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The Psychology of Mobile Technology and Daily Mobility

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Abstract

In this chapter, we chart parallel lines of research on mobile technology and daily mobility. Specifically, we review how people engage with mobile technologies in-place and on-the-go, as well as their broader connection with their mobile devices. In each section, we review and link perspectives from psychology and mobility studies towards an integrative understanding of mobile media use. We then survey emerging mobile methodologies with potential for interdisciplinary work. To conclude, we collapse these boundaries – between being in-place and on-the-go, and mobile technology and daily mobility – to consider the trajectory of future research on the psychology of mobile technology.

The fact that mobile technologies can be used almost anywhere makes them seem almost placeless, as if they were independent from their surrounding environments. Theorists, designers, researchers have long heralded the possibilities of mobile media to circumvent spatial constraints (see Campbell, 2019; McLuhan, 1964). Yet over time it has become clear that this projection of mobile capabilities is overstated (Frith, 2015; Humphreys, Karnowski, & von Pape, 2018). In this chapter, we review how the use of mobile media is deeply embedded in and shaped by the spatial contexts that we inhabit in our daily lives. Consequently, our understanding of mobile technologies, including their psychological effects, must be grounded in an understanding of daily mobility: how people move through everyday spaces.

To illustrate, consider an individual, Jerry, who plays the popular (as of 2020) mobile game *Candy Crush*. Jerry's total usage of *Candy Crush* can be considered an aggregation of playing the game in a variety of spatial contexts. Perhaps he especially likes to play the game at home before bed ("in-place") and on the bus before work ("on-the-go"). The ways that Jerry experiences *Candy Crush* are thereby contingent on whether he is in-place or on-the-go (Engl & Nacke, 2013), as well as whether he is in a particular place or moving in a particular way (Mehrotra et al., 2017). For example, as Jerry swipes and swirls his thumbs across the screen, he might talk with his partner in bed, or overhear some juicy gossip on the bus. He might find the game relaxing after

work in the comfort of his own bed, or find it challenging when the bus is crowded. In turn, how Jerry makes sense of his everyday surroundings may also depend on his *Candy Crush* habits (Figeau & Chaulet, 2018).

Here, we contend that the psychological effects of apps such as *Candy Crush* – and the overall psychological connection between user and device – are based in part on the spatial contexts and mobile patterns that comprise daily life. The above example foreshadows the structure of the current chapter by demonstrating how the psychology of mobile technology can be interwoven with (1) in-place contexts, (2) on-the-go contexts, and (3) daily mobility overall. Ultimately, we aim to demonstrate how a contextual perspective can advance our understanding of the psychological implications of mobile devices.

Crucially, more contextual studies often rely on novel capabilities tied to everyday mobile technologies (e.g., smartphones, fitness trackers). Sensing tools provide opportunities to capture accurate log data of phone use (Stachl et al., 2020) and notifications (Mehrotra et al., 2017). In addition, smartphone sensing provides rich information (e.g., GPS, acceleration) to ascertain mobility features (e.g., places visited, transportation modes) (Müller, Peters, Matz, Wang, & Harari, 2020). In these ways, novel mobile methods can provide deeper insights into the psychological terrain of mobile technology and daily mobility, especially when used in tandem with one another and infused with theoretical rigor.

Given these advancements, we suggest that efforts are needed to lay an integrative agenda for the psychology of mobile technology and daily mobility. Recognizing that “technology” and “mobility” can refer to a wide range of phenomena (Fortunati & Taipale, 2017), we first clarify the scope of our review. Most notably, we treat the psychology of mobile technology as the mental connection between user and mobile device, along with its downstream implications (e.g., well-being). We place special emphasis on smartphones and mobile apps due to the deep literature on them. However, we anticipate other mobile technologies used between and beyond places of destination (e.g., wearables) to involve similar mobility-based psychological processes and receive more attention in the future (see Bayer & LaRose, 2018). Concurrently, we approach the psychology of mobility as the psychological processes underlying how we move and how different spaces (i.e., locations, places) impact our behavior. We thus focus on “daily spatial mobilities” (Kellerman, 2012), which involve “the corporeal travel of people for work, leisure, family life, [and] pleasure” (Büscher & Urry, 2009, p. 101).

In this chapter, we chart parallel lines of research on mobile technology and daily mobility. Specifically, we review how people engage with mobile technologies in-place and on-the-go, as well as their broader connection with their mobile devices. In each section, we review and link perspectives from psychology and mobility studies towards an integrative understanding of mobile media use. We then survey emerging mobile methodologies with potential for interdisciplinary work. To conclude, we collapse these boundaries – between being in-place and on-the-go, and mobile technology and daily mobility – to consider the trajectory of future research on the psychology of mobile technology.

