Understanding spatial media

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Abstract

Over the past decade a new set of spatial and locative technologies have been rolled out, including online, interactive mapping tools with accompanying application programming interfaces (APIs), interactive virtual globes, user-generated spatial databases and mapping systems, locative media, urban dashboards and citizen reporting geo-systems; and geodesign and architectural and planning tools. In addition, social media produces spatial (meta)data that can be analysed geographically. These technologies, their practices, and the effects they engender have been referred to in a number of ways, including the geoweb, neogeography, volunteered geographic information (VGI), and locative media, which collectively constitute spatial media. This chapter untangles and defines these terms before setting out the transformative effects of spatial media with respect to some fundamental geographic and social concepts: spatial data/information; mapping; space and spatiality; mobility, spatial practices and spatial imaginaries; and knowledge politics. We conclude by setting out some questions for further consideration.

Key words: spatial media, locative media, geoweb, neogeography, volunteered geographic information, space, mapping, mobility, knowledge, spatial data

Introduction

Over the past decade, the practices which produce, process, analyze, share and use digital spatial information have diversified and proliferated. No longer are the handling, storage and

examination of digital spatial data confined largely to standalone geographic information systems (GIS), remote sensing packages and specialised geomatic applications that are within the control of a small number of authoritative state, private sector and academic stakeholders, and serviced by a limited pool of skilled personnel. Rather a varied set of new networked and often mobile spatial technologies have been developed that are open to use, contributions and editing by anyone with access to the internet. These developments in technology have accompanied rapid shifts in the social, economic, cultural and political geographies of everyday life, with new opportunities for capitalist accumulation and speculation, state and corporate surveillance and governance, and citizen science initiatives.

These new **spatial and locative technologies** include a suite of applications that are explicitly spatial wherein location and mapping are core to their modus operandi. This includes online, interactive mapping tools with accompanying application programming interfaces (APIs) that enable the easy production of map mashups which can be embedded on any web page and push applications beyond desktop GIS (e.g., Google Maps); interactive virtual globes that users can tag and layer data over (e.g., Google Earth); user-generated spatial databases and mapping systems (e.g., OpenStreetMap and WikiMapia); locative media (e.g., satnavs and location based social networking); urban dashboards and citizen reporting geo-systems; geodesign and architectural and planning tools. In other cases, applications enable georeferencing that produces spatial (meta)data and can transform the technology into spatial media, but this is not core to its functionality and the system can operate independently of such spatialisation. For example, social media apps such as Twitter and Facebook enable users to georeference tweets/posts creating a rich set of geosocial data, but the apps work as intended without such georeferencing (Kelley, 2011). Similarly, articles in Wikipedia and online data repositories can be geotagged, enabling them to be searched by location and spatially visualized. Search has also become spatialized through the location of the searcher. Since 2010, Google has integrated location into all searches either through the IP address of a computer or the GPS coordinates of a smartphone (Gordon and de Souza e Silva, 2011). Furthermore, maps as branded media are being used to promote institutions and showcase policy and provide a means to navigate web content. Concurrently, there are many more non-traditional and administrative datasets making their way into spatial media via open data portals, which in turn are spatializing administrative data.

Geography then has become a key 'organizational logic of the web' and the web has become a key means to mediate space, location and sociality (Gordon and de Souza e Silva, 2011: 3). Indeed, these spatial and locative technologies render virtually everything located or

locatable, and thus open to navigation via maps or spatialisations and interpretation through geographical analysis (Gordon and de Souza e Silva, 2011; Wilson and Graham, 2013).

These new technologies have been enabled by the rollout of dense, distributed internetworking – through a variety of communication channels and protocols such as WiFi, bluetooth, GSM (Global System for Mobile communication), RFID (Radio-Frequency Identification), NFC (Near-Field Communication), and the development of enhanced 9-1-1 services. These systems have been extended through ubiquitous computing (computation being accessible through a plethora of networked devices), new mobile platforms with embedded GPS (e.g., smartphones), convergences in media (text, images, maps, audio, video, *etc.*), and advances in computation, machine learning, indexical and machine-readable identification, non-relational databases, and cloud storage (Cartwright *et al.*, 1999, 2007; Taylor, 2005; Crampton, 2009; Kitchin, 2014; Leszczynski, 2014). In particular, the move from Web 1.0 to Web 2.0 in the mid-2000s was instrumental. In the initial roll out of the internet, the web was largely a broadcast medium focused on consumption in which information could be searched, retrieved and read, and services and goods purchased. Spatial information and mapping was largely curated by a few established sites, backed by large capital investment and skilled technical knowledge, that delivered static or dynamic/interactive content through a one-to-many system of communication (such as US and Canada Online National Atlas, Terraserver USA and NASA World Wind, Mapquest; Graham, 2010). These key framework datasets remain a key resource underpinning much spatial media. However, with the shift to Web 2.0, the web became more participatory, social, open (although the extent to which it fulfils these qualities is a continued debate), shared and dynamic, with content being produced by users in many-to-many relationships, rather than just specialists, enabled by software infrastructure and APIs that were robust, scalable and, in some senses, invisible to user experience (Kitchin and Dodge, 2011). Web 2.0 facilitated people to communicate and work collaboratively through processes of writing, editing, extending, remixing, posting, sharing, tagging, communicating, and so on (Beer and Burrows, 2007). Key developments included the public release of the Google Maps API in 2005 and the centrality of location-awareness in iOS and Android smartphone apps from 2009 onwards that encouraged the development of mobile apps (Crampton, 2009; Gordon and de Souza e Silva, 2011; Kelley, 2011).

