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Article

Digital Maps and Senses of Security: The Influence of a Veracious Media on Urban Life

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Abstract
Digital technologies mediate our experience and use of urban space in several ways. This article argues that people trust the information provided by digital maps (such as Google Maps, Bing Maps, and OpenStreetMap), including datasets embedded within them, e.g., crime statistics and council tax banding. People choose particular sites and routes, and they make wider decisions based on digital map content. The article highlights the senses of security people gain from using digital maps, and the influence that their use has, for instance, on choices of which home to buy (landed capital acquisition), which route to take and by which mode of transport, and which restaurant or hotel to visit. As such, the article argues that digital maps influence the ways in which bodies are distributed and move in urban space. The article applies a practice theory lens to data from a scoping sample survey (n = 261), 32 semi-structured interviews, and three focus groups. Through empirical examples, it demonstrates how a sense of security provided by digital maps is experienced by users, and how that serves to influence the decisions people make in negotiating and making urban space meaningful.

Keywords
digital maps; ontological security; senses of security; urban life

Issue
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1. Introduction

Digital maps feature in people's decisions over where to go, how to get there, and in their understanding of urban space—from choosing homes to rent/buy, jobs to take, hotels or restaurants to visit, or travel routes. This article examines how people make sense of urban space through digital maps. It argues that people elicit different senses of security by using them, which influence the movement and distribution of bodies in urban space. Thus, it contributes to debates about what it means to live amidst an emerging 'digital skin' of sensors, screens, and infrastructures within contemporary urban life (Kitchin & Dodge, 2011; Rabari & Storper, 2015). For urban planning this provides useful knowledge about how a specific set of technologies mediate people's experiences of the city and how they mobilise and make use of urban space as a result.

The next section provides a technical history of digital maps, explaining how they emerged from various precursor web-based technologies whilst drawing on paper-based maps and geographical information systems (GIS). It then turns to the treatment of map use and users in map studies, noting that although attention is often paid to the moment of use, it has often come at the expense of how digital maps feature within people's lives in general. This identifies a gap in contemporary thought about the extent to which digital maps influence people's experiences of urban space. The article then builds a practice theory framework which it later uses to examine data. Next, a methods section sets out the approach taken towards data gathering and analysis, detailing the survey, interviews, and focus groups used throughout the article. The article then presents its findings: First, it argues that digital maps inform a myriad of decisions people make in their day-to-day lives over where to go and how

to get there and their overall understanding of a place. Here, it extends map studies by examining one of the ways in which maps feature in people's social and cultural lives beyond the immediate moment of use; second, the article argues that digital maps only partially inform people's day-to-day decisions, adding that when they do it through the meanings that people ascribe to their imagery, a point that extends practice theory to examine digital media as materials; third, the article shows that people tend to accord the imagery of digital maps a degree of indexicality as veracious representations of reality, and by extension as legitimate resources of continually updated and revised (and therefore emergent) sources of information; and fourth, that it is the various senses of security people gain by using digital maps as legitimate resources that inform their experiences and practices. The concluding section argues that it is the trust people place in the perceived veracity of digital map imagery and datasets embedded within them that informs (but does not fully structure) the distribution of bodies and things in urban space.