Using Mobile Technology In-Place

An avid gamer like Jerry will likely play *Candy Crush* in a wide variety of *in-place* spatial contexts. We use the broad term “spatial context” to refer to physical spaces (i.e., locations, places; e.g., in bed, on the bus), concentrating on the central spaces that make up daily mobility patterns given their attention in prior work. Importantly, such spaces often carry strong

psychological associations in people's minds, in addition to providing a more regular influence on their technology behavior. As mobile devices afford the possibility of use in a variety of regular locations (e.g., at home, at work), usage is frequently tied to particular spaces (Humphreys et al., 2018). Jerry may play *Candy Crush* differently – and react differently – when alone at home versus with friends at a café. Spatial contexts can also be shaped by mobile technology; the surrounds of a café may be experienced differently while playing *Candy Crush* versus talking to friends. In this section, we first examine how people use their devices in varied ways across in-place contexts. We then review research from psychology and mobility studies on how spatial contexts may have distinct psychological effects, before integrating this work towards understanding mobile media use in-place.

A considerable body of work has demonstrated that people engage with their mobile devices differently across spatial contexts. This work often distinguishes between four major locations: home, work, “other meaningful places” (see also “third places,” Oldenburg, 1996), and “elsewhere,” where the latter two locations are distinguished in terms of visit frequency. Usage sessions are consistently longer at home than at work, with mixed results in comparison to other meaningful places and elsewhere (Hintze, Hintze, Findling, & Mayrhofer, 2017; Soikkeli, Karikoski, & Hammainen, 2011; Verkasalo, 2009). For example, a person might spend more time per phone check at home due to the (relative) lack of constraints on their time. In contrast, users display the highest usage frequency – the number of usage sessions per time spent in a certain place – in other meaningful places (Hintze et al., 2017); a person might check their phone frequently yet briefly while at their favorite watering hole. Although people may spend significant time on their phones at home, this usage is relatively less frequent due to the overall amount of time spent at home, even when accounting for sleep (Soikkeli et al., 2011). Due to this lower intensity, locked usage sessions (e.g., checking the notification dashboard) are longest at home though similarly frequent as other places, perhaps reflecting an accumulation of notifications when not in use (Hintze et al., 2017).

The content of these usage sessions also differs across spatial context. Verkasalo (2009) found that at home (versus at work or elsewhere), people were more likely to make long voice calls, send SMS messages, and use alarms, but less likely to use multimedia and Internet browsers. Other key spatial contexts have their own tendencies. Karnowski and Jandura (2014) found that people were more likely to use multimedia services (e.g., cameras) and less likely to communicate with others via calling or messaging apps when hanging out with peers than when at home or on-the-go. Mehrotra and colleagues (2017) demonstrated that music and reading apps were most frequently used at bus stops and train stations. In sum, mobile media use changes in combination with spatial context, including the average session durations, session frequencies, and the types of activities engaged. These patterns of mobile technology usage suggest psychological implications as a function of the surrounding spatial context.

Perhaps the most fundamental in-place context is the home, where usage sessions are longer but occur less frequently. People have more freedom to do a variety of activities (e.g., play the boardgame *Candyland*) and are less likely to need to be attentive or receptive to notifications (Mehrotra et al., 2017). As a result, phone use at home may represent a deviation from a laid-back environment; posting on Facebook at home – but not elsewhere – is associated with higher emotional arousal thirty minutes later (Bayer, Ellison, Schoenebeck, Brady, & Falk, 2018). Beyond particular places, Mehrotra and colleagues (2017) found connections between different qualities of places (e.g., relaxing vs. distressing places, as rated by independent coders) and notification receptivity, notification attentiveness, and phone use. Most notably, app use was lower in more

distressing and more natural places, and attentiveness to notifications was higher in more productive places (Mehrotra et al., 2017).

The findings above can be understood through theoretical perspectives on the role of spatial context in media use (see Campbell, 2019). The constant accessibility of information and communication afforded by mobile technology spreads a digital layer over physical space, creating “hybrid spaces” (de Souza E Silva, 2006, p. 272). On the surface, this might suggest that mobile technology can be used independent of place, leading to an “annihilation of space and place” (Frith, 2015, p. 3). But conversely, it can be argued that mobile devices are actually more coupled with physical space than stationary media. Whereas the spatial context is constant for the television in the living room, the context constantly shifts for mobile media, implying that context may be more impactful for the latter. Furthermore, different spatial contexts may even enable certain uses (e.g., to catch a Magikarp in Pokémon Go) or trigger notifications (e.g., to give feedback on the crowdedness of a subway). Humphreys and colleagues (2018) mapped a theoretical framework to substantiate these notions, describing how context shapes our uses and gratifications of mobile technology, as well as our perception of the affordances of the device. This perspective echoes Farman’s (2012) mobile interface theory, which characterizes mobile phone use as the negotiation of space. In these ways, the physical space surrounding our usage is intertwined with the digital spaces we explore through mobile interfaces.