Importantly, new networked spatial and locative technologies are not simply a re-working or extension of traditional maps and GIS. Rather they employ 'different digital structures, techniques and applications', enable different functional and technical affordances,

and emerge from different knowledge communities and commercial and political economic contexts (Elwood and Leszczynski, 2013: 549; Wilson and Graham, 2013). As such, while they are related and co-implicated, they are largely 'genealogically distinct from GIS developments' (Leszczynski, 2015: 730; Wilson and Stephens, 2015) and represent 'a profound shift within regimes of the production, dissemination, and institutionalization of geographic information' (Leszczynski, 2012: 72). Moreover, they are much more ubiquitous and entrenched within peoples' everyday practices than GIS technologies (Leszczynski and Elwood, 2015).

Collectively, these spatial and locative technologies and the effects they engender have been referred to in academia and industry in a number of ways, including the geospatial web or geoweb, neogeography (Turner, 2007), volunteered geographic information (VGI), locative media, spatial media, and more specific terms related to certain forms, for example, cybercartography (Taylor, 2005), map hacking (Schuyler *et al*., 2005, Erle *et al*., 2005), maps 2.0 (Crampton, 2009), GIS 2.0 (McHaffie, 2008), ubiquitous cartography (Gartner *et al*., 2007), wikimapping (Sui, 2008), crowdsourced cartography (Dodge and Kitchin, 2013), and citizen cartography (Graham and Zook, 2013). It is worth untangling and defining each of the more general terms, which are often used interchangeably.

The geospatial web, more commonly known as the **geoweb**, refers to the spatial *technologies* (hardware, software, APIs, databases, networks, platforms, cloud computing), *spatial content* (geo-referenced and geo-tagged data) and the internet-based mapping and location based *applications/services* that they compose and enable (Scharl and Tochtermann, 2007; Haklay *et al*., 2008; Crampton, 2009). While the geoweb includes conventional, web-based GIS, it is generally taken to refer to new spatial technologies that are more interactive, participatory, social and generative in nature (Haklay *et al*., 2008; Kelley, 2011; Elwood and Mitchell, 2013; Wilson, 2014). In essence, the geoweb is the collective noun for the aggregate of spatial technologies and geo-referenced information organized and delivered through the internet (Scharl and Tochtermann, 2007; Elwood and Leszczynski, 2011; Leszczynski, 2012). **Locative media** are a subsection of the geoweb that situate users in time and space and mediate interactions with locations (Wilken and Goggin, 2014). As such, the underlying data, practices, and services are location-orientated (Thielmann, 2010). Such locative media include navigation and routing applications, location-based services, and advertising practices where users are recommended options with respect to activities based on their present location, and location-based social media (Wilson, 2012). Sui and Goodchild (2011) group the latter into three categories: (1) social check-in sites (e.g., Foursquare); (2)

social review sites (e.g., Yelp, Tellmewhere, Groupon); (3) social scheduling/events sites (e.g., Meetup). New applications, such as Waze, crowdsource real-time traffic and share navigation recommendations.

Neogeography and VGI refer to the *new relations and practices of geographic production and consumption* that are created by the rollout and use of the geoweb (Wilson and Graham, 2013). Because the geoweb is largely part of the movement to Web 2.0, 'non-expert' users can use tools to generate, map and share their own spatial data and spatial apps (Turner, 2007; Graham, 2010; Wilson and Graham, 2013; Leszczynski, 2014). In this sense, it constitutes **neogeography -** a new form of producing geography, in that those who interact with and help build the geoweb do so by adding new georeferenced data to initiatives such as OpenStreetMap or WikiMapia, creating map mashups, geotagging encyclopaedia entries, building spatial wikis, reporting urban issues to city geo-services, checking-in to locations, *etc.* Here, geoweb users undertake a form of prosumption adding crucial value in the creation of a product or delivery of a service, which they also actively consume, for little or no recompense (Ritzer and Jurgenson, 2010; Dodge and Kitchin, 2013). With respect to a project such as OpenStreetMap (a political project countering the Ordnance Survey Great Britain's closed data policy), rather than rely on prepared, proprietary, and copyrighted cartographic data/products, users voluntarily collect, clean, and upload GPS data, add attribute data, and edit, refine and extend the contributions of others in order to peer-produce a collaborative, detailed, open-source mapping platform (Dodge and Kitchin, 2013; Haklay, 2013). Such spatialised prosumption has been termed **volunteered geographic information** (Goodchild, 2007), though VGI also refers to the generation of spatial information that has not been consciously produced such as the spatial data fumes of geosocial media (Kelley, 2011; Thatcher, 2013).

Neogeography and VGI, it is thus argued, constitute a new form and era of geographical production/consumption in that control and creation shifts from elites and professionals to ordinary people – it is personalised geographical praxis for 'anyone, anywhere, and anytime, and for a variety of purposes' (Haklay, 2013: 56). As such, it is *neo-geography* in that the geoweb supersedes and breaks with traditional mapping regimes, practices and technologies, such as conventional cartography and GIS (Leszczynski, 2014). That said, not all of the geoweb is supported by neogeography, with a number of initiatives, especially those supported by the state, relying on more traditional production practices (such as urban dashboards), and the supporting architecture and software being developed by specialist staff. Cybercartography, and more specifically cybercartographic atlases, include

participatory mapping, neogeography and VGI but also reconfigure mapping technology to enable emerging ontologies, especially indigenous knowledge representations. Further, these atlases recognize that spatial media are also multimodal, and can be multisensory, and include multimedia, and that new legal structures are required in order to ensure that collective knowledge represented in maps and atlases, especially indigenous knowledge, can be protected in a copyright regime (Taylor, 2005; Taylor and Lauriault, 2014).