2. Contextualising Digital Maps as Different from Digitised Maps, SatNav, GPS, or GIS

Census agencies like the Office for National Statistics (2019) have provided spatial datasets on electronic media since 1966 and digitised cadastral maps have been delivered via web-based geoportals since 1993 (Land Registry, 2014). However, neither feature regularly in people's everyday lives, requiring specialised competence in statistics, spatial science, GIS, or computer-aided designs (UK Data Service, 2019). Meanwhile, satellite navigation (SatNav) systems and GIS have both emerged as mundane technologies in the public realm. SatNav (launched 1978) uses a Global Positioning System (GPS) of networked satellites (NASA, 2019) to continually survey the Earth (Milner, 2016), powering various applications from fitness trackers to logistics routing systems, which now "comprise the fastest growing sector in web technology businesses" (Speake, 2015, p. 243). Meanwhile, SatNav has become synonymous with car-driving. Both technologies offer dynamic and customisable geovisualisation, but content is not amendable by end users. Similarly, since their origin in a 1960s Canadian government experiment (Wright, Goodchild, & Proctor, 1997) GIS have matured from desktop based proprietary software to paid and open-sourced web-based applications. Many expected a convergence between GIS and digital maps (cf. Sui & Goodchild, 2011), enabling non-experts to produce their own grassroots maps (*pace* Hudson-Smith, Batty, Crooks, & Milton, 2009). Here, Perkins (2008, p. 151) notes that when "[d]esktop mapping and GIS gave the general public tools to make their own maps…[they provided a way to] interact and explore, rather than just employing the image as a final presentation." However, the data politics behind the two technologies has led them to different social trajectories, hampering any democratisation of cartography. To clarify, as technologies, "new spatial media and GIS [have been] torn in two distinctly different directions" (Crampton, 2009, p. 97). Digital maps are free to access and offer Application Programming Interfaces (APIs) for users to add/edit content as layers of a base reference map with ease. Meanwhile, GIS and cartography require specialised skills to produce bespoke maps. However, as Haklay (2013) notes, technological affordances are not value-free. He identifies, for instance, a tension at two levels in neogeography—the use of digital maps by end-user to generate their own maps (Turner, 2006). At the 'lower' level, he argues that unlike GIS, with end-user generation of digital maps "control over the information is kept, by and large, by major corporations and the participant's labour is enrolled in the service of these corporations" (Haklay, 2013, p. 67). At the 'higher' level, Haklay (2013, p. 67) adds that neogeography (like GIS) also "require[s] skills and aptitude that are in short supply and are usually beyond the reach of marginalised and excluded groups…beyond the reach of most civic society organisations." In doing so, what Haklay highlights is a tension between digital maps offering users access to generate their own map layers and a set of social dynamics over who has the competence to do so.

Although digital maps employ technologies and techniques from cartography and GIS, six precursory computing technologies shaped them considerably: (1) Microsoft's 'text-based routing' programme *AutoRoute* (launched 1988) introduced a graphical user interface (GUIs) for non-experts to generate road-like maps from any spreadsheet containing georeferenced data (Hoffman & Stewart, 1993); (2) *MapViewer* (launched 1993) enabled users to generate thematic maps and distribute them over the web, albeit to a limited scientific community (Golden Software, 2019); (3) PARC's HTML-based Map Viewer (also launched 1993) stored longitude and latitude coordinates in URL addresses, and instructed web browsers to fetch and display specific portions of a global map (held as a single HTML image; Putz, 1994). However, it was not made public (Newton, Gittings, & Stuart, 1997); (4) AOL's *Mapquest* (launched 1996) was the first web-based map to make "a huge impression…[bringing] online mapping into the public sphere" (Geller, 2011, p. 186) gaining over a million users in its first year (O'Leary, 1997). As a Javascript application (Edelman, 2015; Mapquest, 2017), it combined satellite and geocoded paper-based map data, fetching portions of a global map image on the fly. However, any "change in the map, however small, [had] to be sent back to the server for regeneration of the image" (Johnson, 2002, p. 5) requiring specific expertise; (5) Keyhole's *EarthViewer*, launched 1999 and acquired by Google in 2005 (Crampton, 2010), marked the first feasible virtual globe to "run nicely on a normal personal computer, enabling smooth rotation and zooming" (Kaplan & Lenardo, 2020, p. 208); and (6) Microsoft's *MapPoint* (released 2000), desktop software that intro-

duced the idea that maps were not just a static image, but could include "road map data (raster data from the Ordnance Survey[])]…a streetmap…and the capability to import, link, and map other sources of data held in a spreadsheet" (Green & King, 2000, p. 149) in various 'views.' Together, these precursors provided maps that were easy to access at home (without specialised knowledge or equipment), distributed over the web, and had layers of information.

Building on these precursors, Where2 launched *Expedition* in 2003, selling it to Google in repackaged form as a web-based application the same year to produce Google Maps (Gannes, 2015). Expedition placed the "map [at] the center of the display…letting people scan around and zoom in and out" (Gannes, 2015). Like AutoRoute, its GUI enabled users to incorporate data "into a map frame, including beyond the view-frame of the browser…[to] pan around…a 'slippy map'…without reloading the whole page for every minor adjustment" (Dalton, 2012, p. 84), thus marking a differentiation from the separate sheets/pages of paper-based maps or files for GIS. When Google launched *Earth* and *Maps* in 2005, they included a publicly open API and intuitive GUI enabling users to add/edit external data as layers over Google's base map (Crampton, 2010, pp. 26-27). Simultaneously, the OpenStreetMap project was "born at University College London (UCL) in July 2004" (Haklay & Weber, 2008, p. 13). However, "unlike the mashups…[that] built parasitically on Google Maps, OpenStreetMap…[adopted] an open source ethos of mass participation" (McConchie, 2015, p. 886) by crowdsourcing content. Conceptually, this meant digital maps were not defined by the base map, but through a continual revision of map content. As such, digital maps become emergent—always in a process of becoming, and therefore different to cartography and GIS where the map is pre-set before being printed or saved as static file.

