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Locative Mobile Social Networks: Mapping Communication and Location in Urban Spaces

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ABSTRACT *This study conceptualizes the new spatial logic created by the social use of location aware mobile technologies, analyzing how mobile communities are formed by the mapping of social networks in urban spaces. It explores two main areas with the goal of understanding how locative mobile social networks (LMSNs) challenge the traditional logic of networks. First, it conceptualizes LMSNs by comparing them to (1) traditional transportation and communication networks, and (2) mobile social networks (MSNs). Second, the paper discusses potential social implications of LMSNs, such as privacy, surveillance, and social exclusion.*

KEY WORDS: Location-aware interfaces; mobile technologies; networks; space; urban spaces; Internet; cell phones; location; location-based services; *Loopt*

Introduction

Location-aware technology embedded in mobile devices transform cell phones into more than two-way voice communication tools. By being able to locate their position in space these devices are employed as location-aware technologies, connecting people to physical places. One of the ways in which these devices have been used has been to connect people to each other, forming what we call *locative mobile social networks* (LMSNs). One of the characteristics of LMSNs is that they allow users to see each other's position on a map on the cell phone screen and to interact with one another according to their relative distance in physical space. We argue that LMSNs represent a new way by which mobile technologies mediate relationships: (1) between users and physical/digital spaces, and (2) among users connected in a social network.

Mobile phones have been analyzed as interfaces used to coordinate large numbers of people in many-to-many communication settings, developing what Rheingold (2002) called 'Smart Mobs' or mobile social networks (MSNs). Although acts of

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macro-coordination (collective action shaped by the use of mobile technologies in public spaces) have been analyzed by a wide array of scholars as new communication phenomena (Bimber, Flanagin, & Stohl, 2005; Castells *et. al*., 2007; Keyani & Farham, 2005; Ling, 2004; Paragas, 2003; Rafael, 2003; Rheingold, 2002), these studies focused on interactions using mobile technologies without location awareness. Consequently, although MSNs can be considered forms of social networks created via mobile technologies, the organization of the nodes in the network is not necessarily dependent upon the users' position in space.

After 2001, GPS signals became much more accurate, which generated a renewed interest in the development of location-aware technologies. Artists, researchers and the entertainment industry began exploring the potential implications of attaching information to places and locating people and things in physical space. Initially these projects fell under three categories: locative media arts[1] (Bleecker & Knowlton, 2006; Galloway & Ward, 2006; Hardey, 2007; Hemment, 2004, 2006; Hight, 2006; Levine, 2006; Shirvanne, 2007; Tuters & Varnelis, 2006; Vollrath, 2007a, 2007b), location-based games developed by small start-up companies (de Souza e Silva, 2008; de Souza e Silva & Hjorth, 2009; Licoppe & Inada, 2006; Sotamaa, 2002), and experimental research on the potential educational and entertainment uses of location-based applications (Delacruz, Chung & Baker, 2009; Klopfer & Squire, 2008; Person, Espinoza, & Cacciatore, 2001).

Primarily because of delays in opening the location-aware application program interface (API) in cell phones, but also partly due to privacy issues and lag in bandwidth, for almost a decade these types of location-aware projects have belonged to the experimental domain of art, research and games. However, in 2008 the release of the GPS-enabled iPhone 3G, Google's Android operating system, and their accompanying authoring interface contributed to the popularization and commercialization of location-aware applications. Current commercial applications are building off earlier projects and integrating established models of geotagging, mapping and social networking into their functionality. These applications are broadly called location-based services (LBSs). LBSs represent an attempt to commercialize location awareness – LBSs are typically commercial applications that are funded either through location aware advertisements, subscription fees or venture capital. They include a diverse set of applications, ranging from mapping out golf courses and country clubs to helping users find the closest gas station.

Locative mobile social networking applications represent a specific type of LBS, in which, in addition to providing users with location specific information, they allow users to locate each other in physical space via their representation on a map on their cell phone screens. Instead of only attaching information to places or delivering place-based information to users, as is the case for most types of LBSs, LMSN applications also allow users to find each other in physical space. Also, differently from early locative media art works and academic research projects, these are commercial applications, made widely available to the general public. Examples of LMSN applications are *Loopt* (2008), *Brightkite* (2008), *Centrl* (2007), *Whrll* (2009), *Foursquare* (2009) and *CitySense* (2008). LMSN applications enable the mapping of online social networks onto physical space.

This paper argues that, differently from MSNs and other types of LBS, the commercial development of LMSNs might not only affect how we understand urban public

spaces, but also how we connect to other people in these spaces. Ultimately, we suggest that the emerging uses of location-aware social networking mobile technologies lead to a shift in the traditional meaning of networks: from spatial structures where the nodes overshadow the paths, as it was commonly believed when analyzing cell phones, to structures in which the paths indeed matter to the user, since the use of location-aware technologies encourages nodes (users) to pay attention to the paths (physical space) they take. Finally, we must also take into consideration the social and political implications of the popularization of these interfaces, accounting for how they might affect privacy, surveillance, social exclusion and communication in urban spaces.