Given that the geoweb does not simply present spatial information but mediates a diverse set of socio-spatial practices – communications, interactions, transactions – that extend beyond the representational practices and work of traditional maps it has been argued that it constitutes a set of **spatial media** (Crampton, 2009; Elwood and Leszczynski, 2013; Wilson, 2014). Early antecedents of this conceptual shift can be found in references to maps/GIS as media (Peterson, 1995; Sui and Goodchild, 2001; Wilson and Stephens, 2015), the spatial mediation of heterogeneous content (Cartwright *et al.*, 2007), and cartographic mediation or the processes of geo-mediation (Pulsifer and Taylor, 2005). Leszczynski (2015: 729) argues that spatial media refers to 'both the technological objects (hardware, software, programming techniques, *etc.*) with a spatial orientation' that make-up the geoweb, as well as the 'geographic information content forms produced via attendant practices with, through, and around these technologies'. With respect to the latter, spatial media are 'the mediums, or channels, that enable, extend or enhance our ability to interact with and create geographic information online' (Elwood and Leszczynski, 2013: 544). In effect, what the geoweb does is act as spatial *media;* as *interfaces* to create, access and share information and *communication channels* to express spatial relations and meanings (Gordon and de Souza e Silva, 2011; Leszczynski, 2015). From this perspective, the spatial and locative technologies of the geoweb constitute a set of spatial media through which spatial information can be collectively generated, contested, shared, and analyzed, spatial practices are facilitated, and value leveraged. They are 'sites of potential relations between individuals; persons and places; and people, technology, and space/place'; and they re-shape spatial knowledge, mediate spatial behaviour, and enact spatial politics (Leszczynski, 2015: 729; Elwood and Mitchell, 2013; Elwood and Leszczynski, 2013). Focusing on the geoweb as media prioritizes a concern with the *production and flow of information through them, the practices and uses they enable, the work they perform,* and the *new mediatizations of space, place, location and mobility they enact* (Wilson and Stephens, 2015).

In this chapter, we are concerned with the geoweb, neogeography and spatial media -- taken to encompass all of the other neologisms discussed so far -- but use spatial media in the

title because it encapsulates both the technological components, spatial content (geoweb) and the emergent socio-spatial practices (neogeography), and stresses the work that these do in mediating and conditioning everyday life and producing new spatialities and mobilities. The following section examines some of these new mediatizations and how spatial media is helping to fundamentally transform: the generation of spatial information; the processes and forms of mapping; the nature of space, spatiality and sociality; the practices of mobility and spatial behaviour; the contours of spatial knowledge and imaginaries; and the formation and enactment of knowledge politics.

The transformative effects of spatial media

As documented in detail in Part 3, spatial media have diverse effects on various aspects of everyday life, for example: modifying spatial behaviour, creating new products and markets, transforming governance and paradoxically enhancing openness, transparency and participation and helping to produce smart cities whilst simultaneously increasing surveillance and control, and spatial profiling, sorting and prediction, and transforming the nature of privacy. Rather than rehearse the arguments presented in these chapters here, it is more instructive to examine how spatial media are transforming thinking with respect to some fundamental geographic and social concepts. Indeed, it is important to stress that spatial media do not just challenge and reshape the practices, discursive regimes and materialities of everyday life, but also how we make sense of them and their affordances and effects.

Spatial data/information

As examined in detail in Part 2, spatial media are inseparable from spatial data, and spatial data/information and the practices that surround such data/information are being transformed alongside general developments in spatial media. First, there has been an explosion in the volume, velocity, and coverage of spatial data. Spatial media enables the handling of a diverse set of spatial data, but it also generates massive amounts of such data, including map layers, new framework data (e.g., attribute rich vector data as in OpenStreetMap), location and movement traces, and geotagged and georeferenced data (related to specific phenomena), and metadata (related to posts, comments and photos). Importantly, these data are generated on a continuous basis as spatial and locative media are used, and a much more diverse set of phenomena and practices have associated locational data (essentially most activities mediated via the web, especially those using a smartphone or tablet). These data can provide spatial histories of a media and the places and activities captured by them, although it should be

noted that because they are generated and stored in proprietary platforms, their long-term preservation is dependent on their host company. Gordon and de Souza e Silva (2011: 19) thus conclude that, given the drive to ensure that all data are georeferenced as an inherent part of their generation, soon 'unlocated information will cease to be the norm'. In turn, this enables all such data to be tracked and mapped (Thielmann, 2010). This is clearly a significant difference to the pre-spatial media age in which a limited amount of data were spatial, and they were generated on an infrequent basis due to the significant effort and cost expended to generate them. This explosion in production is leading, in the words of Sarah Elwood (2010: 350), to an increasing 'everywhereness' of spatial information in our daily lives.

