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Screens are a game changer: How environments influence social capital in the digital era

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Abstract: Accumulated social interactions shape social capital—that is, resources available through social ties—that benefits individuals, groups, and society at large. Personal electronic communication media and devices, termed herein screens, are a new type of environment interacting with other environments within an ecological system. Environments influence interpersonal communication in and across settings; yet little is known about the influence of context wherein virtual and in-person social interactions occur. After overviewing the characteristics of the screens, the present paper examines how four geographical contexts—middle-class suburbs, impoverished neighborhoods, urban neighborhoods, and college communities—can influence on the relationship between the screen and local social capital. Lastly, this paper discusses environmental design implications for reducing screen usage that harms social capital.

Subjects: Urban Studies; Environmental Psychology; Interpersonal Communication; Architecture; Urban Design

Keywords: social capital; context; mobile phones; social networking sites (SNS); environmental design; ecological framework

1. Introduction

The most terrible poverty is loneliness, and the feeling of being unloved. — Mother Teresa

Social isolation and loneliness are prominent risk factors to human well-being (Bronfenbrenner & Morris, 2006; Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015); and scholars have investigated the impacts of the Internet on social isolation. Screens have considerable potential to affect...
interpersonal interactions, but their contributions to social capital likely depend on context. Context is a broad term encompass physical and sociocultural milieus wherein human behaviors of interest are embedded (Bronfenbrenner & Morris, 2006; Burleson, 2009; Zerubavel, 1985). Environments are a subset of contexts (Figure 1(a)). Contextual factors are intertwined and have the power to moderate or condition the effects of target variables on behaviors. Timing (e.g. time of day/week) is a type of context often associated with other environmental properties such as technology, but not of environment. Temporal properties (e.g. duration, periodicity) can leverage the effects of interactions (Figure 1(b)).

Screens overarch personal electronic communication media including the Internet, mobile phone calls, text messaging, and smartphone apps (Table 1). The screen is an environment in which people communicate with each other including generating and accessing web contents. The “context-collapsing” nature of screens means not the lack of but the superimposition of physical and (multiple) virtual contexts (Wesch, 2008). Screen environments range from private to public on one device, and the degree of privacy depends both on medium types—such as, text message versus Twitter—and users’ audience selection. More importantly, screen is a set of environments nested within but also independent from a physical environment. Perhaps because of this independence, the linkage between the screen and the surrounding environment has been understudied. The present paper aims to examine the interplay between screen and other contexts as they converge to affect the amount

![Figure 1. (a) Interaction between human and the surroundings (b) Accumulated human-environment interactions over time and associated temporal patterns shapes the person’s development, based on the bioecological systems model (Bronfenbrenner & Morris, 2006).](image)

| Variables     | Definitions                                                                 | Examples                                                                                   | Environment? |
|---------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------|
| Physical      | Physical settings often associated with social roles or expected behaviors    | Home, school, work, streets, greeneries, neighborhood                                      | O            |
| Social        | People in a given environment                                                | Number of people, relationships with people                                               | O            |
| Sociocultural | Societal and cultural factors, norms of society or group                      | Societal trends, changes, policy, culture, history, technology, economy, generation        | O            |
| Screen        | Portable personal electronic communication devices and platforms              | Mobile phone, tablets, laptops, cell phone call, text messaging, the Internet, social networking sites, social media, smartphone apps | O            |
| Temporal      | Temporal patterns associated with setting or activity; timing                 | Duration, periodicity, stochastic properties; time of day or week, season, time in history | X            |
| Individual    | Individuals’ biological and behavioral factors                               | Age, gender, ethnicity, socioeconomic status, genetic, personality, personal history      | X            |
and the quality of social interaction. How online platforms (e.g. Facebook versus email) vary and what people do with each of them are less of concern given focus of this article.