Why Mobility Matters to In-Place Contexts

Prior work on the psychology of mobility is concerned with being in-place to the extent that (1) mobile people visit different places and (2) experiences with places shape subsequent movement (di Masso et al., 2019). To the former, in a typical day, many people will spend a majority of their time in their homes or workplaces. However, people also choose to go to a variety of so-called “third places,” such as cafés, shops, or parks (Oldenburg, 1996). Such places have been associated with relaxation and social activities (Mehta & Bosson, 2010), suggesting that the places we spend time in reflect our needs. People derive a sense of security (Scannell & Gifford, 2017), bolster their personal goals and identities (Ratcliffe & Korpela, 2016), and feel a sense of continuity in life (e.g., through repeated visits; Froehlich, Chen, Smith, & Potter, 2006) through their attachment to particular places (Scannell & Gifford, 2010), and people select and manipulate their environments accordingly (Buss, 1987). These processes have been sometimes examined through the lens of place attachment, which broadly refers to the “emotional bonds which people develop with various places” (Lewicka, 2011, p. 219). Although most research on place attachment concerns itself with geographic regions (e.g., a country), some work has described the home in particular as a symbol of centrality, comfort, and security – and people often seek it out for these reasons (see Lewicka, 2011).

To the latter, places themselves have psychological implications that can impact downstream mobility decisions. To that end, recent work has harnessed advancements in mobile capabilities to capture the affective and cognitive implications of particular places (Harari, Müller, Aung, & Rentfrow, 2017). On the affective front, Sandstrom, Lathia, Mascolo, and Rentfrow (2017) found that participants reported more positive moods in social places (compared to being at home) and at home (compared to being at work). From a cognitive standpoint, Slepian, Masicampo, and Ambady (2015) found that experiences of high verticality (e.g., looking up) prime high construal level (i.e., more abstract, superordinate processing) (see also Meyers-Levy & Zhu, 2007). Consequently, the affective and cognitive implications of particular places may be related

to subsequent mobility choices, as people seek environments more conducive to their current mood or mental state (see Meagher & Marsh, 2017).

Integrating Research on Mobility and Mobile Media In-Place

The above work on daily mobility provides ample possibilities for explicating the psychology of mobile technology in-place. People move to spatial contexts in ways that reflect their identities and form attachments to particular places. These processes likely shape whether individuals view a certain location as a meaningful locale or a simple pitstop, and then shape how people use mobile media. Furthermore, mobile technology can structure the importance of particular places (Schwartz, 2014): a previously overlooked street corner can become imbued with meaning to Pokémon Go users if it is the site of a virtual gym that offers in-game rewards. In these ways, hybrid spaces can underpin spatial contexts.

Moreover, the effects of mobile technology are likely contingent on the psychological contours of spatial contexts. By contextualizing the ways that our homes and other places structure our emotion and cognition, we will be better positioned to understand the unique role of mobile media use at home. Moreover, understanding how certain spaces and technology behaviors are interwoven may clarify when individuals choose to move. In the process, the perception of different types of spaces must be explored to reveal a deeper understanding of how place matters to media effects (and vice versa).

Using Mobile Technology On-The-Go

Next, Jerry may play *Candy Crush* while going from place to place. These usage sessions can be seen as the “most mobile” of spatial contexts: when users are *on-the-go*. Being *on-the-go* is a unique state of behavior. People must navigate their physical surroundings, often with fast-changing scenes and dynamic decision-making. Thus, Jerry may play *Candy Crush* differently when in a Lyft versus at home. As above, spatial context can also be shaped by mobile technology; commuting is experienced differently when playing *Candy Crush* versus looking out a car window. In this section, we examine how people use their devices in varied ways while navigating on-the-go contexts, highlight work on how such actively mobile contexts may have distinct psychological ramifications, and conclude by integrating these perspectives.

Theoretical frameworks of mobile media are grounded in spatial mobility: the idea that users can use their devices to stay permanently online and permanently connected as they move (Vorderer, Hefner, Reinecke, & Klimmt, 2017). According to the theory of the niche (Dimmick, Feaster, & Hoplamazian, 2011), mobile media have a competitive advantage over other communication technologies in these moments. For example, on public transportation, playing *Candy Crush* is more easily accomplished on a phone rather than a computer or even a tablet; it is more socially acceptable, physically comfortable, and technologically possible. As such, mobile media are often used in on-the-go contexts (Karnowski & Jandura, 2014; Leung & Wei, 2000).