Second, how spatial data are produced has changed rapidly. Rather than being a skilled process conducted by a limited pool of specialists (e.g., surveyors, GIS technicians, cartographers, spatial database operatives, scientists), usually in the employ of the state or corporations, new actors have become involved. Neogeography, for example, has become a key form of generating spatial data, with data increasingly being generated 'actively/deliberately/knowingly' by millions of ordinary citizens (Graham *et al*., 2013: 3). This has been accompanied by more automated forms of data production, such as the automatic geotagging of social media posts or the recording of GPS traces as metadata using locative media, in which data are generated 'passively/unconsciously/unknowingly' (Graham *et al*., 2013: 3). While traditional, formal institutions place a strong focus on standardization, interoperability, and quality/accuracy of spatial data to ensure useable, authoritative and exchangeable data, such an emphasis is variable across spatial media. While some platforms strive to produce spatial data that hold the same qualities as authorative institutions (e.g., OpenStreetMap vis-à-vis national mapping agencies), in other cases spatial media maybe less about scientific and engineered forms of data quality, but more about the qualities of what the data concern and the mapping of narratives (Caquard and Cartwright 2014). There is also a geography to this production which is highly uneven, largely following the unevenness of physical infrastructure and access to spatial media across the planet, but also censorship regimes and cultural differences in content creation (Graham, 2010). As Graham *et al.* (2015: 88) note, 'information has always had geography. It is from somewhere; about somewhere; it evolves and is transformed somewhere; it is mediated by networks, infrastructures, and technologies: all of which exist in physical, material places.' Even when spatial data have been produced, there is a geography and politics to their visibility. For example, given that search is ordered by some criteria (e.g., calculated relevance, popularity) some content is

prioritized over others (Graham, 2010). Spatial information then is 'fractured along a number of axes such as location, language, and social networks [and] the resulting constructions of place are complex and far from uniform across space, class, or culture' (Graham and Zook, 2013: 78).

Third, the ontological nature of the data produced are often quite different to previous generations of spatial data, often constituting big data or linked data. Big data hold the characteristics of being generated continuously, seek to be exhaustive of a phenomena or population (n=all), are typically fine-grained and indexical (relating to individual people, places, objects, transactions and interactions) and relational (they can be easily conjoined with other datasets) (Kitchin, 2014; Kitchin and McArdle, 2016). Linked data transform the internet from a 'web of documents' to a 'web of data' through the creation of a semantic web that seeks to encode and extract information within web pages – names, addresses, places, product details, facts, figures, and so on – through the use of unique identifiers and a markup language to make them visible and enabling others to automatically process, understand and link them together (Berners-Lee 2009; Miller 2010). Whilst many of the new spatial data being generated are privately held by states or companies, some are open in nature, available to citizens and companies to use. The ontological security of spatial big and linked data is unstable due to the continuous and ever-shifting nature of the data generated and the mutability of the underlying technologies and algorithms. As Graham *et al*. (2013) note, spatial media data are less coherent and fixed due to additions, edits, and the contestation and spatial politics of content (e.g., edit wars). Moreover, spatial media themselves have an evolving form, constantly being tweaked and refined, and are designed to provide tailored content based on the profile/location of the user so that there is no fixed representations of place. As such, spatial media and their spatial data 'are enacted and practised in contingent and relational ways', being 'necessarily spatially, temporally and personally context-dependent' (Graham *et al*., 2013: 467).

Mapping

Until recently mapping was understood as a representational science; one of producing spatial representations of geographic relationships. Within this conception, maps sought to faithfully, objectively and accurately capture and portray the absolute position of spatial relations (Robinson *et al*., 1995). The critique of this notion was that mapping was far from a neutral exercise and was saturated with power and ideology (Harley, 1989). In contrast, over the past fifteen years or so, mapping has been reconceptualised within a post-representational

perspective; that is, a position that does not privilege representational modes of thinking (wherein maps are assumed to be mirrors of the world) nor automatically presumes the ontological security of a map as a map (Kitchin, 2010). For example, Del Casino and Hanna (2005) argue that maps are in a constant state of becoming; that they are 'mobile subjects' whose meaning emerges through socio-spatial practices of use that mutate with context and is contested and intertextual. In other words, the map is not fixed at the moment of creation, but is in constant modification where each encounter with the map produces new meanings and engagements with the world. Similarly, Kitchin and Dodge (2007: 5) argue that maps are not ontologically secure representations but rather a set of unfolding practices: '[m]aps are of-the-moment, brought into being through practices (embodied, social, technical), *always* re-made every time they are engaged with; mapping is a process of constant re-territorialisation. As such, maps are transitory and fleeting, being contingent, relational and context-dependent.'

While such thinking was initially applied to traditional maps it is clear it has much resonance for how to make sense of mapping within spatial media. In large part, this is because spatial media are inherently fluid, transitory, contingent, and context-dependent. While a traditional map gives the impression of a fixity and a totalising and universal perspective, spatial media are constantly being updated (added to, edited) and regenerated (e.g., refreshed through zoom, panning, turning on/off features/layers, during movement), and are contextually filtered in delivery – individually (with respect to search history), temporally (results change over time), socially (based on social networks), and geographically (based on present location) (Galloway and Ward, 2005; Chesher, 2012; Wilson and Graham, 2013; Wilson and Stephens, 2015). As Wilson and Graham (2013: 6) contend 'not only do we transduce maps and content in unique, grounded ways, but the very content that we have available to us varies from person to person and place to place.' For example, the searching and browsing of a map mashup of Google Maps and rental and for sale properties is contextualised with respect to the user's location and search history and dynamically alters as units are added/removed from the market. Such contextualisation creates a type of spatial homophily, in which where we go and what we see is mediated by where and who we are, in turn ensuring we are spatially and socially sorted to be in places with others like us. With respect to satnavs, the mapping is aligned to the driver's viewpoint and alters with the real-time movement of the vehicle in space so that as the driver navigates, the route and map are held in alignment (Chesher, 2012). Those that engage with spatial media mappings are never

then simple percipients of maps, but are active in bringing the mappings into life, shaping its configuration and meanings (Elwood and Leszczynski, 2013; Wilson and Stephens, 2015).

