Geospatial technologies in the location-aware future
Viewpoint for special issue of *Journal of Transport Geography*

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Abstract:

Arguably, there have been few shifts in the GISciences so paradigmatic as the emergence of locationally-aware mobile devices. GISc researchers in the US have witnessed these changes in just the last crop of PhD students, with topics on location-based services, the geoweb, volunteered geographic information and neogeography, somewhat eclipsing earlier, trendy topics on web-based GIS and interactive digital cartography. Indeed, there are new important players in GISc, with training in and outside of Geography, with backgrounds as diverse as the engineering/computational sciences and the digital humanities as well as critical human geographies. Mobilities researchers, qualitative GIS scholars, cyberinfrastructural scientists, and social and cultural geographers have configured research programs around the proliferation of locationally-aware devices and the 'big data' that have emerged from them. In this viewpoint, I shall outline these diverse developments and sketch what I argue are the foundational issues that comprise a research agenda with and about geospatial technologies in the location-aware future: technological development, the social life of data, and the everyday practices around mobile digital devices.

Key words: location-based services; mobile devices; location-aware future; GIScience

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Bodies as digital infrastructure?

> "if we could only find a way to create electricity from the heart beats of the homeless people now as well, companies could also provide the 'tangible and valuable' service of allowing us to plug in and recharge their phone batteries while we surf.... wow the first world is really getting somewhere at last!" Hunter Karen, commenter on ReadWriteWeb article on homeless hotspots at SXSW (Mitchell 2012)

Is there room for scholarship around the social implications of geospatial technologies within contemporary GISc research? As the proliferation of mobile digital information technologies continue to generate massive geospatial datasets about everyday life, the GISciences are responding with new analytic and visualization techniques as well as new considerations around the utility of such data (its quality, accuracy, interoperability, etc.). However, how might the GISciences respond to the treatment of homeless bodies as digital information infrastructure, a question that requires a recognition of the broader implications of the growth of digital technologies? Indeed, GISc research about the geoweb is research that is impacted by (and necessitates) new mobile technologies and expanding digital infrastructures.

The above sarcastic comment was placed on a blog entry critiquing the use of homeless people as wireless hotspots at South by Southwest (SXSW) 2012 in Austin, Texas (Mitchell 2012). Recognizing the influx of the digerati at this music, arts, and technology conference, a Brooklyn-based marketing company decided to tackle what they saw as a design problem -- homeless people selling newspapers on street corners. They wondered: why not enroll the homeless population in selling a higher end product, and one that they felt held more potential value by a range of consumers? By partnering

with a local homelessness advocacy group, FrontSteps, this company enlisted the homeless of Austin to wear t-shirts stating 'I am a hotspot', encouraging people standing in lines for restaurants and music venues at SXSW to pay for access to a wireless hotspot, such that they could use their mobile devices to access the internet. Nearly instantaneously, this development became controversial as commentators on the web debated the utility and broader significance of the seemingly benign nature of this socio-technical innovation.

Is this exceptional, an unusual development at a gathering already prone to techno-hype and should be dismissed as such? Or is this perhaps illustrative of the peculiar pervasiveness of digital culture, wherein the demands of connectivity necessitate new, innovative infrastructures, and new vehicles to serve the throng of digital technophiles on the move?

If the rise of the GIS & Society movement in the 1990s indicates a recognition of the entanglement of geospatial technologies and their utilizations (see Smith 1992), then how might GISc research respond given the saturation of location-based mobile technologies and the complex assemblages that condition their prevalence? Here, I argue that with the rise of the location-aware future, wherein digital media increasingly draws upon geospatial technologies, the GISciences have a responsibility to interrogate the increasing interplays between socio-technical systems like location-based services (LBS) and everyday life. In what follows, I briefly sketch the new actors in this field of study and then offer what I argue are the foundational issues in this emerging research agenda.

Location, location, location

Socio-technical developments like the geoweb, neogeography, and volunteered geographic information parallel new and important players who are both within GISc and are engaging at the

margins, with training in and outside of Geography (see Wilson and Graham 2013). Their backgrounds are as diverse as the engineering and computational sciences as well as the digital humanities and critical human geography. Mobilities researchers, qualitative GIS scholars, cyberinfrastructural scientists, and social and cultural geographers have configured research programs around the proliferation of locationally-aware devices and the 'big data' that have emerged from them.

For instance, 'mobilities' is a buzzword that has relatively reached a plateau, with journals like *Mobilities* and *Transfers* exploring not only the behavioral aspects of movement but also the cultural and affective significance of mobility (Cresswell 2011). GIScientists have brought geospatial methods to bear upon these studies, to generate datasets and visualizations to breathlessly capture the aggregation of movements across the planet or within cities. These cinematic gazes capture the seemingly restless intensities of space-time interaction as well as the negative spaces of the seemingly immobile, stationary, and static.

The study and representation of movement is not limited to the quantitative aggregation of massive, individual events. Indeed, qualitative GIS is an area of research that provides that mapping technologies can be utilized to better link qualitative inquiry to geovisualization. This iterative research process holds that the map can inform interrogations into social-spatial phenomena, just as the emergent qualities of interviews, participant observations, and ethnographies alter the map production (Brown and Knopp 2008). Indeed, the study and representation of spatial relationships, including but not limited to movement, is mired in questions of who speaks for whom, what generalizations are made to simplify complex spatial phenomena, and ultimately how the mapped representation sets into motion new social-political relations.