Extending digital maps further, Microsoft launched a three-dimensional 'view' for *Windows Live Services Maps* (now Bing Maps) in 2006 (Bing, 2006; Microsoft, 2017). Google did the same a year later, alongside their launch of *StreetView* (Plantin, 2018). Like GPS, StreetView sought to map the whole Earth, albeit in photographic detail at ground-level via "online Kalman-filter-based algorithm" (Anguelov et al., 2010, pp. 33–34) stitching photos from car-mounted cameras together in real-time. This presented more than a map of geocoded data over a base set of coordinates. It offered a claim to legitimacy through the realism of photographic representation of place at eye-level. For some, this meant "the construction of place rest[ed] finally with a transnational corporation" (Power, Neville, Devereux, Haynes, & Barnes, 2012, p. 1034) with users unable to amend content. Although Google briefly extended "the familiar tagging and layering interface of Google maps to allow users to create or edit the base map itself" (Boulton, 2010, p. 1) in 2011 with Mapmaker, they withdrew it in 2017 (Google, 2017). By contrast, Microsoft's *StreetSide* (launched 2009) "takes directories of photos, finds commonalities, and stitches them into a seamless single-object experience…[using] Flickr photos" (Pendleton, 2010, p. 16), by crowdsourcing content from social media and creative commons photo libraries to generate a photographic view from 'volunteered' images. In 2016, Google incorporated 700 trillion pixels of Landsat-8 satellite data (Herwig, 2016) into Google Maps, providing far more detailed satellite views, removing clouds, and algorithmically stitching archival satellite data together to simulate seasonal change (Meyer, 2016). Since then, Google has focussed on mapping air quality at street-level through *AirView* (Bettman, 2018) while Microsoft has focussed on commerce and transport travel-routing (Bing, 2017).

Throughout their development, theorists have been keen to examine the influence digital maps have on urban life. Power et al. (2012) and Shapiro (2017), for example, argue that StreetView imagery stigmatises place and ossifies place-identities. Others have focussed on an emancipatory potential for underrepresented people to generate their own grassroots maps (Turner, 2006). In urban planning too, theorists have sought to examine the role of digital technologies in fostering forms of public participation in shaping cities (e.g., Douay, 2018). However, the onus across these theories has primarily been on how maps operate and what it is that they do, with the moment of use taken as the key site of study. Little attention has been paid to the ways in which digital maps feature more generally in people's lives, or what that means for the ways in which bodies are distributed in urban space.

3. Identifying How Digital Maps Feature in Social and Cultural Life as a Gap in Map Studies

The idea of map studies began with Eckert and Joerg's (1908) argument that a 'map logic' could increase accuracy and help understand use, but it was not until Robinson (1947) that anybody attempted to do so. Robinson sought to counter misinformative and propagandic maps during World War II (Crampton, 2011) by removing subjectivity, based on a positivist belief that normative representation could be reached whilst focussing on users' needs. After World War II, public demand and use of maps grew as damaged cities, towns, and infrastructure were rebuilt (Robinson, 1979) and they became everyday technologies. However, map-production remained a specialism venture. Here, Robinson sought to "regularize the principles of map design…[but also to]…establish cartography as a properly academic discipline" (Edney, 2005, p. 715). For this, he drew on architectural functionalism—where users are not expected to conform to a structure—to develop a functionalist inspired map-communication model (MCM) with spatial information passed from cartographer to agentic user via the 'neutral' mediation of a map. How people make sense of maps, however, was not considered. To date, theorists such as Board (1972)

and Morrison (1977) have sought to extend and refine Robinson's MCM, while others have sought to challenge it in various ways.