Indeed, within the context of the geoweb, maps *are* media; they become a prime communication channel and interface for accessing and revealing web content. As Gordon and de Souza e Silva (2011: 20) note 'web mapping is doing more than transforming mapping practices; it is transforming communication more broadly.' Mapping is not simply a mode of visualization, but a 'central organizational device for networked communications', an adaptive interface through which users can access, alter and deploy an expansive database of information, and a platform to socialize spatial information through collective editing, annotations, discussion, *etc.* (Gordon and de Souza e Silva, 2011: 28). In other words, through its enrolment, the mapping of spatial media content is performing a much more expansive role than revealing spatial relations. In turn, how mappings are being used is becoming a highly immediate, individualised, experiential means to structure search and exploration (not to narrate a set of pre-given spatial meanings), with an approach to asserting credibility based on 'witnessing, peer verification and transparency' (rather than a 'receive and believe' paradigm wherein a map is a secured artefact of legitimacy and authority) (Elwood and Leszczynski, 2013: 554; Wilson and Stephens, 2015). In turn, this is substantially transforming the knowledge politics of mapping (see below).

Further, the relationship between map and territory is being altered. Two of the fundamental conventions of traditional cartography are that space is continuous and ordered and that the map is not the territory but rather a representation of it. As Dodge and Kitchin (2000) illustrated, these conventions are subverted with respect to maps of cyberspace: the spaces of the internet can be discontinuous and organised non-linearly, and in many cases the spaces are their own maps (rather than being external to a representation of data, the map is literally the means to navigate the data). Here, map and territory become synonymous. This is equally becoming the case for spatial media concerning geographic space. Graham *et al.* (2015: 89) thus contend 'geographic augmentations are much more than just representations of places: they are part of the place itself; they shape it rather than simply reflect it; and the map again becomes part of the territory.' In other words spatial media do not simply represent space but are integral to the production of space: 'A restaurant omitted from a map can cease to be a restaurant if nobody finds it' (p. 89).

Space and spatiality

Following on from the last point, a number of commentators have noted that spatial media are transforming the production of space and the nature of spatiality. Spatial media are more and more mediating how space is understood and the interactions occurring within them. Geographic spaces are evermore complemented with various kinds of georeferenced and real-time data – pictures, thoughts, statistics, reviews, historical documents, routes – that can be accessed through a plethora of augmented and location-aware maps and interactive displays which have multiple points of view (Gordon and de Souza e Silva, 2011; Graham and Zook, 2013; de Waal, 2014). This information is observable alongside the space itself at the same time as they generate further data about those places (Chesher, 2012). Moreover, individuals can check into locations, create new georeferenced data, navigate routes, and locate friends and services (de Souza e Silva, 2013). As such, the virtual and material are being entwined, changing the ways in which places are defined and experienced, transforming the 'social production of space and the spatial production of society' (Sutko and de Souza e Silva, 2010: 812; Galloway and Ward, 2005; Graham *et al.*, 2013; de Waal, 2014). For Chesher (2012), spatial media is shifting the balance in the production of space away from what Lefebvre (1991) termed 'conceived space' (formal abstractions about space such as plans, maps, policy documents) to 'lived space' (space of human action); from representations of space to spaces of representation. In essence, neogeography and access to spatial media opens up space for new kinds of engagements and spatial practices, widens a user's sense of perceived space, and undermines the centralised power expressed through traditional maps and GIS. In turn, this is leading to the generation of new spatialities and spatial formations that have variously been termed code/spaces, hybrid spaces, digiplace, net locality, and augmented reality.

Code/space refers to the mutual constitution of software (in this case spatial media) and the spatiality of everyday life (Dodge and Kitchin, 2005). That is, a dyadic relationship exists between code and spatiality wherein how a space is produced, perceived and experienced is dependent on its mediation through code, and the spatial media is dependent on the encoding of spatial relations. Interactions in space mediated by spatial media thus enact a form of code/space. As Kitchin and Dodge (2011) elaborate, the relationship between code and space is neither deterministic (that is, code determines in absolute, non-negotiable means the production of space and the socio-spatial interactions that occur within them) nor universal (that such determinations occur in all such spaces and at all times in a simple cause-and-effect manner). Rather how code/space emerges – as with mapping – is contingent, relational and context-dependent. Code/space unfolds in multifarious and imperfect ways,

embodied through the performances and, often unpredictable, interactions of individuals and spatial media.