In order to conceptualize LMSNs and address some of their social implications, we first briefly define the traditional concept of network, focusing on historical network examples, such as the railroad and the telegraph, as transportation and communication networks. We then define MSNs and single-user location-based services, contrasting them to LMSNs by using the locative social network software *Loopt* as an example. *Loopt* illustrates the three main characteristics of LMSNs: mobility, use of network paths, and potential for sociability through the mapping of a user's social network. The paper concludes by examining some of the possible social consequences of LMSNs. By exploring these issues, the paper contributes to the ongoing studies on mobilities through its focus on the interconnections among mobile technologies, location awareness, space and communities. We hope to add to the existing literature on cell phones that already analyzed how these devices influence perceptions of time (Katz & Aahkus, 2002; Ling, 2004; Rheingold, 2002), space (Moores, 2004; Palen, Salzman, & Youngs, 2001), place (Gordon, 2008; Hardey, 2007) and collective action (Castells *et. al*., 2007; Rafael, 2005; Rheingold, 2002) by exploring how the use of location-aware applications influences the relationships between location and communication.

Defining Locative Mobile Social Networks

LMSNs can be understood in four parts: (1) LMSNs are networks; the term network refers to any structure of connected nodes, such as transportation networks, communication networks, information networks, or even social networks, (2) LMSNs are formed when the nodes of the social network (people) are mobile because they are equipped with mobile communication devices and able to move through physical space while communicating to each other, (3) LMSNs are a form of LBS – in other words, LMSN applications are commercial applications available to cell phone subscribers, and (4) LMSNs refer specifically to those types of applications that employ location awareness in order to visualize the physical location of the nodes of a social network (people) on a map on the mobile screen. Mapping users' positions on the cell phone screen is a characteristic that distinguishes LMSN applications from MSNs and other types of LBSs.

Traditional networks, such as transportation and information networks, have generally emphasized speed and flow in order to circulate things and information from node to node in a fast and efficient way (Monge & Contractor, 2003; Rosenstiehl, 1998). LMSNs invert the traditional logic of networks by emphasizing their paths. Rather than attempting to develop a history of networks, the examples that follow aim at illustrating how networks (in this case, the railroad, the telegraph and MSNs such as Smart and Flash Mobs) have been understood in relation to communication and

mobility, as structures that privilege nodes instead of paths. These definitions will help us to demonstrate how LMSNs invert this logic.

Traditional Networks

All types of networks have common characteristics such as spatial quality, connectivity, nodes and paths (Castells, 2000a, 2000b; Deleuze & Guattari, 1987; Petitot, 1988; Rosenstiehl, 1988; Wellman, 1988). Traditionally network analysis has tended to emphasize connectivity and nodes at the expense of paths. Let us take the example of the railroad as a transportation network. With the development of the railroad, the traveling time between two points (nodes) decreased substantially (Schivelbusch, 1986, p. 35). Before the development of the railroad, people spent a considerable amount of time going from place to place, that is, using the paths of the network. They could literally 'feel' the distances and interact with the environment through which they moved, as well as with the people they met along the way. The railroad opened up new spaces that were not easily accessible before, since it became much easier to travel long distances. Schivelbusch notes that paradoxically it did so by apparently 'destroying space', namely the space between points – or the paths of the network. Within this context, the transportation network created by the railroad has been generally analyzed as a structure that privileged the efficiency of the connection between nodes (places) in detriment of the paths (or the space in-between nodes), leading to a perception of space-time compression (Harvey, 1991; Warf, 2008).

We can see a similar perception of communication networks. Following James Carey (1989), Sterne (2003, p. 125) writes, 'every claim made for the telegraph was made for trains beforehand'. Like trains, the communication network of the telegraph was thought to destroy time and space, emphasizing nodes while ignoring the paths the communications had to follow. The telegraph allowed a message to seemingly travel from one telegraph operator to another instantaneously, annihilating the perception of an in-between time and space. Of course, as Sterne points out, the telegraph did not actually annihilate time and space, just as the train did not. Telegraph networks were fast, but not instantaneous, and like trains, they had to follow physical paths (Carey, 1989; Marvin, 1988; Sterne, 2003). Nonetheless, the *perception* was that these mobility networks annihilated space and time and emphasized connectivity and nodes, not paths.

One of the goals of any transportation or communication network has always been to move things (people, goods, information) efficiently, achieving the next node in the fastest possible way. We can see a modern example of this model of networks with the structure of the Internet, which seems to connect distant nodes instantaneously, independent of the path the information follows. With the rise of the Internet as an informational network, some believed geographical distance would no longer matter (Benedikt, 2000; Robins, 2000; Virilio, 1997, 2000; Wertheim, 1999). This notion also caused fears related to the death of geography and the end of cities. Couclelis (2007, pp. 73–74) points out several popular foundational myths of the informational city during the 1990s, two of which are: (1) a much-reduced need for mobility, since everything (shopping, working, socializing) could potentially be done online, and (2) the idea that 'physical networking will be substituted for by virtual', that is, all our social relationships would take place online. We know today

that such predictions did not come true (Couclelis, 2007; Gordon, 2008; Hardey, 2007; Johnson, 2003; Manovich, 2002; Matsuda, 2005; Townsend, 2004; Wellman *et. al*., 2001).

Couclelis' observations highlight two characteristics of the traditional conceptualization of networks, as seen with the examples of the railroad, the telegraph, and the Internet: the perception of the 'annihilation' of space, due to the ability to apparently 'instantly' go from point to point, and the preference for connecting with distant nodes, rather than ones nearby. The ability to carry mobile technologies equipped with an Internet connection allowed people to communicate while moving through physical space, causing one initial change in this traditional model of networks: nodes (that is, people carrying connection interfaces) become mobile.