These challenges include: (1) Tobler's (1970) notion of 'analytical cartography,' which underpins GIS (Möellering, 2000)—although it shares a progressivist attempt to remove 'interferences' from the map design, it draws solely on statistical data, purposefully omitting local detail to achieve generalisation (Tobler, 1970, p. 234); (2) semiotics-based approaches focus on meanings within map content, examining the indexicality of maps, and how people interpret and read them, e.g., Schlichtmann (1985) and Wood and Fels (1986)—steeped in an underlying assumption that people share interpretive schemes; (3) cognitivist-behaviourial approaches, which assert map design can be improved by understanding how people compute and process maps (Eastman, 1985; Keates, 1996). Here, onus sits on the act of interpretation, not the use of maps itself; and (4) critical cartography which has sought to uncover the hidden politics embedded within maps (Crampton & Krygier, 2006; Harley & Woodward, 1987), treating them as "complex series of interactions, involving their use as well as their making" (Harley, 1987, p. 2) rather than as neutral indexical representations. Its challenge to map positivism has led to deep-rooted divisions amongst cartographers and GIS practioners and map theorists (Schuurman, 2000). Some have looked at alternative mappings of space and subjectivity (Cosgrove, 1999) and the politics behind map design (Black, 2002). Meanwhile, others produce alternative maps by giving voice to otherwise silenced people and narratives (e.g., Barford & Dorling, 2007; Bhagat & Mogel, 2008). It is worth noting, however, that these different approaches were not always discrete. Montello (2002), for instance, explains that Robinson's functionalism informed later cognitivist-behaviourial approaches to map design.

To summarise map studies, Dodge, Perkins, and Kitchin (2009) conducted a major review of the field and set out a landmark 'manifesto' with five modes of inquiry—interfaces, algorithms, cultures of map use, authorship, and infrastructure. With the exception of cultures of map use, they saw map studies to be focussed on design/production and on the politics of representation. However, work on the cultures of map use has produced a diverse range of knowledges about: how different cultures are formed around the production of specific maps and the circulation of ideas and material involved in their assembly (Perkins, 2008); what maps offer (as media, technologies, and cartographies) for understanding alternative and playful uses of urban space (Lammes & Perkins, 2016); errors and discontinuities in digital map content and users reactions to them in navigating urban space by smartphone as undermining of any claims to objectivity (Wilmott, 2020); and a focus on people's interactions with particular aesthetic schemes in digital maps, such as the difference between two and three dimensional map views (Dodge, 2017, 2018). Despite the diversity within the works on cultures of map use, there has been little attention paid in map studies to how digital maps feature within people's cultural and social lives beyond the moment of use. Where this has occurred, such as in Lammes and Perkins' (2016), the focus has not been on identifying their social consequences. Instead, the onus has been on developing conceptual understandings of what future cities could be.

Digital geographers and media theorists have focussed on digital maps too, examining: the development of particular digital map platforms over time (Plantin, 2018); how particular technologies might alter our future uses of the city through the automated classification of places based on external data such as crime statistics (Thatcher, 2013); the colonisation of everyday life through personal data, including geospatial being accumulated and linked and used to shape our use of space (Thatcher, O'Sullivan, & Mahmoudi, 2016); how wayfinding is enacted through SatNav systems (Axon, Speake, & Crawford, 2012) and other GPS-based navigation systems—in a return to cognitive-behavioural studies (Ishikawa, Hiromichi, Imai, & Okabe, 2008; Münzer, Zimmer, & Baus, 2012); user-centred design studies that compare paper-based maps with the interfaces of digital ones (Roth et al., 2017) to assess user experience; changes to the classificatory schemes used within geospatial dataset management as a result of digital maps' emergence (Alvarez, 2016); and the focus in media studies on the impact of digital map imagery (Google StreetView in particular) and its role in ossifying place identities and shaping perceptions of place. For example, Power et al. (2012) explain how Google StreetView serves to stigmatise a particular neighbourhood. Meanwhile, Shapiro (2017) explains how Google StreetView opens a set of data politics around what and how it represents to the world, and the likely impact on how people perceive particular places through those representations. Across these different approaches theorists have focussed primarily, as map studies has, on either the design and production of digital maps, the politics involved with the choice of what is/is not represented on the map, or on processes of interpretation. With the exception of Power et al. (2012) and Shapiro (2017), whenever digital map use has been examined, it has revolved around the specific moment of use. This leaves questions unaddressed about how digital maps feature within people's social and cultural lives beyond the immediate moment of use, what people garner by using them, and to what extend they mediate and or shape contemporary urban life.