For de Souza e Silva (2006) these code/spaces are hybrid spaces that are simultaneously physical and virtual, a combination of localities and information mediated through spatial media. Such hybridity is evident in the navigation or searching of a locale using mobile locative media, wherein the spatial media directly shapes an individual's understanding and experience of a place and, in the case of a location-based social network (LBSN), connections to people in place (Gordon and de Souza e Silva, 2011). These hybrid spaces, de Souza e Silva (2013: 118) contend produce 'net locality', that is 'practiced hybrid space, developed by the constant enfolding of digital information and networked connections into local spaces.' That is, through the use of spatial media an individual is simultaneously local and globally networked. As such, the 'web is brought into the spaces we occupy, and, similarly, those spaces are brought into the web' (Gordon and de Souza e Silva, 2011: 86) and the 'borders between remote and contiguous contexts no longer can be clearly defined' (de Souza e Silva, 2006: 269). For de Waal (2014) this produces both a de-spacing of spatial experience (the ability to share experiences with those not physically present) and an intensification of the same experience through a double interaction (with the space and with absent others). This is leading, he suggests, to a double articulation of place: people meet in a place such as a shopping mall, discuss the encounter in social media with those present and absent, and keep in contact via social media. In so doing, spatial media heighten the symbolic meaning of spaces.

Zook and Graham (2007: 468) have termed hybrid spaces 'digiplace', noting that the complex entanglements between the physical and virtual are dynamic and mutually constitutive; that is, interdependent. In other words, places are increasingly constituted by a mixture of 'material and virtual social processes and in turn constitutes those practices' and individuals navigate such locales using dense clouds of information via spatial media. Given the fluidity, contingency and contextuality of spatial media, locales are revealed as lived, fluid spaces, shaped by space, time, information, user profile, and filtering and framing algorithms (Zook and Graham, 2007). Digiplace is thus a specific and automatically produced spatiality. This spatiality, they have more recently suggested, is a form of augmented reality (Graham *et al.*, 2013; Graham and Zook, 2013). They define augmented reality as 'the indeterminate, unstable, context dependent and multiple realities brought into being through the subjective coming-togethers in time and space of material and virtual experience … enacted in specific and individualised space/time configurations' (Graham *et al.*, 2013: 465).

As Leszczynski (2015: 744) notes, such hybridity – whether conceived as net locality or digiplace or augmented reality – means that experience of spatialities produced by spatial media is always-already mediated through the 'the multiple yet momentary comings-together of persons, places, and emergent spatial technologies'. This experience, she argues, is 'intensified by the proximate and synchronous nature of location-aware mobile devices through which this content is both generated and called into being both in situ and in real time' (p. 746). Here, spatiality is recognized as ontogenetic – constantly bought into being – though its articulation is not reducible to technology, social relations, or spatiality, but their entanglement (Leszczynski, 2015). Moreover, the new spatialities produced are in part a product of new mobilities and spatial practices, but they also facilitate them, inherently reframing the social interactions within spaces and providing different ways to know and navigate locales, as we now discuss.

Mobility, spatial practices and spatial imaginaries

The new spatialities just discussed are the product of new mobilities and spatial practices enabled by spatial media, which in turn are reactive to these spatialities. Spatial media, given their widespread usage and substantive presence in people's daily life (unlike other spatial technologies such as GIS, Leszczynski and Wilson, 2013), increasingly mediate social interactions within spaces and provide different ways to know and navigate locales. For example, satnavs provide calculated routes on dynamically-located maps, spatial search and LBSs provide information on and recommendations concerning local businesses, LBSNs enable users to see the real-time location of their friends and to check-in to locales, map-mashups reveal detailed information about a location, and urban dashboards provide real-time and statistical data visualisations about a place. And, importantly, these tasks can be undertaken in situ, on-the-move and in real-time, augmenting a whole series of activities such as shopping, wayfinding, sightseeing, protesting, *etc*. In other words, spatial media alter how we understand, relate to, move through, coordinate and communicate in, interact with, and build attachments to space/place. They do this in four ways.

First, as Gordon and de Souza e Silva (2011) note, when using spatial media the perceptual horizon of a person is no longer limited to the environment in which they are located, such as a street, or a limited source of information such as a paper map or guide book. Instead, the person has access to a range of sources of information, including locative and social media, augmented maps and visualisations, place-related websites and gazetteers, *etc*. These provide a huge array of supplemental information, filters it with respect to location

and activity, which helps guide decision-making and shape spatial practices (Chesher, 2012). As such, Leszczynski (2015: 745) contends that 'everyday encounters with spatial media 'actualize new spaces' that are experienced and perceived as interpenetrated – marked, intersected, and constituted' – by spatial data such that 'the experience of *being there* is the experience of being in a location where data is accessible' (Gordon and de Souza e Silva, 2011: 36, original emphasis).

Second, spatial media changes the practices of coordination and communication in space enabling on-the-fly scheduling of meetings and serendipitous encounters (Sutko and de Souza e Silva, 2010; de Souza e Silva, 2013). In the case of LBSN there is no need to actively schedule or make a call, instead viewing the location of friends and intersecting with their location/paths. Sutko and de Souza e Silva (2010: 811) thus suggest that location-aware technologies and the visualization of spatial relations are replacing the management of time and 'the clock as a medium for coordinating meetings in space.' As such, spatial media demands a rethinking of the processes of sociability (de Waal, 2014). Wilson (2012: 1270) suggests that part of this new sociality is the development of conspicuous mobility created through continuous connectivity to spatial media 'that serves to restructure urban experiences as transactions' by figuring people's mobilities.