Mobile Social Networks: Mobile Nodes Converging in Physical Space

Mobile social networks are formed when the nodes of the social network (people) become mobile through access to mobile communication devices. MSNs have four main characteristics: (1) their nodes converge in physical spaces, generally urban centers, (2) the organization of the network takes place in digital spaces via mobile technologies or Web-based tools, (3) they are ephemeral, that is, as fast as they are formed, they might be dispersed, and (4) mobile technologies are used as many-to-many means of interaction, rather than two-way voice communication devices. Flash and Smart Mobs are the paradigmatic MSNs and have been analyzed as powerful ways in which cell phones and other mobile devices can become tools for the formation of social networks in public spaces (Bimber *et al*., 2005; Castells *et al*., 2007; Paragas, 2003; Rafael, 2003; Rheingold, 2002).

Smart Mobs, such as the one that gathered in Manila's main square to protest against President Estrada of the Philippines, are typically political in origin. In contrast, Flash Mobs are generally non-political acts. Groups simply agglomerate in order to perform some unexpected bizarre act, like worshipping a gigantic Tyrannosaurus Rex at Toys'R Us (New York, 2003), dancing in a silent rave (New York, 2008), or having a public pillow fight (San Francisco, 2006; London, 2006; Buenos Aires, 2006), and then promptly disperse. However, both Flash and Smart mobs have the common characteristic of being quickly generated via SMS or email in order to form groups that suddenly gather at specific locations.

Although the nodes of MSNs do converge in a physical space (in contrast with online social networks, such as a Massively Multiplayer Online Role-Playing games, which have a virtual meeting place), the paths they travel until they gather in this physical location is irrelevant for the final outcome of the network. Within this context, MSNs still fit with some of the traditional de-emphasis on paths we found in earlier networks such as the railroad and the telegraph. For example, if someone sends out a mass text message to hundreds of people in central London with the goal of forming a Flash Mob in Kensington Gardens, it does not matter *how* the nodes converge in the space, only that they do converge. The network is spatially located because only nodes in the London area may converge, but whether a node takes the subway, a taxi or walks does not change the outcome of the MSN. The MSN is successful if it features speed and connectivity, just as with earlier networks.

In contrast, individuals using location-aware technologies create a new network structure where the nodes' perception of the paths traversed is once again emphasized. In essence, the basic difference between MSNs and LMSNs is that MSNs are not location-aware. By allowing nodes to 'attach' digital information to physical space and to follow the movement of other nodes on mobile maps, the paths become emphasized in LMSNs, altering the traditional configuration of social network structures.

Locative Mobile Social Networks

Despite its recent popularity, the idea of linking information to places is much older than combining cell phones and GPS, and even older than the removal of the GPS signal degradation in 2000. In 1996, Jim Spohrer (1999) envisioned a system called Worldboard, which employed technology to enhance physical space with digital information. Using GPS devices, the Worldboard project attached information to specific places, superimposing relevant digital data on the physical world. Spohrer envisioned, 'imagine being able to enter an airport and see a virtual red carpet leading you right to your gate, (…) or simply look at the night sky and see the outlines of the constellations' (1999, p. 602).

Spohrer (1999, p. 603) suggested three ways in which our notion of place might be transformed by the use of location aware technology. First, a new conceptual category of thing, as nonphysical information, can now be in a place. The nonphysical information becomes a 'thing' overlaid on physical space and becomes part of that space, not just an augmentation of it. Second, the same place can appear differently according to who perceives it and for what purpose. Depending on the technology available (or the lack of it), people might be able to experience urban spaces in personalized ways. Finally, many of the most useful properties of a place, such as its history, can be stored with the place (Chalmers, 2004), perhaps altering the need for going home to look for information in an encyclopedia or on a desktop computer using the fixed Internet.

Current examples of LBS applications, that use location awareness to combine digital information with physical space, are the iPhone applications *Geopedia* (2008) and *WikiMe* (2008). They use cellular positioning functionality to locate the cell phone in physical space and then provide users with a Wikipedia feed customized to their location. For example, someone walking down 5th Avenue in New York City would see all the Wikipedia articles relevant to that area. By providing users with articles about landmarks, *Geopedia* and *WikiMe* give those landmarks presence and may increase the chance the user notices those places. The digital information becomes more than an addition to that space; rather, it becomes part of the space – a 'thing', in Spohrer's terms. Likewise, the Wikipedia page functions like a physical marker, guiding users to new places or providing new information about familiar places, without requiring the user to leave the place to look for the information. Another example of an early commercial location-aware authoring system is the *HP Mscape* (2005), which allows users to create location-based experiences (such as audio walks and games) by placing virtual objects on a map that can be accessed whenever a user finds herself within the vicinity of the physical location of the placed object. *Geopedia, WikiMe,* and *HP Mscape* affect the way people encounter space because, as Ben Russel, possibly the earliest locative media art theorist, puts it, 'If a device gives you a

personalized view on an unfamiliar place, it changes your experience of that place' (1999, p. 28).