Several early studies established that people utilize different functions of mobile technology while on-the-go. Böhmer and colleagues (2011) found that users were more likely to use music apps and, perhaps counterintuitively, less likely to be using travel apps (e.g., Google Maps). Likewise, Verkasalo (2009) showed that on-the-go users were more likely to use productivity apps and Internet browsers, perhaps because the computer would have a competitive advantage for these functions in the home or at work. A brief caveat, though, lies in

how “on-the-go” was operationalized in these studies: moving greater than 25 kilometers per hour (Böhmer et al., 2011) and not being at home or at work (Verkasalo, 2009). More work is needed that adopts a broader measurement approach, in order to include slower modes of transportation (e.g., walking) and exclude being in other places (e.g., a café).

Perhaps due to these difficulties, most of the work regarding on-the-go mobile media use has been experimental or qualitative in nature. Numerous studies have demonstrated that people walk differently when using their phones (Argin, Pak, & Turkoglu, 2020). For example, Hyman and colleagues (2010) found that people on their phones were more likely to walk slowly, change directions frequently, and not acknowledge other people (compared to control conditions of walking with an MP3 player, with another person, or alone). This suggests that people split their attention between the physical and virtual domains. Figeau and Chaulet (2018) provided more nuance to this attention split via a video-ethnography. At the beginning of trips on public transportation, people are often visually engaged with their mobile devices to check for notifications and other updates. After this initial intensive period, users proceed to browse social media, play games, and do other activities that require less attention, with gaze switches increasing over the course of the trip (e.g., after a scroll, during a game transition). Hence, although the beginning of the trip may be more immersive due to the user’s focus on checking notifications or completing a task, awareness of the physical environment increases over time. Schneier and Kudenov (2018) showed that the degree of this awareness is indeed based on the intensity of the task. When participants were texted more difficult questions, they displayed heightened keystroke activity (e.g., deletions, revisions) and had more difficulty navigating their physical environment. Notably, this study was grounded in mobile interface theory, affirming how an interplay exists between mobile technology and mobility because both our virtual interactions and physical engagements involve the senses (e.g., the “sensory-inscribed” body; Farman, 2012).

Such studies provide insights into our understanding of the psychological implications of using mobile technology while on-the-go. In terms of affect, usage of mobile technology is often driven by boredom, but perhaps more so while on-the-go due to the lack of available alternatives (Figeac & Chaulet, 2018). Furthermore, Reichow and Friemel (2020) argued that perceived insecurity is more likely on public transportation, and users may utilize mobile technology to create a sense of social presence that dispels insecurity. The phone’s status as a symbol of security, which was particularly relevant in the early days of mobile phone adoption (Aoki & Downes, 2003), may remain especially relevant in transit. In terms of cognition, being on-the-go presents a changing physical environment, with ramifications for attention. Some users may ignore external constraints and quickly immerse themselves in their mobile devices (Bayer, Dal Cin, Campbell, & Panek, 2016); indeed, Engl and Nacke (2013) found that playing a mobile game on-the-go versus in-place was associated with more immersion. However, others seem to structure their device usage around their physical environment (Figeac & Chaulet, 2018). As such, on-the-go mobile media use may be particularly habitual, in that it is cued and contextualized by one’s surroundings, as well as incorporated into the flow of everyday mobility routines (Schnauber-Stockmann & Naab, 2019).

Why Mobility Matters to On-The-Go Contexts

Research on mobility provides a fruitful avenue to explicate the psychological mechanisms that underlie on-the-go contexts. For example, a growing body of work investigates the implications of daily mobility experiences for well-being. Ettema and colleagues (2011) introduced

travel satisfaction as a precursor to subjective well-being (Olsson, Gärling, Ettema, Friman, & Fujii, 2013). Satisfaction with travel is shaped by perceptions of travel and waiting time (Carrel, Mishalani, Sengupta, & Walker, 2016), and also drives future transportation decisions (Le, Carrel, & Li, 2020). Other recent work relates travel to a variety of well-being dimensions (de Vos, Schwanen, van Acker, & Witlox, 2013; Mokhtarian, 2019). For instance, Singleton (2019) found that walking and cycling were both perceived as conducive to subjective well-being, but that cycling was also associated with distress, fear, and low security. Hence, daily mobility is inextricably linked to daily well-being.