Third, at the same time as spatial media can produce serendipitous encounters, they can also work to structure and nudge user perception and movement. For example, suggested routes within a satnav provide a reified path that displaces ad hoc spatial practices (Chesher, 2012). As Chesher (2012: 316) explains, the presented route has 'rhetorical force, with multiple strategies to persuade the driver to take certain paths' and has 'more actuality and force than a street directory flopped open on the passenger seat, and more precision than directions scrawled on a scrap of paper' (p. 323). Likewise the filtering, prioritization and side-lining of information, for example within a LBS recommender system, works to direct choices (Graham *et al.*, 2013; de Waal, 2014). Indeed, the designers of some spatial media are quite explicit in their desire to generate nudges. For example, Foursquare (a LBSN), states that it is in the 'business of changing user behavior' (Crowley, 2010). Given the commercial nature of most spatial media, it is fair to say that these nudges often have a specific consumption agenda.

Fourth, spatial media help produce new spatial imaginaries. These imaginaries extend well beyond those institutions who have traditionally compiled maps and spatial information. Instead, they are more collective, generative, and interconnected, and accessed through a diverse set of apps that provide varying perspectives (Kelley, 2011). They are full of the

traces (paths, views, annotations, photos, *etc.*) of millions of people. These imaginaries can also be highly contested as highlighted by the edit wars in Wikipedia with regards to places (Graham *et al.*, 2015). These imaginaries are 'more than just representations of places: they are part of the place itself; they shape it rather than simply reflect it'; they express attachments to place, but also produce them (Graham *et al*., 2015: 88). In so doing they also provide a new framework through with identity is formed, constructing an 'inseparable sense of *our-self-our-world*' (Wilson 2014: 536; original emphasis).

Knowledge politics

A key argument concerning the transformative effects of spatial media is that it radically changes the knowledge politics associated with geographic information. Elwood and Leszczynski (2013: 544) detail that 'knowledge politics refers to the use of particular information content, forms of representation or ways of analysing and manipulating information to try to establish the authority or legitimacy of knowledge claims.' Spatial media, it is argued, alters the traditional basis of knowledge politics because it changes who is generating spatial data and the nature of expertise and opens up different epistemological strategies for asserting 'truth'.

With respect to the former, the advent of neogeography suggests that the production of spatial information has shifted from trained professionals in institutions or corporations to anyone who wants to contribute; from controlled, curated spatial datasets to multivocal, patchwork datasets of curated and volunteered data (Elwood, 2010). As such, there has been a fundamental shift in the processes and power relations of creating and sharing of geographic knowledge, with enhanced access, participation, transparency, and technical literacy and know-how (Elwood, 2010; Haklay, 2013). Some have characterised this move as a form of democratisation, of creating a level playing field, wherein a lay public is able to create, share, explore and interact with maps and other data visualizations (Goodchild, 2007; Turner, 2007; Warf and Sui, 2010; Chesher, 2012). As well as providing an alternative to institutionally-curated datasets and tools (e.g., maps, GIS), spatial media can provide challenges to establishment geographies, generating counter-narratives and new knowledge representations as in the case of traditional knowledge; Taylor and Lauriault, 2014). In this sense, spatial media is continuing the work initiated within participatory GIS and countermapping projects but on a much grander scale (Haklay, 2013). As Elwood and Mitchell (2013) note, neogeography initiatives are thus powerful sites of political action and

engagement, and also of political formation, helping to shape the making of political subjects and to mobilize social groups.

Further, the differing technologies and practices of spatial media mean that they are not wholly underpinned by the cartographic and technicist rationalities of GIScience and they enable different epistemological ways to try and assert legitimacy and authority (Elwood, 2010; Taylor and Lauriault, 2014). In other words, the varying possibilities for structuring, manipulating, sharing and visualising information mean that how knowledge politics is enacted is different (Warf and Sui, 2010; Elwood and Leszczynski, 2013; Wilson and Stephens, 2015). For example, Elwood and Leszczynski (2013: 545) contend that spatial media deploy a variety of geovisual modes to 'structure experiential, exploratory ways of knowing and tend to assert the credibility of those representations through a grounding in practices of witnessing, transparency and peer verification' rather than legitimacy being asserted through 'cartographic abstraction and scientific expertise'. Here, geovisual artefacts 'structure a visual experience' rather than 'narrate a set of pre-given spatial meanings' (Elwood and Leszczynski, 2013: 555). Spatial media also enable other forms of legitimacy, credibility and authoritative knowledge structures to emerge such as in the case of traditional/indigenous knowledge (Pyne and Taylor, 2012), changing normative and legal structures and providing inclusive mappings (Browne and Ljubicic, 2014; Scassa *et al.*, 2014). Through spatial media the politics of the map/GIS is undermined and replaced with and through a politics of the geovisual/crowdsourcing and new underlying infrastructures which enable these politics to emerge (Wilson and Stephens, 2015; Hayes *et al.*, 2014).