Since 2008, the release of the GPS-enabled iPhone 3G and other 'smart' phones, like the Blackberry Storm, has contributed to the sudden popularization and commercialization of location-aware applications, called location-based services, moving these applications into the mainstream.[2] There are currently a wide variety of LBSs, including applications that show users the closest bank machine, provide reviews of all the restaurants in the users' physical proximity, or enable them to play location-based games. LMSNs are a type of LBS, but they differ from others LBSs, such as *Geopedia*, because users are able to visualize each other's positions on a map on the cell phone screen and communicate with each other depending on their relative proximity in physical space. These new types of networks emphasize the use of physical space as the network paths, thus challenging the way these structures were formerly analyzed. LMSNs, unlike MSNs, refer specifically to networks that employ location awareness as a way of connecting nodes (people equipped with mobile technologies). Digital information linked to space in the form of other people's locations makes users aware of the paths of the network, and might contribute to change the way they perceive the traversed space. In contrast to an MSN, where nodes use mobile technology to coordinate a final destination, LMSN nodes currently active in the network know where other nodes are located at all times and may adjust their movement in space accordingly. In LMSNs, communication may alter the structure of the traditional network because two nodes that are aware of each others' location might coordinate the paths they choose, emphasizing the paths in a way that traditional networks and MSNs do not.

Following this logic, we propose four characteristics of LMSNs: (1) the organization of nodes and formation of the networks occur in hybrid spaces[3] (de Souza e Silva, 2006), (2) unlike MSNs, they are not ephemeral because users are constantly part of a network as long they are logged in to it, (3) instead of tracking only information attached to specific places, like with *Geopedia*, LMSNs track the location of people in physical space, and (4) unlike all other types of previously mentioned networks, LMSNs emphasize the paths – the trajectory space in-between the nodes.

In LMSNs, the totality of the immediate space matters, not just the final destination, as in MSNs. For example, members of the LMSN can see where other individuals are on a digital map and contact people within their immediate surroundings. The ability to find and coordinate with other people leads to a type of connectivity not present in other social networks, such as Flash and Smart Mobs, or online social networks like chat rooms and social networking sites. For instance, one person can send out a mass text message to start a Flash Mob, but that person does not know who is in her immediate vicinity to respond to the message. Users in an LMSN can see where their friends are located and can contact specific friends precisely because of where they are. LMSNs also might lead to serendipitous social connections that are not likely with MSNs. One person may be sitting in an airport terminal, log into her LMSN, and see that one of her friends is sitting a few gates away. This kind of serendipitous connection would be unlikely without location-aware technology that overlays digital information on physical space.

Loopt (2008) was the first commercially available LMSN in the US. Since then, over 200 location-based applications have been developed that include some aspects

of LMSNs (Morgan, 2009), including prominent ones such as *Brightkite*, *Whrll*, *Centrl,* and *Google's Latitude.* All of these applications have two common characteristics: (1) they use the cell phone's location awareness to automatically display a user's location, eliminating the need for self-reported position, and (2) they have the ability to display in real-time users locations on a 2D representational map of the city.

Loopt is a geosocial networking service that works on many different types of phones, including iPhones and Blackberrys, and it was featured in one of Apple's iPhone commercials. When someone logs into *Loopt*, her mobile device uses GPS or cellular positioning to map their location in physical space. The person can then look at the map provided by the program and see if any of their friends are logged into the network. If friends are logged in, they appear on her *Loopt* map as place markers and it is possible to track their movement or follow what they are doing via status updates similar to *Facebook* and *Twitter*. The status updates allow people to post pictures of their location, letting friends 'see' their physical surroundings. *Loopt* also lets people play an active role in locating friends by providing proximity alerts. For example, if a selected friend comes within a certain physical distance, the phone sets off an alert (Toldt, 2008).

LMSNs do more than just allow users to find each other. Like the early locative media art piece *Urban Tapestries* (2002), they also allow people to digitally annotate physical space. For example, if members of the *Loopt* network are looking for a good restaurant downtown, they can log in and see if their friends left any reviews of the restaurants in their immediate area. They can then read those reviews and choose a restaurant based on the digital information attached to the physical space. Digitally tagging physical spaces is similar to what applications like *Geopedia* do, but there is a major difference: LMSNs add a third element onto the digital-physical convergence of location-aware technology – the social. LMSNs allow people to cooperate and use community-based knowledge to possibly change the perception of an urban area, a phenomenon that has been called network locality (Gordon, 2008; Gordon & de Souza e Silva, 2009).

An interesting addition to *Loopt* is the *LooptMix* feature. *LooptMix* changes *Loopt* from a friend/permission-based network into an open network. If users enable *LooptMix*, they can see all the other *LooptMix* users in their immediate physical space, not just their friends. The physical space changes from an area to connect with friends into an area to connect with strangers. Users can even change their settings to target specific types of strangers. For example, a single male can change his filter settings so that only single females appear on his map, or surfers can set up *LooptMix* so that only people who list surfing as an interest appear on their map. The open social network is also the main feature of other LMSNs, like *Brightkite*. Russell (1999) predicted applications like *LooptMix* back in 1999, when he claimed that location-aware technologies would facilitate community by identifying likeminded people who share spatial proximity but would likely not have met. By populating a map of surrounding space with likeminded people, LMSNs can turn every path into a social, hybrid meeting space, further altering the nodes-paths network relationship. Instead of using the network as a way of reaching a specific pre-defined node, people may walk through physical space reading the profiles of complete strangers and messaging them if they look interesting.