2. Background

2.1. Social capital

Social interaction is the building block for social capital—resources available from social ties as well as for future interactions (Lin, 1999; Putnam, 2001; Resnick, 2002; Thoits, 1995). Accumulated interpersonal interaction in various settings shapes social capital. Even though all social connections and social interactions are not necessarily positive, social isolation harms human health (Cohen, 2004; Holt-Lunstad et al., 2015; Thoits, 1995). Social capital is not only important for one’s own well-being but also benefits others’ (Portes, 2000). On the individual level, neighborhood social capital leads to better mental health (Sampson, Morenoff, & Gannon-Rowley, 2002) and to elderly’s greater life and health satisfaction (Eibich, Krekel, Demuth, & Wagner, 2016). On the community level, it can increase neighborhood safety by attending to children without a caregiver and intervening when suspicious actions occur (Coleman, 1988; Jacobs, 1961). Coined by Granovetter (1983), strong ties are intimate connections such as family members and close friends whereas weak ties encompass linkages with colleagues, neighbors, and acquaintances from various settings. The latter are typically more diverse than the former; thus they are critical in information acquisition (e.g. job information) and dissemination (e.g. subculture to wide population) (Granovetter, 1983). The homogeneity and heterogeneity nature of strong and weak ties are compatible to bonding and bridging ties, respectively (Putnam, 2001). The number of Americans’ strong ties has decreased over the past few decades (Hampton, Sessions, & Her, 2011; McPherson, Smith-Lovin, & Brashears, 2006). This is not surprising considering societal changes such as reduced family size and escalating residential mobility. Despite many people’s belief that the Internet increases their strong ties, it is not associated with the number of strong ties but rather more weak ties (Boase, Horrigan, Wellman, & Rainie, 2006; Marsden & Srivastava, 2012).

While many stress and health studies focus on social roles or social network structure, settings associated with individuals’ social roles have been largely ignored. Bronfenbrenner’s bioecological model explains that recurrent interactions with others and surroundings shape one’s development over time and that interlinked contextual factors generate spillover effects (Bronfenbrenner & Morris, 2006). For example, crowding is a subjective measure in which one experiences more social interaction than desired (Stokols, 1972). Residential crowding leads to less controllable social interaction and reduced opportunities to be alone when desired. Social withdrawal is a common way to cope with crowding (Evans, 2001). Parents’ social withdrawal in crowded homes leads to lower responsiveness to children which damages children’s socioemotional and cognitive development (Evans, 2006). However, enhanced neighborhood safety buffers the effect of decreased parental involvement between kindergarten and third grades on children’s reading scores while decreased neighborhood safety exacerbates the effects (Iruka, Curenton, & Gardner, 2016). Screens likely produce similar effects to behavior in physical environment or vice versa. To understand how screens shape our social capital, we must know the screen’s role in the ecological system.

2.2. The screen

Screens are a game changer for design and planning of spaces to accommodate nearly all forms of social interaction from the intimate to the public. Screens virtually remove spatial and temporal barriers and enable users to communicate anytime and anywhere. They allow social support to family members and friends far away as well as reputation and information acquisition without actual face-to-face interaction.

[Television] is a medium of entertainment which permits millions of people to listen to the same joke at the same time, and yet remain lonesome. — T. S. Eliot
2.1.1. Strong ties, weak ties, and the screen

Strong ties traditionally have been associated with private territory such as home. Activities that used to occur in public space can now happen in private space thanks to technologies and media at the cost of reduced acquaintance opportunities and exposure to urban diversity and (Lofland, 1998). Water supply systems in buildings, for example, removed the need to go get water from a common source outside; newspapers, television, and telephone reduced public space visits for information acquisition. Historically, each newly available communication medium—including newspaper and telephone—brought concerns about prospective side effects from reduced need for face-to-face social interaction for information acquisition (DiMaggio, Hargittai, Neuman, & Robinson, 2001). While early studies of the Internet raised concerns about negative effects on psychological well-being and social capital, recent studies tend to support a more nuanced view. Moreover, while cross-sectional studies reveal negative effects of the Internet use on interaction with friends, longitudinal studies suggest the opposite (Boase & Wellman, 2006). This difference suggests a learning curve operating at both individual and group levels. While adolescents’ adoption of the Internet resulted in reduced family communication initially (Kraut et al., 1998), the effects disappeared in the follow-up study probably because all family members adopted the Internet and utilized it in communicating (Kraut et al., 2002). In addition, communities’ online platforms can take time to become integrated in community interaction (Hampton, 2007).

While strong ties can be reached via multiple communication platforms including face-to-face, phone call, text messages, and the Internet, weak ties have fewer platforms (Haythornthwaite, 2002, 2005). College students reported they reach acquaintances on SNS first, texting, and then phone call as relationship develops (Yang, Brown, & Braun, 2013). SNS can aid the maintenance of weak ties, especially the ones from former contexts after relocation or changing jobs (Boase et al., 2006; Ellison, Steinfield, & Lampe, 2007; Ellison, Vitak, Gray, & Lampe, 2014; Hampton, 2016). A recent type of tie, latent ties, are people who have potential to be weak ties but are not realized yet—for example, a friend of a friend or a colleague in another office or building within the same firm (Haythornthwaite, 2002). Mobile phone applications using SNS accounts (e.g. dating apps using Facebook account and information) also utilize users’ profile and social network information to present potential ties. Although many studies have found Internet’s positive effects in weak and latent tie building and maintenance, the Internet, in fact, supports many types of ties with easier tie maintenance and increased communication channel options (Haythornthwaite, 2002; Tufekci, 2013).