Daily mobility patterns most often take the form of trips (i.e., going from A to B; Xu et al., 2016), and scholars have thus investigated different types of trips and their psychological consequences. For example, Zhang and Li (2017) distinguished between spontaneous and non-spontaneous trips, finding that spontaneous trips involve an activity range that is larger, more heterogeneous, and less periodic. Glasgow and colleagues (2019) demonstrated that trips that were active (e.g., walking, biking), accompanied, or in natural environments were associated with higher moods, whereas neighborhoods with higher walk scores, an objective measure of walkability, negatively impacted mood (likely due to being in urban environments). The negative impact of walk scores suggests a contrast between subjective perceptions and objective aspects of one's environment while on-the-go. To that end, Chan, Schwanen, and Banister (2019) show that positive perceptions of an environment can override low walkability. Thus, the implications of mobility depend on the type of trip as well as perceptions of the environment.

The importance of how one perceives the environment aligns with basic cognitive research on spatial perception. Schnall and colleagues (2008) demonstrated that social support can influence perceptions of geographical slants. Participants who walked up a hill with a friend or while thinking about a friend perceived a shallower slope, demonstrating that cognitive factors can impact spatial perception. Notably, Luo, Falisi, and Hancock (2020) replicated these findings on social support and spatial perception for mobile media, demonstrating that texting reduced perceptions of geographic slant. Similarly, Balcetis and Dunning (2007) found that hills were perceived as shallower when participants were given more choice about their environment. To reduce cognitive dissonance, people perceive their chosen environments as less aversive. In contrast, cross-country athletes and marine recruits likely view the hill that their coach forces them to climb as particularly steep. The previous findings have implications beyond hills for the psychological ramifications of mobility, providing initial evidence that psychological states (e.g., social support, perceived autonomy) can impact spatial perception and potentially broader perceptions of mobility (cf. Durgin et al., 2009; Schnall, 2017).

Integrating Research on Mobility and Mobile Media On-The-Go

The research threads covered thus far suggest that the psychology of mobile technology and mobility need to be considered in tandem. Indeed, a large proportion of mobile technology usage occurs on-the-go and on-the-go contexts are increasingly marked by mobile technology. After long conceptualizing travel time to be a waste that was only worthwhile to reach a destination, scholarship in mobility studies over the last two decades now recognize that media use occupies a central part of contemporary mobile experiences (Lyons, 2019). For instance, research has demonstrated that perceptions of the value of travel time are pinned to technology use while traveling as well as downstream mobility choices (e.g., Ettema & Verschuren, 2007; Mokhtarian, 2019; Singleton, 2018). Our mobile devices even anchor how we move (e.g., to look

up information about a destination or aid navigation), with psychological ramifications for how we experience mobile technology and mobility (Delbosc & Mokhtarian, 2018).

Unfortunately, these studies remain overlooked within the literature on mobile media, despite their clear relevance and psychological bent. Work on the psychological implications of mobile technology demonstrates that on-the-go usage is often driven by boredom and the need for security, which are likely based in part on characteristics of the mobility itself (e.g., travel time, co-presence of others). In turn, perceptions of mobility are likely shaped by the psychological effects of mobile media use. An example regarding perceived security illustrates this dynamic relationship. Reichow and Friemel (2020) found that traveling on an underground train was associated with perceived insecurity, hypothesizing that travelers would use their mobile devices to increase perceptions of social presence in order to reduce such feelings of insecurity (e.g., texting; Luo et al., 2020). But this behavior feeds back to influence perceptions of the environment itself. In other words, the environment could come to be seen as a lower threat of insecurity, whetting the initial reason to text in the first place. Over time, a malleable but stable balance between security and insecurity likely forms, perhaps codified in the gaze switches between the device and the environment (Figeac & Chaulet, 2018). This example displays the potential for mobile technology and mobility to become tightly interwoven in individuals' minds and depicts their relevance to psychological well-being in daily life.

Users and Mobile Devices

In the previous sections, we explicated how the psychology of mobile technology is interwoven with the psychology of mobility across *in-place* and *on-the-go* contexts. We now compile these contexts into *daily mobility patterns*, seeking to untangle the overall psychological connection between users and their personal mobile technologies. To illustrate, we return once more to our obsessive *Candy Crush* user, Jerry. Because he plays *Candy Crush* in his favorite places as well as out-and-about, clarifying the effects of playing *Candy Crush* – or using smartphones in general – requires evaluating the interaction of media and space. Furthermore, daily mobility patterns are highly regular over time (González, Hidalgo, & Barabási, 2008), suggesting that they serve an outsized role in shaping the mental connection between users and their mobile devices. Next, we review existing research on the user-device connection, overall daily mobility patterns, and their intersections.