LMSN applications, like *Loopt*, take the mobility of MSNs one step further by emphasizing the paths the nodes travel through. The space through which members of a LMSN travel is fundamentally different from the space experienced by members of a MSN. In networks that do not use location-aware systems, the time spent moving through paths to converge in a final location is at least partially removed from the networking experience. For example, if one node messages another group of nodes to meet somewhere, they respond and will likely be out of contact much of the time each node travels through physical space to converge. Additionally, these nodes often are unaware of the location of other nodes until they reach their final location. Members of a LMSN, on the other hand, are constantly connected to the network. The paths of the LMSN are littered with community constructed digital annotations, friends and strangers mapped out in digital space, place-dependent status updates, community created digital images of the streets being passed through, and basically any other inventive way users can think of to use the blurring of the physical and digital as a social mechanism.

Historically, the time spent traversing the paths of modern transportation networks has not been traditionally regarded as social time. In fact, it has frequently been regarded as 'dead' time (Kellerman, 2006; Lyons & Urry, 2005; Schivelbusch, 1987; Sheller & Urry, 2006). Licoppe and Inada (2006, p. 45) note that in Tokyo's public transportation (as in any other large city in the world) sociability 'is limited to polite inattention'. Train passengers typically do not talk to each other and just use the transportation to get from one point to the other. When a user is logged into *Loopt*, however, all time is potentially social time. People might be walking to the subway on their way home from work and see that one of their friends is in a coffee shop a block away. They might then leave their regular path home from work to meet with that friend. Licoppe and Inada (2006, p. 45) have noted that in LBMGs people consciously change the way they commute, avoiding underground transportation that might interfere with their connectivity to the network. Although this scenario is specific to a game, individuals heavily invested in LMSNs will likely make the same decision, avoiding paths that temporarily remove them from the network. Instead of going from place to place, they inhabit the network and use its paths for specific goals: communication and social networking.

Lyons and Urry (2005, p. 263) argued against the traditional assumption that travel time is 'dead time', stating that the boundaries between travel and activity time are increasingly blurred by mobile technologies. For someone using *LooptMix*, for example, travel time in the traditional sense is challenged. As long as there are other *Loopt* users within a set physical radius, whether the other user is a friend or complete stranger, the individual might interact with other nodes in the network. The idea of travel from fixed place to fixed place as 'lost' time is then dispelled because the time users spend in paths may actually be the most active social time of their day. Indeed, the time spent during the act of moving from place to place – i.e., using the paths of the network – acquires meaning again, through what Sheller & Urry (2006, p. 209) call 'the new mobilities paradigm'. According to the authors, 'the mobilities paradigm indeed emphasizes that all places are tied into at least thin networks of connections that stretch beyond each such place and mean that nowhere is an 'island''.

So here we have the three characteristics of LMSNs working together: mobility, use of paths, and potential for communication created by the mapping of friends on

the interface of the mobile device. *Loopt* inverts the traditional logic of the network by transforming the paths of the network into a space to be inhabited. Differently from transportation networks, which also take place in physical space but treat paths as means to get to the nodes, the location-based social network constructed in *Loopt* emphasizes the paths people travel through. The users' movement through physical space gains significance in relation to other network nodes' movement. Unlike railroad space, physical space is not detached from the users' experience. They can stay constantly connected to the network and to the physical space around them. Something as simple as reading about another member of the network's experience at a nearby coffee shop is still a social act and emphasizes the paths the node passes through to get from place to place.

A useful tool to examine the emphasis on paths in LMSNs is Deleuze and Guattari's (1987) theoretical framework of nomadic networks. In nomadic networks, the paths are emphasized over the nodes. Nomads traveling through space still travel from point to point, just like members of an LMSN still travel from point to point. But for the nomad, it is the 'intermezzo', the in-between, which matters more than the final destination. With both the nomad and members of a LMSN, points are 'relays along a trajectory' (Deleuze & Guattari, p. 380), which we can see through an examination of how location-aware technologies may change the traditional perception of paths in networks. For LMSN members, the journey from point A to point B can no longer be thought of as 'travel time' or a commute. Instead, it may become the nomadic trajectory Deleuze and Guattari point to, where the individual constructs her path as she travels, constantly connected to the local network and constantly aware of the social implications of the traveled space. Members of LMSNs no longer travel from point to point – they occupy the space between those points.

So how does this emphasis on paths possibly change how users experience the network structure, and consequently the space that it occupies? In Deleuze and Guattari's terms, nomads travel through smooth space compared to the striated space occupied by sedentary dwellers. In striated spaces, 'lines or trajectories tend to be subordinated to points', and in smooth space 'points are subordinated to the trajectory' (Deleuze & Guattari, p. 478). According to these two statements, it would seem obvious that the space of LMSNs is a smooth space; however, the authors use the example of the sea as 'smooth space par excellence', and discuss how the sea was striated through the use of bearings and the creation of maps. Bearings and maps imparted the sea with *logos,* or law, which translated it into striated space. Following that example, it would seem that the spaces of LMSNs are the ultimate striated spaces. Everything is mapped, and as long as one is logged into the network, the phone screen gives users bearings to help them move through striated urban spaces. Like with the rest of Deleuze and Guattari's work, however, the difference between smooth and striated space cannot be understood on such simple terms. The members of an LMSN may move through space that is intricately mapped and in one sense striated, but because of the way they move in that space, they deterritorialize the striated space back into smooth space. Deleuze and Guattari point to the same phenomenon with the striated space of urban areas where it is possible to reimpart urban areas as smooth spaces by occupying those spaces as an urban nomad. They point to Henry Miller and his strolls through Brooklyn as an example of an urban nomad deterritorializing striated urban areas as smooth space by emphasizing the paths of

his journey and discovering new orientations of the city (1987, p. 482). Smooth spaces are constantly being translated into striated spaces and striated spaces are constantly being reverted into smooth spaces. In this sense, active members of LMSNs revert striated spaces back into smooth ones by emphasizing the journey over the destination.