2.1.2. Functional convenience

Originated from workplace studies, functional inconvenience refers to short-term inconvenience in access to amenities that helps long-term organizational efficiency (Becker, 2007; Perlman, 1989). Allocating multiple common facilities together (e.g. pantry, mailroom, restrooms) not only compensates for a little longer walk but also creates greater unplanned social interaction across disciplines. Such centrally-located amenities create a node—that is, where people gather in urban planning typology (Lynch, 1960)—within the office. And, a successful node increases the frequency and the duration of visits. This strategy also converts hallways to social space where employees casually converse on the way to or from the node. Functional inconvenience is applicable in residential development or in neighborhood. Locating mailbox and bike rack together, for instance, is less convenient than having them in front of doors but can facilitate unplanned, casual encounters among residents. Similarly, clustered third places can lead to greater foot traffic (Oldenburg, 1999). After home (first place) and work (second place), third places are for social gathering whether indoors (e.g. cafés, pubs) or outdoors (e.g. neighborhood streets, greeneries) (Oldenburg, 1999). Regular visitors, whether they have a specific purpose to visit or simply enjoy being there, develop a sense of ownership and contribute to the liveliness of the places and the safety of neighborhoods (Boyd, 2014; Dempsey, Bramley, Power, & Brown, 2011; Jacobs, 1961; Oldenburg, 1999).

On screens, the rules are functional convenience both physically and virtually. For instance, smartphone affords text messaging, phone, Internet browsers, apps, etc. in your hand. Both close physical proximity and interlinkage among apps lead to one app after another effect. In addition, docking on
major SNS has become many websites’ survival strategy. Articles on the New York Times website have a Facebook icon linking to its Facebook page that will feed briefs luring viewers to full articles on their website. This strategy, however, may be less effective if targeting specific small audience like neighborhood webpages. Functional convenience explains why the neighborhood email list (listserv) works better than free neighborhood webpages in Hampton’s (2007, 2010) studies because the listserv does not add another platform to regularly visit but feeds messages to existing email inbox. In addition, SNS’ facilitation of social interaction with weak or strong social ties may generate positive effects of the screen if many of your social ties are regulars there (Lieberman, 2013). In short, Facebook has become a giant, customizable, one-stop shopping spot.

2.1.3. Screen as a coping strategy
A sense of temporary escape may be desired more often than occasional prolonged vacations. Caregivers of young children can restore away from home (Cattell, Dines, Gesler, & Curtis, 2008); professionals escape from workspace (Hampton & Gupta, 2008); and people go to green spaces for a sense of escape from daily life (Chiesura, 2004). Household crowding can be mitigated if access to outside or to another setting is readily available (Evans, Lercher, & Kofer, 2002). Easier access to local parks and more greenness in neighborhoods also boost recreational walking and social cohesion with neighbors (Sugiyama, Leslie, Giles-Corti, & Owen, 2008); and the frequency and the duration of local park visits rise with the number of local social connections (Kazmierczak, 2013). Soukup (2006) suggests digital third places can be successful if they are geographically localized, accessible, and have welcoming existing members. Escape from mundane or stressful life was among the motivations of screen use. Mothers are criticized for screen use during breastfeeding babies because it might interfere bonding with babies; yet, screen use can be an escape for exhausted moms while babies fall asleep (Tufekci, 2013). In addition, screens afford a sense of control that is critical in coping with stress (Cohen, Evans, Stokols, & Krantz, 1986). Leung (2006) links the inverted-U relationship between arousal and performance to wellbeing suggesting that one’s ability to regulate the amount of stimulation on screens can enhance wellbeing. Access to a smart phone in a crowd (e.g. elevator, commuter train) aids coping with crowding while avoiding unwanted interactions.