People often come to feel psychologically close to their mobile devices as they use these always-present tools for myriad purposes (Walsh & White, 2007). This phenomenon has been described by a multiplicity of terms, including digital companionship (Carolus et al., 2019), virtual friendship (Fullwood, Quinn, Kaye, & Redding, 2017), extension of the self (Ross & Bayer, 2021), and attachment object (Trub & Barbot, 2016), among others. A large body of work considers this phenomenon from the lens of behavioral addiction, though this designation remains debated (cf. Bayer et al., 2016; Pivetta, Harkin, Billieux, Kanjo, & Kuss, 2019). Although the exact nature of the mental connection is complicated and contested, a range of perspectives have defined the strong psychological link that can exist between user and device.

A variety of processes drive this global psychological connection. In terms of cognition, people can offload information and navigation to their devices, which can enhance access to knowledge (Clark, 2008; Ishikawa, 2019). Personal devices offer a wide array of cues, contexts, and outcomes that can be linked together to form complex mental habits (Bayer & LaRose, 2018). In terms of affect, feelings of pleasure, connection, control, and safety are always within arm's

reach (Cumiskey & Brewster, 2012; Fullwood et al., 2017). As a result, mobile technology is able to quell stress and anxiety at key times – and drive such feelings at other times (Carolus et al., 2019; Cheever, Rosen, Carrier, & Chavez, 2014; Melumad & Pham, 2020). In many cases, the resulting user-device connection is strong enough to disrupt or displace other cognitive and affective processes (e.g., memory, face-to-face interaction; Dwyer, Kushlev, & Dunn, 2018; Ward, 2013). This connection is also likely shaped by individual differences (e.g., Big Five; see Stachl et al., 2020).

The above research suggests that the psychological link between user and device – whether framed as “companionship” or “addiction” – is underpinned by daily cognitive and affective processes. Critically, these processes are often contextual. Jerry may develop the habit to play *Candy Crush* to avoid the boredom experienced while waiting in line at the bus stop. This contextual perspective, however, is often glossed over when considering the overall user-device connection. Consequently, we argue that the complex connection between user and device has the potential to be deciphered through a dual focus on mobile technology and daily mobility.

Why Mobility Matters to the User-Device Connection

The notion that the user-device connection represents a combination of contextual usage sessions is further supported by the fact that daily mobility patterns are highly regular. Although people move in a variety of ways (e.g., walking, scootering), mobility is marked by clear intraindividual regularity (González et al., 2008; Song, Qu, Blumm, & Barabási, 2010). Most people walk or ride the same set of paths on daily loops, frequenting a few places (one’s “activity space;” Smith, Foley, & Panter, 2019) with clear temporal patterns. As a result of this stability, researchers are able to predict an individual’s location at a given moment with a remarkably high degree of accuracy (de Montjoye, Hidalgo, Verleysen, & Blondel, 2013). The regularity of mobility likely reflects consistent motivations for movement. Mokhtarian and colleagues (2015) argue that people move for broadly similar reasons, including intrinsic pushes (e.g., wanting to roam about) and extrinsic pulls (e.g., wanting to go to an event), and these motivations are largely stable within individuals.

In turn, researchers have explored the psychological implications of stable movement patterns by relating mobility to sociability, personality, and health. Alessandretti, Lehman, & Baronchelli (2018) found that people who visit more places tend to connect with more people, cementing an association between mobility and sociability. This lends evidence to the idea that people are driven to move because they are driven by a desire to interact (van der Waerden, Béréños, & Wets, 2019). Furthermore, extraverts tend to visit more places and travel farther than introverts (Alessandretti et al., 2018). Mobility patterns also correspond with mental health profiles (see Müller et al., 2020). For example, a wide variety of mobility features (e.g., lower regularity of movement) have been used to predict depression with relatively high levels of accuracy (Canzian & Musolesi, 2015; Saeb, Lattie, Schueller, Kording, & Mohr, 2016). Research has also linked movement patterns to other indicators of mental health, such as stress (Ben-Zeev, Scherer, Wang, & Xie, 2015). Overall, individuals move in regular patterns, and these patterns are related to sociability, personality, and health, illustrating how mobility is integral to mental and physical well-being.