While it is true that location-aware technology, particularly when used in social networks, has the potential to change how people encounter existing space, it is important to note here that our technologically mediated spaces are primarily social constructions. Following Dourish's (2006) notion of spatiality, which echoes Lefebvre's (1991) definition of space as a social production and De Certeau's (1988, p. 5) view of space as a product of everyday cultural practices, we understand that although technology might play an important role in staging encounters among people and between people and urban spaces, the way this technology is used and appropriated depends on users' cultural, social and economic backgrounds. Within this context, members of LMSNs do have the potential to embrace a sort of urban nomadism and emphasize the paths they travel through over the nodes of their everyday commute; however, not all users will appropriate the technology in such a manner. Some might use these technologies to become more of an 'augmented commuter' than an 'urban nomad', using the location-aware capabilities to move from point to point without any additional emphasis on the paths of their journey.

While people have the ability to appropriate technology in different ways, we should also not forget that access to technology directly affects how people interact with space. For example, proximity to public transportation affects movement through space; cell phone signals or wireless coverage affects movement through space; now, location-aware mobile devices and their affordances will likely affect movement through space. Indeed, Dourish (2006) claims mobile technologies encourage a certain 'appropriation of space' in ways that reflect DeCertau's tactical spatial practices, as modes of personalizing spaces. Furthermore, following Dourish, we suggest that mobile and location-aware technologies also reflect forms of strategic spatial practices, since their development and use are intrinsically connected to issues of power and control. Not only the design of these technologies influence how users might see and find each other in public spaces and what type of person one can find, but also the very issue of having or not having access to the location-aware device determines what types of people one might be interacting with in public spaces, promoting different kinds of urban mobilities. Some issues related to social exclusion, privacy and surveillance that may arise with the increasing use of LMSN applications are analyzed in the next section.

Potential Social Implications of LMSNs: Privacy, Surveillance, and Social Exclusion

Although an extensive analysis of the social effects of LMSNs is outside the scope of this paper, we point out three possible issues that will likely receive scholarly attention as a consequence of the widespread use of location-aware technology in connection to social networks: privacy/surveillance, exclusion, and sociability/communication. Much has been discussed about the threat mobile technologies

represent to personal privacy (De Gournay, 2002; Green, 2003; Ling, 2004; Plant, 2001). With location awareness and the ability not only to link information to places but also to track the position of individuals, it is likely that the discussion about privacy will grow.

One interesting example of the potential privacy issues involved with LMSNs is the *Loopt Facebook* application, which merges the *Facebook* network with the *Loopt* network (Loopt, 2008a). If a *Loopt* user installs the *Facebook* application, all of her *Facebook* friends who have the application can see her location. Generally, on *Facebook* people do not have to be particularly discerning about whom they allow to be their friends. *Facebook* allows users to control privacy settings, but even if one has full access to someone's profile, the available information is limited. People do not typically put their address on their profile, and most users do not include their phone number. Importing a full list of *Facebook* contacts to a locative network will likely change what people consider a 'friend' in social networks. Indeed, Humphreys' (2006) empirical work on *Dodgeball* shows that users recognize that not all social networks are used for the same purpose and not all feature the same friends. With *Facebook*, people may be less discerning about who they accept as friends because of the divide between online and physical spaces. LMSNs blur this divide, leading to increased questions of privacy and surveillance. Letting a random acquaintance know your favorite books or even your current status is far different from letting that acquaintance know where you are. *LooptMix* further questions our idea of privacy and the divide between physical and online privacy by allowing people who are not even random acquaintances to see a user's location.

These privacy concerns are somewhat managed by the design of these LMSN applications. For example, the designers of *Loopt* have created safeguards to limit risk, such as the ability to select which friends are allowed in the network, or the ability to hide location from specific friends. Currently most location-based applications are designed with three main functions in order to allow users to control privacy settings (Arran, 2009): (1) the opt-in function, that is, users need to download the application to their cell phones and explicitly accept the software request to access the user's location, (2) the adjustable accuracy function, that is, users may choose to adjust how precise their location will be displayed to friends, or even may choose to update their location manually (in which case they can lie about their real location), and (3) the out of reach function, or the ability to block location awareness if the cell phone is lost or stolen. However, the security of users' information, i.e., the ability to prevent location information from being accessed by unknown other parties, is still debatable when it comes to LMSNs.

A core privacy concern with LMSNs is whether location information will be provided to advertisers. LMSNs such as *Loopt, Brightkite, Whrrl,* and *Google Latitude* are all provided to the user for free. The easiest way to monetize these services is through location-based advertising, an area that marketing scholars have been studying for some time now (Gidofalvi, Larsen & Pedersen, 2008; Kolmel & Alexakis, 2002; Unni & Harmon, 2007). When individuals are logged in to LMSNs, they provide the applications with their location information. What the developers choose to do with that information is up to them. If location information is sold to advertisers, they can then send ads to people's phones depending on where they are located in physical space. For example, if an individual walks by a coffee shop, she

might receive an advertisement for that coffee shop based on her location. Providing location information to advertisers raises serious privacy concerns, and *Loopt*'s stance on advertising is muddled at best. In an interview with the *Christian Science Monitor, Loopt'*s founder, Sam Altman, stressed that *Loopt* respects users' privacy and does not sell location information to advertisers (Farrell, 2009). However, *Loopt'*s privacy statement includes the following passage:

> Loopt discloses some personally identifiable, registration, profile, or location information to subsidiaries, affiliated companies, or other businesses or persons for the purpose of providing certain features of the Loopt Services, in order to serve relevant advertisements in support of the Loopt Services, and for processing such information on our behalf. (Farrell, 2009)

By including this passage in the privacy statement, *Loopt* will likely be able to provide location information to its partners, who will then be able to target advertisements based on location. The FCC requires that services obtain consent from users before targeting them with mobile advertising, but that consent is often buried in the fine print of user agreements (Holahan, 2007).