4. Developing a Practice Theory Framework for Examining Digital Map Use

Practice theory offers a useful lens for examining how digital media feature within social practices (Postill, 2010). In first-wave practice theory (Postill, 2010), Bourdieu, de Certeau, and Giddens circumvented primacy being

attributed either to structure or agency (Couldry, 2004; Postill, 2010; Schatzki, 2001). Instead, they hold them to as mutually reinforcing. Giddens (1984, p. 25) argues the "structural properties of social systems are both the medium and outcome of the practices they recursively organise." Here, structures are understood as "recursively organised sets of rules and resources" (Giddens, 1984, p. 25) which may be divided into "cognitive and moral rules and to allocative and authoritative resources" (Bryant & Jary, 2001, p. 16). Resources can be "allocative, or material, and authoritative, or non-material [where] the former derive from dominion over things, the latter from dominion of people" (Bryant & Jary, 2001, p. 13). Rules are understood as "(codes, norms) methodologically applied, generalizable procedures of action implicated in the practical activities of daily life" (Schatzki, 1997, pp. 290–291). Giddens does not view people "as cultural dopes, but rather [as] knowledgeable and capable agents who reflexively monitor their action" (Bryant & Jary, 2001, p. 12) in skilfully negotiating and usurping rules and resources encountered in the durée of everyday life. For digital maps, this means people are not necessarily influenced into thinking or acting in particular ways based on map content, but through choice to act (or not) on specific interpretations. This differs from many map studies and media theories of digital map use, such as Power et al. (2012) and Shapiro (2017) who show that digital maps do influence knowledge about place and actions, but do not fully account for reflexivity. To explain how people negotiate structures and social systems, Giddens adds that structures exist in memory traces (Bryant & Jary, 2001, p. 16), with memory as the mechanism through which rules are drawn on and resources comprehended and acted upon (Giddens, 1984, p. 45). Thus, structures are actively brought-into-being by knowledgeable actors drawing on biographical experience to negotiate rules and resources. To explain why people draw subjectively on some rules and resources, and not others, Giddens draws on Freud, Erikson (Kort & Gharbi, 2013, p. 96), and Laing (Hiscock, Kearns, MacIntyre, & Ellaway, 2001, p. 50) to argue that early socialisation is generative of feelings of trust (or mistrust) as "the deepest lying element of the basic security system" (Giddens, 1984, p. 50)—a point congruent with the accumulation of memory traces through personal lived experiences. He adds that this trust extends to "people having confidence in the social order, in their place in society, in their own right to be themselves, and a belief that their self-realisation can be achieved" (Hiscock et al., 2001, p. 50). In existential terms, it provides an ontological security (Giddens, 1991) orientated towards the shared structures, social positions, and material arrangements of everyday life and their predictable continuity.

Second-wave practice theorists (2000s onwards) have focussed on a wide range of concerns, from philosophising shared practices (Barnes, 2001, p. 34) through to eking out positions for posthumanism (Pickering, 2001) and objectual agency (Knorr-Cetina, 2001). Within this, Shove, Pantzar, and Watson (2012) developed a simplified Giddensian framework for studying social practices. They content that practices operate at two levels: performances, as individual instances of doing; and entities, enacted, stabilised, and shared through repeat performances. Both levels are constituted through an interplay between three elements: (1) *materials* (objects and technologies) as allocative resources (Shove, 2017, p. 157) provide structures which enable and constrain particular performances too; (2) *competences* (skills and/or knowledges required to use materials)—which "can lie dormant, persisting in memory [traces] for years without being activated, or…be preserved in written forms" (Shove et al., 2012, p. 34) and other media; and (3) *meanings*—(interpreted purposes of materials) as notable in the 'associations' and 'classifications' (Shove et al., 2012) people apply.

As urban life becomes increasingly mediated by smart and digital technologies, including "work, travel, consumption, production, and leisure" (Ash, Kitchin, & Leszczynski, 2016) it becomes important to examine how technologies (including digital maps) feature within people's cultural and social lives, and on how people navigate, use, and make sense of cities through them. What a practice theory framework offers is a way of examining both what people do (their actions and the technological materials they draw on) and the meanings they ascribe to place through those technologies. For urban planning, this offers a way of examining the relationship between people's use of specific technologies to make sense of place and the practices (and use of urban space) as a result.