The rise of 'big data' has also generated a cluster of cyberinfrastructural scholars within Geography around what has been called 'cyberGIS' (Wang 2010, Sui and Goodchild 2011, see also http://cybergis.org). CyberGIS is a domain of research and development which maintains that with 'big data' comes significant challenges in storage, processing, and visualization, in ways that require innovative leveraging of computing power from multiple and distributed sources. The proliferation of mobile devices collecting massive amounts of information about individual events in specific locations necessitates the distribution of computing architectures to spatially analyze and 'make sense' of a variety of socio-natural phenomena, from traffic patterns to global climate change.

Central to these diverse areas of scholarship and development is innovation in location-aware mobile devices and the capturing of geospatial data at unprecedented rates. These emerging datasets capture movements as well as the absence of movement at new levels of granularity -- both in terms of individually identifiable and trackable objects as well as the personalization of objects through the interoperability of a range of information from an object's digital dossier (histories of habits and preferences, anomalies and outliers, etc.). In other words, the code/spaces of everyday life are increasingly saturated with digital geographic information technologies (Kitchin and Dodge 2011). There is a need, therefore, to sketch an emerging research agenda that draws together scholarship examining the social and political implications of these expanding digital geographic technologies with research that enrolls these technologies to understand social-spatial phenomena.

Foundational issues in an emerging research agenda

Given these diverse developments, I suggest three foundational issues that comprise an emerging research agenda *with* and *about* geospatial technologies in the location-aware future: the conditions of

technological development, the social life of data, and the everyday practices around mobile digital devices. This perspective is guided by existing GISc research that is increasingly within the domain of both technical and critical scholarship (Elwood 2006a, b, Leszczynski 2009, 2012, Schuurman 2008). I conclude, then, with brief sketches, to underline the importance of social/critical scholarship within GIScience research about mobilities.

1. The conditions of technological development

The prevalence of location-based services built into mobile devices emerges as a result of government regulation of enhanced-911 services in the US and the recapturing of capital investment necessary to follow these regulations through the commercialization of mobile LBS. As I have argued previously (Wilson 2012), interrogation of the discursive and material relations that condition the rise of mobile LBS further develops the conceptual footing which enables the production of geospatial data. In other words, being able to study how LBS companies like Foursquare and Google produce the circumstances under which a potential user might feel compelled to 'check-in' to a particular location -- thereby producing geospatial data -- is crucial to the representation of such geospatial data. Big data landscapes are therefore conditioned by particular technological developments that GIScientists interested in mobility need to understand. For instance, research questions that attempt to examine the thresholds for positional accuracy which verify individual check-ins must also understand the commercial interests that condition the establishment of these thresholds. In this sense, volunteered geospatial data is often implicated (if not propelled) by broader concerns for the *value* of such data.

2. The social life of data

Data matter and have matter. Additionally, geospatial data have particular effects which enable and drive public participation in shared governance (Elwood 2004, Ghose 2007), the advocacy of indigenous knowledges (Weiner and Harris 2003), the controversies of participatory research (Herlihy 2010), and mediations of place (Zook and Graham 2007). As I've suggested, data, as more-than-human actors, are types of power/knowledge that transform anecdotal concerns into legitimate evidence while altering the speed of subject formation in the shifting politics of the urban (Wilson 2011). The pervasiveness of geospatial data in the location-aware future demands a deeper and sustained response, therefore, such that data about movement and stasis are understood as catalysts for change -- whether social-political or of the built environment. In other words, data are expressions of power, and are potentially dangerous if not taken seriously and responsibly. Data can motivate a whole series of policies and political subject formations that can render opaque processes of difference. That 'data speak for themselves' is undoubtedly transformative and yet the affective domains produced by this statement bear further investigation. The work of GIScience can serve to further these sentiments, and yet being attentive to the peculiar power/knowledge force of data can also enable a deepening of the connections between GIScience and the societies that condition these engagements.

3. The everyday practices around mobile digital devices

Not all mobile devices are created equal, nor are the different kinds of interactions made possible through them. Here, I suggest that research examining the various everyday practices around mobile digital devices is foundational to GISc scholarship around mobility. Some devices are meant to be held; some are meant to be worn. Others are ambient, collecting information about movement and stasis without user intervention or knowledge. Some geospatial data are knowingly volunteered;

some data are ancillary to provide the informational fabric from which other mobile LBS are built and interacted with. Therefore, studies and representations of mobilities demand a recognition of the various interfaces to mobile digital devices -- interrogations of the discourses and material conditions that saturate geospatial data practices. For instance, work by Sam Kinsley (2010, 2012) has sought to examine the logics of anticipation that are productive of digital information technologies, while James Ash (2010a, b, 2012) examines the constitutive experiences of temporality in video games and navigational systems. However, these social and cultural geographies of everyday technological interactions are largely not taken up within GISc research about mobility, missing an opportunity to broaden the impact of such scholarship, as mobility is both a technical and cultural phenomenon. What would it mean to further a GIScience that not only appreciates the technical diversity of interfaces that give rise to geospatial data but that also understands these interfaces as social and cultural, as amenable and optimized for specific capacities (of thought/action) and not others?

Geospatial technologies are increasingly placed within a co-constitutive relationship with the discourses of the location-aware future. As geospatial industries are restructured and reconfigured around 'big data' and the affordances of the ubiquity of mobile digital devices, new opportunities and challenges emerge for the *use of* and *the study of the use of* geospatial technologies. The tacking back and forth between technical practices and critical practices -- the hallmark of the GIS & Society tradition -- is ever more pressing. The rise of massive geospatial datasets does not negate the need for this interactive research practice. Rather, 'geospatial technologies in the location-aware future' is a reorganization of what should be considered GISc scholarship, necessitating new collaborations, new practices and conceptualizations, which should be both demanding and rewarding.

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