Interestingly, the commercialization of location-aware devices caused tension even before the widespread development of LBSs. Locative media art, for example, has been criticized by Tuters and Varnellis (2006, p. 359) for often not engaging critical positions and instead embracing 'the possibility of commercial application'. Much locative media art is funded through corporate sponsorship and venture capital, blurring the lines between promotion, research and development, and art. The tension between commercialization and location awareness is even more pronounced with LBSs, and debates over location aware advertising will continue.

What we see with the development of LMSNs is a possible change in how we understand privacy and consequently surveillance. Since the popularization of camera phones and portable camcorders, it is clear that we have moved away from the Orwellian model of top-down surveillance and Foucault's idea of the panopticon (Foucault, 1987). Indeed, Deleuze (1996) already emphasized the shift from disciplinary societies, represented by confined spaces (prison, school, hospital) and a one-to-many model of control, to the societies of control, represented by open spaces (corporations and markets) in which the control model is not as evident but is nonetheless continuous and unlimited. More recently, Mann, Nolan, and Wellman (2003) proposed the concept of sousveillance to describe ways by which individuals might be empowered through the use of portable communication technologies such as cell phones and camcorders (de Souza e Silva & Sutko, 2008). Mann *et al.*'s idea of sousveillance emphasizes a bottom-up approach in which users are able to neutralize surveillance by inverting its mechanism (i.e., allowing individuals to observe and control both corporations and government). We argue that what we are perhaps seeing with the development of LMSNs is a shift in the current model of surveillance: no longer the traditional top-down surveillance – as in the disciplinary societies – or even sousveillance – where individuals are able to control corporations – but rather a model of co-surveillance in which all individuals in the network know the position of all others. This shift might also imply a change in how people understand issues of power and control – either by normalizing new surveillance

mechanisms, or by making users more aware of them (Hemment, 2004). As LMSN applications develop, it will be critical to investigate how they might fit into these two tendencies.

Built on the foundation of reciprocal surveillance, eventually in LMSNs the safety and privacy of users will still come down to trust. To be completely safe, LMSNs would have to be too limiting to work as a useful social networking tool. Instead, users have to choose how private they want to be and whom they want to trust. Indeed, trust is already demonstrated in the use of urban spaces, where people are comfortable being around strangers and know there are social rules and that others are watching and can assist the enforcement of those rules (de Souza e Silva & Sutko, 2008). When walking in a city, surrounded by strangers, people trust each other to behave in a certain way, creating what Lehtonen and Mäenpää (1997) call street sociability. Obviously LMSNs add another layer to the traditional street sociability, since interaction among users is not randomly created in urban spaces, but rather relies on software that provides precise location information, and possibly additional profiling data about users. However, ultimately, privacy and trust in LMSNs will have to be negotiated both among the members of the LMSN and between the LMSN members and its designers.

Another possible consequence of the use of LMSNs is exclusion. Wood and Graham (2005) identify a type of exclusion in their discussion of 'differential mobility', as the exclusion of the population who does not have access to technology, and therefore cannot move freely. They distinguish between two types of mobility: (1) high mobility, pertaining to those few with easy access, and (2) slow mobility, which includes the majority with difficult, blocked access. In this sense, mobility is directly related to power. At their core, locative technologies are mobility technologies and will likely contribute to Wood & Graham's 'differential mobility'. For example, *Loopt's* release on Google's Android phone uses its location-aware function to provide place-specific traffic updates through Google Live Traffic Maps (*Loopt,* 2008b). The ability to access digital information overlaid on physical space will provide individuals who have access to location-aware technologies with ways to enhance their mobility. However, as Wood and Graham note, differential mobility has always existed. From the moment some people rode or were carried while others walked, there have existed differences in mobility which reflect and reinforce social structures (2005, p. 177). Differently from former types of mobile technologies though, locative mobile technologies may do more than contribute to differential mobility; they may lead to a new kind of 'differential space'.

Eriksson (2005) sees the exclusion/inclusion binary as the functioning logic in Castells' idea of networks, and LMSNs may further the exclusion dynamic of networks by possibly changing the perception of physical spaces for the 'in' crowd. Castells (2000b, p. 470) describes networks as open structures, 'able to expand without limits, integrating new nodes as long as they are able to communicate with the network'. LMSNs are open structures that will expand as more people gain access to location-aware mobile phones, but those who do not have access to these phones will not be able to 'communicate with the network'. The consequences of this network exclusion may affect more than the communication between nodes; they may affect our perception and understanding of public space, where individuals equipped with

these technologies have the opportunity to interact with a space that is markedly different from the space perceived by individuals who do not have access to the technology. For example, two individuals may be walking side-by-side down a crowded street, one individual perceiving the street as a physical space while the other perceives the street as a hybrid space. The physical space is unchanged for the individual excluded from the LMSN while the member of the LMSN perceives the physical space overlaid with digital information.