Integrating Research on Mobile Media Users and Daily Mobility

The above precursors of mobility can dovetail or conflict with the precursors of mobile technology usage. Kellerman (2012), Taipale (2014), and others argue that physical mobilities (e.g., spatial movement) and “virtual mobilities” (e.g., communication- or information-based mobile technology usage) are driven by the same core psychological motivations (e.g., desire for proximity to others; Mokhtarian et al., 2015). That is, the same motivation could shape both spatial and virtual behavior, but also potentially be satisfied by either one. Typically, the relationship between physical and virtual mobilities has been examined at the individual level (Dal Fiore, Mokhtarian, Salomon, & Singer, 2014; Mokhtarian, 2002; van der Waerden et al., 2019), such as investigating whether frequent mobile users spend more time at home (Thulin & Vilhelmson, 2019) or visit fewer locations (de Nadai, Cardoso, Lima, Lepri, & Oliver, 2019). But this relationship could also manifest at the situational level (see Ling & Haddon, 2003). For example, extroverts may message their friends on the way to a party, whereas introverts may either message their friends or go to the party (and instead play *Candy Crush* on-the-way). Untangling the shared and distinct precursors of daily mobility and technology usage can advance the psychology of mobile technology.

Taken together, these perspectives provide an underutilized lens to understand Jerry’s mobile device usage. Spatial contexts shape his experience of *Candy Crush*, whether he is in bed or on the bus, and these media-context pairings coalesce into an overall connection to his device. Given the regularity of daily mobility, Jerry likely spends the most time in these spaces and other key locations that form the foundation of his smartphone usage. Hence, the user-device connection cannot be understood without identifying the interactive effects of technology and mobility behaviors, including how the precursors – and effects – of these usage patterns and spaces operate in tandem. If mobile gaming relieves stress during his work commute, yet also amplifies stress during his sleep routine, then the underlying mechanisms of digital well-being may be overlooked (vanden Abeele, 2020). For the above reasons, unpacking how users are psychologically synced with their technologies increasingly demands that researchers delineate the spatial contours of daily mobile behavior.

Methodological Approaches and Advances

An avid gamer like Jerry will likely play *Candy Crush* in a wide variety of *in-place* spatial contexts. Adopting a more integrative approach to studying mobile technology and mobility requires reflection on the methodological toolkit at hand. Much of the work mentioned in this chapter utilized cross-sectional self-reports as part of a survey or experimental approach. Of course, self-reports are the most appropriate way to measure many psychological constructs, as they can uniquely tap into user perceptions (e.g., attachment towards mobile devices; contours of social environments). However, self-reports of mobile media use have faced criticism for being prone to a number of biases. For example, self-reports of constructs that have verifiable answers (e.g., time spent on smartphones) have been found to be fairly inaccurate, if not systematically biased (e.g., confounded with well-being and mental health) (Parry et al., 2021). For self-reports of other constructs (e.g., habitual phone use), it can still be challenging to determine validity, especially when measured in a cross-sectional survey (Ohme, Albaek, & de Vreese, 2016).

In addition to general self-report issues, a large share of the work on the psychology of mobile technology and mobility has relied on surveys that were not administered in naturalistic contexts. Hence, our current knowledgebase overlooks crucial aspects of *in vivo* spatial contexts. Going forward, more studies can be designed to make use of the family of approaches (and terms)

falling under the umbrella of experiencing sampling method or ESM (also referred to as ecological momentary assessment and ambulatory assessment). A variety of means have been adapted to achieve experience sampling over the years (e.g., pagers; Larson & Csikszentmihalyi, 1978), but the widespread diffusion of mobile media such as smartphones and wearables enables ESM studies with relative ease (Schnauber-Stockmann & Karnowski, 2020).

Contemporary media also provide new opportunities to obtain insights about the psychology of mobile technology and daily mobility. Researchers can be in direct contact with participants as they are actively mobile (Kaufmann & Peil, 2020). Alternatively, mobile technology can be used to record or log *in vivo* technology behavior (Deng et al., 2019). Some studies have used log data to infer psychological processes; for example, Oulasvirta and colleagues (2012) measured habitual smartphone use as the frequency of brief checking behaviors instead of using a more traditional self-report measure. Other approaches include video-ethnography, in which participants record their interactions with mobile technology while on-the-go (Figeac & Chaulet, 2018), and keystroke logging, in which researchers analyze how participants type in different spatial contexts (Schneier & Kudenov, 2018). Such data can serve as the basis for interviews and focus groups, as participants can retroactively discuss their phone use and mobility patterns (see Schoenebeck, Ellison, Blackwell, Bayer, & Falk, 2016).

Beyond offering digital traces of emerging media use, mobile technologies represent a new frontier by enabling access to geospatial and transportation data. Scholars have utilized a variety of data sources to acquire spatial insights about mobile behavior, including call detail records (CDR's), cell tower identification, WiFi, smartphone GPS sensors (vis-à-vis native and downloaded apps), and geo-tagged social media (Harari et al., 2017). These methods can passively affix GPS coordinates to a variety of activities and allow researchers to link their datasets to other location-based data sources (e.g., maps, zip codes; Andris, Godfrey, Maitland, & McGee, 2019). Despite these advances, there can still be problems with data accuracy due to satellite geometry, receiver quality, and whether an obstacle (such as a building) blocks the direct line of sight between the receiver and the satellite. These problems may motivate researchers to use multiple data sources (Tu et al., 2017) if possible, or rely on broad typologies of places (e.g., home, work, "other meaningful," and "elsewhere") rather than more specific categorizations.