2.1.4. Concurrent screen and face-to-face interaction
A photographer created a series of pictures of people looking at their empty hands while physically proximate to others as if they held smartphones to express the absence of genuine face-to-face interaction (see https://www.removed.social). Not surprisingly, his pictures spread quickly over SNS. Despite many benefits, screen use likely harms concurrent in-person engagement (Brown, Manago, & Trimble, 2016) unless individuals share a screen and talk about what’s on it. Even the mere presence of a mobile communication device on the next table reminds of informational rewards (Duhigg, 2012), which interrupts contiguous face-to-face interaction (Misra, Cheng, Genevie, & Yuan, 2016; Przybylski & Weinstein, 2016). The context-collapsing nature of screens lead to multi-tasking across places. Multitasking in general increases perceived productivity but harms actual productivity because of divided attention (Cumiskey & Ling, 2015; Resnick, 2002; Turkle, 2011, 2015). Texting while driving is dangerous for the same mechanism. Multitasking with irrelevant screen use has become a norm in American society (Junco & Cotten, 2012; Lohnes & Kinzer, 2007; Oblinger & Oblinger, 2005; Turkle, 2011). Irrelevant screen use in classroom not only interferes with screen users’ learning but also distracts others’ (Sana, Weston, & Cepeda, 2013). Moreover, screen use is contagious: one’s screen use quickly increases other’s on-screen engagement—that is, the iPhone effect (Jecole, 2009). Furthermore, screen interactions are prioritized over in-person communication (Höfflich, 2006), which leads to responding to texts when dining with friends or family and checking social media while doing homework.

On the other hand, screens can promote lingering in public space (Hampton, Goulet, & Albanesiou, 2015); but the effects of screen use in public settings may vary by device type and activities. Despite their immediate screen use, solitary laptop users can afford acquaintanceship with strangers. While laptop workers largely ignored surrounding others in urban cafés, some casual laptop users utilized their laptops to initiate conversations with co-located others (Hampton & Gupta, 2008). Some of the
latter are regulars thanks to close proximity from home or work, thus likely meet acquaintances. However, mobile phone use is unlikely to lead to interaction with strangers. Perhaps this is because smaller screens could look transient as people easily turn into phone when they had a moment to kill or interacting with a close tie whereas laptop users would appear to stay for a while as they were there to “work” or have something to do.

This paper is a theoretical essay that discusses the influence of geographical contexts on the relationships between screen use and social capital. Screens, when used well, foster social capital (Kraut et al., 2002; Resnick, 2002; Valenzuela, Park, & Kee, 2009), which may be determined by contexts. For instance, SNS use in their rooms can help friendship building but may reduce face-to-face conversation when used at a party. Rather than a utopian or dystopian perspective of screen use, this paper attempts to understand the linkage between screen use and its geographical contexts as it aids or interrupts local social capital building.

3. Geographical contexts

Even in this digital era, our lives are still grounded in offline communities (Katz & Hampton, 2016). Despite many benefits of local social capital as discussed earlier, Americans’ neighborhood social capital has significantly decreased over the past few decades (Hampton et al., 2011; Marsden & Srivastava, 2012; McPherson et al., 2006). Lower physical, temporal, and psychological barriers facilitate casual encounters in neighborhoods and promote social support among neighbors in the long run (Jacobs, 1961). Similar activity patterns increase the likelihood of acquaintanceship (Demerath & Levinger, 2003; Oldenburg, 1999; Zerubavel, 1985) whereas variability in lifestyle among neighbors contributes to neighborhood safety and liveliness throughout the day (Jacobs, 1961). Greater heterogeneity in age, income levels, etc. can act as social barriers (Gans, 1962) but also increases tolerance to other cultures (Cattell et al., 2008; Jacobs, 1961; Lofland, 1998). On screens, geographical, temporal, and perhaps demographic heterogeneity can be mitigated (Boase & Wellman, 2006; Hampton et al., 2011; Tufekci, 2013). In addition, unlike early Internet users who actively made new online friends with similar interests regardless of meeting them in person, screens are nowadays mainly for communicating with existing ties (Baym, 2000; Boyd, 2014; Ellison et al., 2007; Lenhart, 2009; Lieberman, 2013). Therefore, screens can help local community building such as neighborhood and college communities because residents have already acquainted or expect to meet in person in near future or online again. Physical contexts are associated with social interaction patterns. For instance, socialization with neighbors was highest in rural areas and lowest in suburban neighborhoods whereas socializing with friends showed the opposite trend (Marsden & Srivastava, 2012). Urbanites’ social patterns were closer to suburban but to a lesser extent. This can be explained by tightly integrated work and social life in rural settings compared to urban and suburban lifestyles. Signing up on listservs probably has little impact on local network size or face-to-face interaction with neighbors (Hampton, 2007). The following section describes the role of screens and social capital in four local community types: middle-class suburbs, impoverished neighborhoods, urban areas, and college campuses.