The 'differential space' perceived by individuals with access to location-aware mobile phones may harm the collective experience of space. Previously, individuals could listen to music, read or daydream to partially remove themselves from their physical space, but the space they occupied was still the same space occupied by other people sharing that physical location. Location-aware technologies may alter our understanding of collective space by allowing even shared public spaces to become individualized and continuing the trend towards hyper/radicalized individualization (Beck, 1992; Beck & Beck-Gersheim, 2002). With location-aware mobiles, users can 'customize' public spaces with features like *LooptMix,* which allows a user to choose what type of person shows up on her map. The customization of space, whether through programs like *Geopedia* or LMSN applications like *Loopt*, has the potential to detract from the shared experience of public space. If, as this paper argues, members of a LMSN occupy a hybrid space combining social, digital and physical elements, how will their 'differential space' affect their relationships with people outside that hybrid space? Further research should ask what the social implications of this customization of space are for public space as a space for negotiating cultural and social differences.

Finally, it is generally assumed that location-aware social networking applications are designed to enhance communication and therefore the connection among the nodes of the network. However, there is already some evidence that the proximity of the nodes in fact creates new types of tensions and communication issues in public spaces. For example, Licoppe and Inada (2009) describe a user interaction while playing the LBMG *Mogi* that was perceived by three players as a case of stalking, due to the close proximity of a fourth player. This situation led to the perceived stalked player to disconnect from the game to avoid further contact. Similarly, Nova and Girardin (2009) tested their LBMG *CatchBob!* in two modes: with and without mutual location-aware interface. One of the findings was that there was 'an underwhelming effect of mutual location-awareness on players' communication: the location-awareness feature not only lowered the exchange of messages about location (which is logical), [but] it also diminished communication about strategy and direction issues' (2009, p. 179). While this finding seems obvious (if you have information about each other's location, you do not need to call to ask for it), it will be important to understand to what degree these applications will decrease verbal and textual communication, rather than enhance it.

Ultimately, future discussions of LMSNs and location-aware media in general should not forget that these technologies are designed inside systems of power. Dourish (2006, p. 5) argues against the understanding of mobile technologies as creating an urban utopia, stating that utopian understandings of users wandering the city with unlimited information at their fingertips often 'fail to acknowledge his [users'] considerations of the systems of power and control within which those tactics emerge

(and against which they should be read)'. We have discussed LMSNs and how locative mobile devices can be used to increase sociability and change how individuals encounter space. This sociability is only one way these technologies can be adopted and shaped inside systems of power. Advertisers can easily use location information to target ads at people based on the stores they walk by and their previous purchases; governments can use location awareness to track how fast people are driving; some products are even being marketed for individuals to track their spouses or their children. LMSNs are merely one way people have developed location aware technology. LMSNs may change the way people travel through space and the way they socialize by adopting surveillance technologies for less dangerous purposes. This adoption may even expose surveillance practices by making them explicit (Hemment, 2004). But LMSNs may also decrease privacy, change our understanding of what it means to be watched, and lead to an exclusion that turns away individuals who are not members of the technological elite. Further research needs to address these issues, never forgetting that, as Dourish (2006) reminds us, an understanding of the way people use the technologies should address how and why the technologies are designed.

Conclusions

This paper conceptualized LMSNs, taking into consideration how they might change our perception of space and create a new logic of networks. With the goal of understanding the spatial and networked logic of LMSNs, the paper conceptualized LMSNs in comparison to MSNs and as a particular instantiation of LBSs. Finally, we considered some of the possible social implications of the use of LMSN applications, such as privacy/surveillance, exclusion and sociability/communication. Although we still do not know what types of applications and social implications will emerge from the social use of location-aware technology, the conceptualization of such networks will be useful to create a theoretical framework through which to study them.

Notes

1. The art movement that utilized locative technologies was called locative media, and since the early 2000s the term 'locative media' has been widely used by artists as a way to describe the use of location aware technologies (Galloway & Ward, 2006; Hemment, 2004; Russel, 1999). In this paper, we are using the term locative media in its strict sense (referring to locative media arts), and applying the term LBS to broadly specify the employment of location-awareness in order to deliver / retrieve location-based information to users within the domain of commercial applications (instead of artistic or research projects). LMSNs, in this case, are a particular instantiation of LBS, denoting applications that allow users to visualize other users in real time on a map on their cell phone screens. We believe this distinction is important because the social analysis of exclusion, privacy and surveillance we develop later on in this paper acquires increased significance when these applications move out of the experimental domain of art and research and start being widely used by the public.
2. We are not claiming that location aware applications have suddenly left the experimental domain of art and research and are now available to the general public only because of the development of specific hardware – that would be too simplistic. As with every new technology, there are many of social, economic, cultural and technological issues that contribute to the development and adoption of new technologies (Kellerman, 2006). However, it is undeniable that the availability of new

platforms that allowed users to both access and build these applications significantly contributed to their popularization.

3. Hybrid spaces are mobile social spaces created by the constant movement of users who carry portable devices continuously connected to the Internet and to other users (de Souza e Silva, 2006). http://www.aec.at/en/archives/prix_archive/prix_projekt.asp?iProjectID=10954

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