Last, an increasing number of studies use *in vivo* self-reports and track participants' spatial context in tandem (Harari et al., 2019; Rhee, Bayer, & Hedstrom, 2021). Participant self-reports can be used to establish a ground truth, thus improving the accuracy of the location sensing (Froehlich et al., 2006). Moreover, participants can self-report their psychological states (e.g., Sandstrom et al., 2017), aspects of their environment (e.g., Rauthmann, Sherman, Nave, & Funder, 2015), and their mobility patterns (e.g., Glasgow et al., 2019) while in-place or on-the-go. Looking forward, future work even has the potential to leverage mobile eye-tracking (Pérez-Edgar, MacNeill, & Fu, 2020) and brain imaging (Huckins et al., 2019) to deepen our understanding of mobile cognitive processing.

Future Directions and Conclusions

This chapter has advanced a contextual, spatial, and mobile perspective on the psychological implications of technology usage. We first affirmed the importance of central spatial contexts (e.g., home) by examining *in-place* use of mobile technologies. Next, we considered the contexts linking these focal places by reviewing *on-the-go* usage. These sections laid the groundwork for recentering how we study the fundamental psychological connection between

user and device. We suggest that *daily mobility patterns* – which take the individual to and through these in-place and on-the-go contexts – play a pivotal role in shaping user-device connections, as well as the effects of technology usage. In other words, Jerry's attachment to his smartphone can also be seen as a mental connection between Jerry, the device, and the spaces where he uses apps such as *Candy Crush*.

Future research will be challenged to pinpoint the direct and interactive effects of spatial context on the psychology of technology usage. As noted above, in-place and on-the-go contexts are often studied separately or simply collapsed into “elsewhere,” especially in studies on the psychology of mobile technology. However, this obfuscates the fact that being in-place and on-the-go, and using mobile media in these contexts, can have significantly different psychological implications for users. Emergent research should not only theoretically and methodologically tease apart these contexts, but also explore how place interacts with movement (di Masso et al., 2019). Indeed, prior work illustrates how place attachment is related to mobility patterns (Gustafson, 2009) and how mobility can “spill over” to impact experience with places (Gärling, 2019). Following these ideas, technology researchers should acknowledge and assess the bidirectional, dynamic relationship between being in-place and on-the-go. For example, using mobile technologies to navigate to a location – or entertain oneself on the way – may shape the psychological effects of such locations. Alternatively, using mobile media in particular places may have downstream effects for subsequent mobile behavior. Notably, study designs to this end could draw on the state-of-the-art methods reviewed above, such as passively tracking individuals' mobility patterns and collecting subjective perceptions of in-place and on-the-go spatial contexts in parallel. Looking forward, the increasing number of psychological methods being translated for mobile data collection suggests that connections between psychology and mobility are just beginning.

There is also a need to bridge the disciplinary gaps between research on mobile technology and spatial mobility, which are seldom considered in tandem. In psychology, communication, human-computer interaction, and other research spaces focused on the psychological implications of mobile technologies, there has been scant recognition of the work in mobility studies. We argue this tech-centric approach is myopic. Mobility researchers provide an essential viewpoint on the effects of mobile media by theoretically and empirically foregrounding the question of *why* people move. Moreover, mobility scholars have increasingly studied technology use in transit and incorporated psychological approaches (e.g., Le et al., 2020). Likewise, future research on daily mobility and human movement may draw on theoretical models of technology behavior, as contemporary mobility is often embedded with mobile media. Ultimately, scholars in all domains should explicate the theoretical similarities between transportation and communication (Hildebrand, 2018; von Pape, 2020).

As everyday technologies become more and more mobile, their usage will come to interact with numerous spatial contexts in novel ways – creating complex combinations of potential psychological effects. Although this represents a formidable challenge to researchers of mobile technology, mobility, and psychology alike, it also represents an opportunity to merge energies and integrate agendas. The array of spaces in which mobile media are used today affirms the need to pull theoretical perspectives on movement and place into the central fold of technology research. In parallel, these same technologies surface new opportunities to assess the fundamental role of spatial context in human behavior and cognition. Though linking this constellation of research perspectives is certain to be complicated, it is likely necessary to fully decode our increasingly mobile world.

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