3.1. Middle-class suburban neighborhoods

A prominent barrier to social capital in suburban neighborhoods is physical design. Longer distance between houses, long blocks, and the lack of public transportation within walking distance discourage walking and decrease serendipitous encounters. Suburban teens’ reliance on social media, which has become a primary locus of youth public space, has increased partially because hanging out with peers outside of school is not easy (Boyd, 2014). On the other hand, suburbs have several attributes for community building including similar socioeconomic status and children at home. Particularly, having children in similar ages would facilitate frequent in-person interaction opportunities such as in their children’s school and in school events or extracurricular activities. Listserv and additional physical settings to socialize can reinforce the relationships whether they meet in person first or online. Israeli suburban residents revealed a bipolar pattern in which about half of them made four or more neighborhood ties at children’s school while the rest made none (Mesch & Levanon, 2003). A gated condominium community whose residents were older, had longer
residency, and less likely to have children at home, on the other hand, failed to integrate a listserv in community communication in a two-year experiment (Hampton, 2007). In addition, a new suburban development can generate move-in cohortship among residents and boost a prosocial atmosphere wherein new residents are eager to get to know new neighbors. This cohortship and home-ownership associated with greater likelihood of longer residency can boost online communication with neighbors and overcoming physical barriers for walking (Hampton, 2010; Hampton & Wellman, 2003). No studies of successful condominium community listserv are identified.

3.2. Impoverished neighborhoods
Impoverished neighborhoods potentially have more barriers to social interaction. Inadequate housing quality can be a barrier that discourages inviting others to one’s home, potentially reducing social interaction and undermining social capital (Wells & Harris, 2007). Insufficient housing quality in low-quality neighborhoods may create inadequate socializing spaces and harm psychological well-being (Jones-Rounds, Evans, & Braubach, 2014). Even though sub-standard housing quality leads to social withdrawal, we also know histories of slum redevelopment projects that often damaged social cohesion built on physical proximity and similar socioeconomic status (e.g. West End redevelopment in Boston, Fried, 1966). Frequent social interaction with neighbors on the street can contribute to neighborhood social capital, which can help the residents more resilient against poverty. However, because of fear of crime, many low-income residents restrict children’s outdoor play and minimize their use of outdoor neighborhood spaces (Pain, 2000).

Impoverished neighborhoods may have greater crime rates and social disorders. Screens may provide an alternative environment for socialization when physical neighborhood or third-place settings are unavailable. Impoverished neighborhoods and middle-class suburban neighborhoods are the two neighborhood types utilizing listserv most actively (Hampton, 2010). The former commented more often about neighborhood and public space (e.g. city, street, park, and block) in their emails to listserv, whereas suburbanites mentioned “home” more. Neighborhood environment and local social capital appears to be more important for those who live in impoverished neighborhoods compared to affluent suburban dwellers. Instead of migrating users into a virtual neighborhood, screens can provide platforms where residents can communicate to collectively improve their offline neighborhoods.

Yet, virtual platforms are not a simple remedy for local social capital building in low-income neighborhoods because even if accessibility to the internet does not differ much among social classes, the quality of access may not be the same. Low-income families have fewer internet-able devices, they are typically older and with less capacity, and low income individuals internet use skills may be limited (Anderson, 2017; Helsper, 2016). For instance, low-income people are less likely to use the internet to connect with close ties (Helsper, 2016). This can widen inequality in career and potentially social support from close ties. While affluent suburban teens utilize social networking sites to overcome distance physical proximity to friends (Boyd, 2014), teens in a poor neighborhood indicated they socialized at home or a local mall due to crimes on the street and through social networking sites such as bullying and aggression (Stevens, Giliard-Matthews, Dunaev, Woods, & Brawner, 2016). The latter reported they used the internet primarily for information. Adolescents’ online social platforms may become a neighborhood street without adult residents’ supervision; and this may be more likely due to parents’ limited internet skills in impoverished neighborhoods.