While some spatial media do undoubtedly change spatial knowledge politics there are two challenges to the kinds of changes described above. First, a number of commentators question the extent to which the practices of neogeography are democratising and replacing established, curated geographies (Dodge and Kitchin, 2013; Haklay, 2013). There is an unevenness in the ability to participate due to variance in people's access to the internet, knowledges, and skills, with divisions reinscribing traditional divisions along lines of wealth, race, gender and development (Elwood, 2010; Haklay, 2013). Moreover, the affordances of different initiatives are designed, either explicitly or tacitly, to target some groups over others (Leszczynski and Elwood, 2015). Within all initiatives there are hierarchies of participation and control, with commentators such as Carr (2007) asserting these are necessary to try and assure quality, authority, and usability. No initiative then is either fully democratic or egalitarian, each imbued with circuits of power (Leszczynski, 2014). And, with a few exceptions, such as OpenStreetMap, Wikipedia/Wikimapia, and cybercartographic atlases,

the underlying technologies, functionalities and governance of spatial media are owned and managed by companies that 'seek to produce new models of capital accumulation by unlocking unwaged virtual labour and information resources and creating new markets' (Dodge and Kitchin, 2013: 20). With respect to Google mashups, for example, Google owns and controls the underlying mapping database, which is professionally sourced, with additional information and mass checking derived from users, and revenue generated via advertising. Google enacts a form of governance that is erratic, opaque, unaccountable, and encloses a portion of the geoweb rather than democratizing it (Zook and Graham, 2007; Leszczynski, 2012; Scassa, 2013; Saunders *et al.*, 2012). As such, many spatial media do not sit outside of conventional political economic relations (Leszczynski, 2012, 2014; Dodge and Kitchin, 2013).

Second, it is quite clear that alongside empowering individuals through access to rich information and tools, spatial media also enrols users within new markets and subjugates them within new relations of control and power. While many spatial media are free at the point of use, they have to generate income to cover their costs and produce a profit and they generally do this either through advertising, referrals or selling user data (as many have noted, if the product is free, then the user is the product). Spatial media have radically expanded the volume, range, and granularity of the data being generated about people, activities, and places, including detailed location and movement tracking, widening the net and scope of surveillance (Elwood and Leszczynski, 2011; Kitchin, 2016). The data generated are easily shared within data markets and can be conjoined with other datasets to extract additional insights, such as predictive profiling, social/spatial sorting, and anticipatory governance (Kitchin, 2014). As well as eroding privacy, spatial media and the data they generate are thus being used to shape and regulate behaviour and life chances. As such, a very different set of knowledge politics is being practised to the emancipatory potential envisaged by some.

Conclusion

No longer entirely comfortable under the subfield of GIScience, digital forms of mapping have become media. While GIScience has also changed rapidly over the past decade it is still largely wedded to a specific set of technologies, practiced by a particular set of institutional actors, and rooted in the map as a one-to-many mode of communication model. Instead, spatial media have largely emerged through different technologies and ways of thinking, has a much wider set of corporate, institutional and civic actors, and reframes mapping as

interfaces and many-to-many communication channels for accessing, navigating, creating, discussing and sharing information. As such, making sense of spatial media requires an analysis which approaches spatial and locative technologies, the geoweb and neogeography in a much more expansive way than simply adopting a critical GIS perspective. Understanding spatial media requires a variety of different perspectives drawn from across the academy – geography, sociology, media studies, computer science, critical data studies, software studies, law, *etc*. And rather than working in disciplinary isolation, a multi-disciplinary approach is required.

As we have argued in this chapter, making sense of spatial media needs to extend well beyond a focus on the spatial and locative technologies themselves and how they work in practice to consider their implications for how we understand key concepts – spatial data/information, mapping, space/spatiality, mobility/spatial behaviour, spatial imaginaries and knowledge politics. Spatial media impacts multiple aspects of social life, including economics, governance, politics and culture, as well as innovation, business, marketing and advertising. Importantly then, no longer should spatial media be seen as peripheral to key processes underlying, and key debates about, the formulation and practice of everyday life. Instead, how spatial media has pervaded and is reshaping social, economic and political life needs to be appreciated more widely.

We argue that more work should be focused on situating and unpacking the emergence of spatial media. We agree with Leszczynski and Wilson (2013: 915): 'the rapid proliferation and diversification of spatial media, content forms, and praxes require new empirical, conceptual, and theoretical approaches to apprehend both the nature and implications of these transitions and materialities.' Who stands to benefit from these new innovations? What are the specific uneven topographies of spatial media and associated infrastructures, but also the uneven topographies of access, capital, surveillance and power created in their wake? How are the core underpinning telecomms (e.g., networking) and computing (the cloud, data centres) infrastructure evolving and core framework data being reconfigured? As 'a discursive/material touchpoint for futurity, speculation, and investment', what are the opportunities and limitations for co-optation and resistance to the amassing of capital and the way in which content is or is not volunteered (Wilson, 2012: 1266). Would we know how to recognize such forms of resistances given our contemporary approaches? How might we situate spatial media 'within historically and geographically contingent enactments of venture capital, the commoditisation of technophilia, networks of natural resource extraction and product disposal, and global divisions of labour' (Wilson and Graham, 2013:

4-5)? Relatedly, we join numerous social and cultural geographers in the focus on practices, which we suggest requires different approaches. Gillian Rose (2016: 2) has called upon cultural geographers to 'unpack both the symbolism of specific cultural texts but also the production and circulation of those texts by specific forms of media institutions' Similarly, Wilson asks (2014: 536), 'how might we situate the emergence of continuous connectivity as a cultural milieu, and what are the implications for how we study geoweb practices?' These are just a handful of potential questions that require research and reflection. There is clearly, however, much empirical and theoretical work to be done to fill in gaps and provide new conceptual tools and insight.

Acknowledgements

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