2015) ▪ Wei (2007) ▪ Foubert, Brosi, & Bannon (2011) ▪ Vossen & Valkenburg (2016) ▪ Collins (2014) ▪ Hamissi, Babaie, Hosseini, & Babaie (2013) ▪ Melchers, Li, Chen, Zhang, & Montag (2015) 	<ul style="list-style-type: none"> ▪ Steffgen, König, Pfetsch, Melzer (2011) ▪ Topcu & Erdur-Baker, (2012) ▪ Brewer & Kerslake (2015) ▪ Vossen & Valkenburg (2016) ▪ Jeong & Lee (2015) 	<ul style="list-style-type: none"> ▪ Cheng, Chiang, Ye, & Cheng (2010) ▪ Oh, Bailenson, Weisz, & Zaki (2016) ▪ Kalyanaraman, Penn, Ivory, & Judge (2010) ▪ Ahn, Le, & Bailenson, (2013)
Perspective-Taking	<ul style="list-style-type: none"> ▪ Topcu & Erdur-Baker (2012) ▪ Vossen & Valkenburg (2016) ▪ Alloway, Runac, Quershi, & Kemp (2014) ▪ Kruger, Epley, Parker, & Ng (2005) 	<ul style="list-style-type: none"> ▪ Topcu & Erdur-Baker (2012) ▪ Vossen & Valkenburg (2016) 	<ul style="list-style-type: none"> ▪ Kandalaft, Didehbani, Krawczyk, Allen, & Chapman (2013)
Emotion Recognition		<ul style="list-style-type: none"> ▪ Uhls, Michikyan et al. (2014) 	<ul style="list-style-type: none"> ▪ Kandalaft, Didehbani, Krawczyk, Allen, & Chapman (2013) ▪ Ke & Im (2013) ▪ Moore, Cheng, McGrath, & Powell (2005) ▪ Cheng & Fan (2008) ▪ Hopkins, Gower, et al. (2011) ▪ Rus-Calafell, Gutiérrez-Maldonado, & Ribas-Sabaté (2014)
Emotional Intelligence	<ul style="list-style-type: none"> ▪ Parker, Taylor, Eastabrook, Schell, & Wood (2008) ▪ Herodotou, Kambouri, & Winters (2011) 	<ul style="list-style-type: none"> ▪ Beranuy, Oberst, Carbonell & Chamarro (2009) ▪ van Deursen, Bolle, Hegner, & Kommers, (2015) 	

Figures

Figure 1. Correlation between empathy and internet penetration, by country



Note: Empathy scores reflect country-level scores of self-reported empathic concern and internet penetration refers to percentage of internet users per population of a country as of 2016.

Figure 2. Three proposed relationships between online technology and sociability within a social landscape. Linked nodes represent offline connections, arrows represent online connections, and darker shading represents people's deeper thoughts and feelings, which are relatively hard to access in online interactions. Online technology could increase sociability by providing additional access to the thoughts and feelings of relatively deep pre-existing offline relationships (Arrow 1). Online technology could decrease sociability by replacing deeper offline relationships with superficial online relationships in which underlying thoughts and feelings are difficult to observe (Arrow 2). Online technology could increase sociability by providing additional access to the thoughts and feelings of relatively deep pre-existing offline relationships (Arrow 3).