3.3. Urban neighborhoods and multi-dwelling units
Proximity to social settings, greater walkability, and public transportation infrastructure may help social capital building and overcome the urban social-heterogeneity barrier. Urbanites are more likely to go to a bar or tavern regularly, and such patrons would meet other regulars or neighbors (Marsden & Srivastava, 2012). Both proximate access to public transportation and neighborhood social support are associated with better health and life satisfaction in greater Berlin, Germany (Eibich et al., 2016). It is unknown if access to public transportation is associated with neighborhood social capital in the study; but given moderate conversions of commuting schedules and public
transportation nodes, this would seem like a reasonable possibility. Greater Internet use, in general, was associated with more frequent public and semi-public space visits in a nation-wide survey (Hampton et al., 2011). Facebook, for example, feeds upcoming events in town along with who are attending. Global positioning system (GPS) can assist to find a destination in a new neighborhood. And if running late, texting friends minimizes the problem.

Better accessibility to friends or to hang-out places does not signify that urbanites are not interested in making local ties. But, our knowledge about urban neighborhood listserv or other online platforms are limited. High potential of casual encounters on the street in the traditional city aided by screens might lead to strong social cohesion. A couple new to Bologna, a small Italian town of almost 400,000 inhabitants (Comune di Bologna, https://www.comune.bologna.it), created a website to get to know neighbors living nearby (Pianigiani, 2015). The website quickly led to community building, and neighbors reported a stronger sense of neighborhood belonging and perceived safety than before. However, this may not work as well in larger metropolitan settings. In a larger metropolitan areas, there is a higher critical mass of others who use same apps or SNS, such as social dining apps or movie-goers’ SNS, for meeting new people. This, in turn, may decrease the need of having strong ties only because of physical proximity (Hampton, 2004; Senior, 2008).

Despite their strong desire to meet neighbors, a large and tall apartment building’s listserv in the City of Boston did not thrive during a two-year-long experiment (Hampton, 2007). Apartments in urban settings are in general more transient and less likely to have children at home compared to other dwelling types. Somewhat counter-intuitively, close proximity to large numbers of people is consistently associated with diminished social interaction, particularly indoors. Multi-unit residential buildings, in general, lack a sense of privacy due to inter-unit noise and unwanted social interactions with neighbors who share transient space like entrances and hallways (Gibson, Thomson, Kearns, & Petticrew, 2011). Long, plain hallways and transient entrances in high-rise multi-unit dwelling fail to provide semi-public space. This can fracture local social ties and exacerbate anti-social behavior further undermining sense of community (Figure 2) (Baum & Valins, 1974; Fleming, Baum, & Singer, 1985; Kearns, Whittley, Mason, & Bond, 2012).

3.4. College communities

While college campuses are generally heterogeneous in race, culture, and socioeconomic backgrounds, students are homogeneous in age and intellectual levels, tech-savvy, live near-by, have cohortship, and campuses are usually pedestrian friendly. College settings may not have equivalent density to metropolitan areas yet well facilitate frequent casual encounters. Unlike apartment buildings, college dormitories likely have more semi-public space, which facilitates social integration (Lieberman, 2013). Plus, college students actively seek for opportunities of social network building on screens. The amount of time college students spent on Facebook does not differ across gender, socioeconomic status, and race; but minority students are less social on Facebook (Junco, 2013). Facebook contributes to bridging social capital on college campus (Ellison et al., 2007, 2014; Yang et al., 2013). Facebook is often the first communication channel among college students (Yang et al., 2013), and with profile sharing, SNS can even accelerate relationship development (Resnick, 2005). As soon as colleges send out admission letters, new Facebook groups form exclusively for incoming freshman in one case study (Park, 2016). This cohortship accompanied by close proximity in the live-and-learn setting more likely convert latent ties to weak or strong ties. A college freshman in the same study met incoming peers from her hometown and formed a social circle even before moving to college campus. See Table 2 for a summary of this section.

Figure 2. Apartment building floor plan diagrams. Unwanted social interaction more likely occur in transient hallways in (a) than in (b).

(a) (b)
To summarize, the effects of screen use on social capital may be dependent on various contexts. Screens can compensate imbalance between desired and achieved social interaction and by connecting latent ties and reinforcing face-to-face interaction, both of which contribute to local social capital building and maintenance. However, screen use can be superior to in-person interaction, which backfires the benefits of screen use. The following section will discuss design implications that can impact on face-to-face and screen interactions.

4. Design implications
Environmental design could increase positive effects or reduce negative effects of screen use. The following ideas emanate from studies before the proliferation of screen but hopefully provide the foundation for some research and eventual applications. My focus is not promoting face-to-face interactions over screen use but enhancing social interactions and supporting social capital. Interdependent in-person and screen interactions can enrich social capital. Neighborhood, building, and seating design are discussed.

4.1. Walkable neighborhood
Neighborhood streets (as opposed to major urban streets) have long been premium community spaces where children learn about social life and build social capital (Appleyard, 1981; Jacobs, 1961). Walkable neighborhood increases residents’ physical activities and social network. Broader sidewalks with smaller block size, higher external density (people/square mile), greater degree of mixed-use, shading trees, less obstructions, and well-designed street lighting attract pedestrians (Demerath & Levinger, 2003; Ewing, Handy, Brownson, Clemente, & Winston, 2006; Gehl, 2010; Jacobs, 1961; Krizek, 2003; Leyden, 2003; Saelens, Sallis, Black, & Chen, 2003) (Figure 3). Enriched sensory stimuli with moderate levels of ambiguity, hint of what’s beyond where one is currently located, and clear boundaries of public space can attract pedestrians and encourage frequent visits. The recent conversion of the busy Broadway Street in New York City around Times Square dramatically increased pedestrian volume rapidly followed by a substantial expansion of street cafés (Dalsgaard & Sorensen, 2012).
“Clustering” third places does not mean only one, dense downtown for a large district but can also be multiple clusters within reasonable distance—that is, mixed-use development. Subway or bus stops can increase foot traffic to such nearby clusters. The number of, or the distance to necessary or attractive destinations (e.g. work or school, commercials, and third places) is among the critical ingredients of mixed-use promoting human interaction (Gehl, 2010). Additionally, vandalism, abandoned structures, and insufficient street lighting can lead to fear of crime, which decrease walkability and work against social capital (Cattell et al., 2008). Poor walkability impacts children, the elderly, and mothers with young children the most because of limited mobility. On the contrary, reliance on automobile creates a social barrier in neighborhood (Freeman, 2001). Intermittences of frequent driveways or garages to sidewalk as well as monotonous streetscape discourages walking (Ewing et al., 2006; Gehl, 2010). High traffic speed and volume decrease perceived neighborhood safety plus lower social interaction among neighbors and neighborhood satisfaction (Gehl, 2010). Traffic volume and accompanying noise were prime motivators for residents’ residential relocations to another neighborhood (Appleyard, 1981). It is also well established that noise reduces positive social interactions, including altruistic behavior (Cohen & Spacapan, 1984). Greater pedestrian traffic throughout the day contributes to neighborhood safety compared to quiet suburban communities during the day and dangerous-looking segregated business districts after office hours.

4.2. Building design
Immediate access to semi-public space, such as social pockets in college dormitories and neighborhood streets, helps residents control the amount of social interaction. The concept of regulation of social interaction is a particularly useful heuristic for designing spaces to support social interaction and minimize stress (Altman, 1973). Contrast to many organizations’ favoring open office design, current workplace research supports employees’ ability to optimize the amount of social interaction for creativity, job satisfaction, stress coping, and well-being (Cain, 2012; Danielsson, 2010). Instead of homogenous open office throughout, options of work environments with a range of enclosure and size can support varying needs of social interaction regulation among employees (Cain, 2012; Danielsson, 2010). This approach is applicable in neighborhood and public spaces.

Furthermore, people have negative impression about those who are alone; but, being engaged with something—e.g. newspaper, and recently, mobile phones—makes being alone legitimate (Goffman, 1963; Humphreys, 2005). This defensive screen use creates a psychological barrier from others (Park, 2016); and people indeed sometimes use screens to avoid unwanted face-to-face interaction (Pew Research Center, 2015). Screen use when with others lowers the quality of in-person engagement, particularly in dyad settings in which other person likely feels vulnerable as if unjustifiably alone (Humphreys, 2005; Turkle, 2015).

Lastly, boredom is among leading motivators leading to screen use (Korgaonkar & Wolin, 1999; Whiting & Williams, 2013). Three to four minutes is the maximum standing in line in a corporate cafeteria before turning to a screen, which can afford in-person conversation with colleagues.
Waiting time before using screens may be shorter in other settings such as a coffee place or in front of an elevator. For example, I have witnessed college students pull out their phones almost immediately after pressing a button for an elevator. A view of scenery or human activities can be entertaining and lead to people staying in public space, but too much visual exposure can make people vulnerable (Appleton, 1975; Gehl, 2010; Whyte, 1980), especially when alone. Semi-enclosed space with something to see may reduce boredom and vulnerability.

4.3. Place to sit
Activities on streets are entertaining, and places to sit and watch them (e.g. chairs or benches, curb or steps, around a fountain) can encourage people to linger whereas long and undifferentiated exterior building surfaces offer no places to sit (Gehl, 2010; Jacobs, 1961; Whyte, 1980). Physical design may matter more to those who are alone than to groups. A recent study found solitary people in public space choose where less groups are around; yet, physical design where groups and the solitary are were not examined (Hampton et al., 2015). If environmental design does not provide psychological safety against, as Goffman (1963) suggested, the negative impression of being alone, solitary people will be more likely fleeing to a screen from this uncomfortable situation. It is plausible to assume that the solitary would prefer greater refuge while maintaining prospect (Appleton, 1975)—such as seats along a wall or shrubs as well as partitions that provide a sense of semi-enclosure (Figure 4).

Furniture design is another influential factor. Solo laptop users in Bryant Park, NYC occupied small tables and chairs with desk attached that would discourage a stranger to join. Similarly, stand-alone two-person tables were taken quickly by solitary and diner pairs during my own observations in college dining halls (Hampton, Livio, & Sessions Goulet, 2010). However, when such small seating is not available, solitary diners and laptop users in cafés don't seem to mind filling in if the table is large enough (Figure 5). This may be because of greater interpersonal distance to a stranger across the table compared to small tables. In Google cafeteria, tables for ten to twelve people are large enough for small groups to take a portion of one (Turkle, 2015). In my casual observations in cafés in a college town, this size seems to work as well both for singles and for small groups. Individuals would hand over a laptop charger to a person close to electric outlets across the table as they would share a salt shaker, converse with acquaintances or friends, make space for a new customer, ask for keeping an eye on their laptop, etc. Interestingly, crowded bar settings in airports exhibited similar activities. Bars have no strangers across the table but a welcoming bartender, which may ease a traveler joining the bar despite tight interpersonal distance to a next person. These travelers would ask for plugging a laptop charger into an outlet, make room for someone who was joining the bar, or easily glance, and even ask, what the next person was eating.

Figure 4. Various seating options in a university library can welcome both groups and solitaries. Diverse enclosure options are likely desired in outdoor seating as well.
5. Conclusions

The ecological context (Figure 1) wherein people use screens has been largely overlooked in communication and social science studies. The present paper considers screens as a new type of environment within an ecological system and overviews how the ecological system influences the relationship among screens, interpersonal interaction and local social capital, using four types of geographical contexts. Screens afford social interaction across physical and temporal barriers. Their potential contribution to local social capital is more likely realized if community members share other contexts to meet or encounter such as streets, third places, neighborhood parks, children’s school, dormitories and classrooms. The contrast in the number of local ties between suburbanites’ with and without children supports this (Mesch & Levanon, 2003). In addition, screens can facilitate interaction with neighbors when lacking of such physical spaces—e.g. suburban teens (Boyd, 2014) and impoverished neighborhoods (Hampton, 2010). Figure 6 illustrates the mechanisms discussed in this section focusing on geographical contexts. Note that digital inequality still persists in the quality of access to (e.g. number and type of devices) and of the utilization of screens (e.g. social interaction versus information acquisition) (Anderson, 2017; Helsper, 2016), which may widen the gap between social classes in the quality of social capital. On the other hand, too many people in a given space may result in too much social interaction, which can discourage in-person interaction and instead encourage escape to screens. While in suburban and impoverished neighborhoods, screens may help residents overcome physical distance, in metropolitan areas people may filter whom to interact with using screens such as social networking sites or apps.

Despite the benefits of screens, screen use during in-person interaction lowers the quality of in-person engagement (Brown et al., 2016; Misra et al., 2016; Przybylski & Weinstein, 2016). Environmental design alone is probably not the most powerful driver for social capital building; but,
it can nudge behaviors in good or bad ways. Physical environments that can promote social interaction is beneficial; however, it may be more important to accommodate various situations—such as being alone, under stress, or in need of a break from daily life. Such inclusive design approach can reduce negative effects of screen use, for example, unnecessary escape to screens due to discomfort to be alone. First, walkable neighborhood design and mixed-use development can aid local social capital by offering multiple settings to encounter. Urban design and planning can encourage walking and public transportation use and enhance perceived neighborhood safety. Second, design attributes can help optimize the amount of social interaction. Third, building design, layout, and furniture selection can accommodate those who want to stay in public space whether they are in groups or alone, which may ease the urges of screen use. Such nudges in everyday social space can bring significant effects, particularly for vulnerable populations such as children. However, the relationship between environmental design and screen use remains understudied. Future studies are encouraged to look into spillover effects between on- and off-screen.

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