5. An Overview of the Data and Methods Deployed to Examine Digital Maps Use

This article draws on an online sample survey (n = 261), 32 semi-structured interviews, and three focus groups—all conducted between 2013 and 2018 (see Hanchard, 2020). The survey gathered details about how people use digital maps (and which ones), when, where, and for what reasons. Also, whether they had amended digital map content, and/or knew how. It closed with questions about the perceived accuracy and/or trustworthiness of digital map content. Respondents were recruited from across the UK by email, phone, via social media (Facebook and Twitter), and through various interest groups to ensure the widest possible demographic distribution (e.g., covering a broad range of people across age groups, genders, ethnicities, and occupational types). The gathered survey sample was relatively diverse across those measures, with the exception of age; over half the respondents were aged below 40. Although the diversity of the sample meant its findings were not statistically representative of any wider British population, and it was skewed slightly by age, the approach fit well with the overall research design. The survey—as the initial point

of analysis—was not directed towards identifying statistically significant findings. Rather, it provided an exploratory way to understand how digital maps feature within people's lives from a large number of people as a scoping exercise. It identified three contexts where digital map use was of interest: (1) the home-buying process; (2) gaining an orientation to new places (e.g., as a tourist or new student); and (3) walking in rural areas where traditional paper-based maps are outdated or lack sufficient detail (e.g., pub phone numbers, historic detail on sites). The survey findings informed the choice of three contexts from which all interview participants were recruited: home-buying; orientation to a University campus; and leisure-walking.

Gathering insights from a purposive sample of interviewees within each of the three contexts (with a sample covering different ages, ethnicities, genders, and employment statuses) provided detail on how digital map use mediates landed capital acquisition, sense of place formation, route-planning, and working with web-based technologies in both urban places and areas with limited or intermittent connectivity. Initially, nine interviews and one focus group were planned per context. In total, 32 participants were interviewed owing to participants arriving with partners, proving a slightly older sample (with over half aged 40 or above and only four participants identifying as having a black or minority ethnic group background). Previously interviewed participants from each context were invited to examine and discuss emerging themes in a focus group. Here, themes identified through analyses of the interviews were presented and discussed to gain iterative feedback on the analysis.

To analyse the data, the research followed a modified form of Charmazian constructivist grounded theory (Charmaz, 2006), with three stages of coding (open, focussed, and theoretical). After open coding verbatim interview transcripts, feedback was sought through focus groups. This helped to amalgamate and winnow the codes inductively into a set of focussed ones across all contexts. To further amalgamate the codes, the analysis was compared with map studies and practice theory literature to develop an understanding of how digital maps feature within people's everyday lives and how they mediate the experience of urban life. In the next section, quotations are taken only from the interviews, serving as illustrative examples. However, the analysis behind them was informed by all three methods.

6. How Digital Maps Influence the Movement and Distribution of Bodies in Urban Space

Digital maps influence many perceptions people have of urban spaces, their choices of where to go, which route to take, and how to get there. For example, Francis explained that if he gets hungry when wondering around the city centre, he uses the "'search nearby' feature…[to see] whether [he is] near a McDonald's or whatever." Likewise, when Dave chooses a place to eat at, he is "already on TripAdvisor" looking for reviewed places nearby, adding that if "they weren't listed, they were missed out." While Francis and Dave highlight the importance for businesses of being on the map, and the consequences of being omitted (cf. Thatcher et al., 2016), they also demonstrate how their decisions are shaped by trust in digital map content. Both find a smartphone meaningful as a material allocative resource whilst on the move, with no specific competence required to use it. Whilst their choice of site is linked to short-term consumption, Kelly describes a similar use of digital maps to buy a house:

> I used StreetView a lot to see what the surrounding streets were like….Zoom in, and have a look at people's gardens, because I wanted to see if they were scruffy or not, to give me a better idea of how well the street was kept.

Rather than just informing her choice of site, Kelly notes that the photographic imagery of StreetView also informs her overall sense of place. Here, she categorises streets with bins left outside as 'scruffy' and associates them with a place she would not want to live at. Here, digital map content serves to stigmatise place (Power et al., 2012; Shapiro, 2017). This raises questions about the extent to which the digital maps inform people's knowledge and practices. Pam addresses this head-on, stating that as an influence on her choice of home, digital maps "were about 50%….It was going really based on what I found on the map, and then going and actually looking at it." She frames digital maps as a key part of her landed capital acquisition decision-making processes. Later Pam adds that not only did digital maps inform her final choice of home, they also increased the overall range of homes from which she selected, noting that:

> Without digital maps I wouldn't have actually viewed them. I wouldn't have put them on my list….I would have to have a lot of trips up there and travel around I think, just to view. By having the [digital] map, I could say a definite yes or no just by looking.

Pam adds that it was "more sort of StreetView than the map" (like Kelly above) to "look at just the general state of the place…get a feel for it…look at the tax and the crime." However, her account goes beyond getting a sense of the place based on photographic imagery of bins being left out. It also includes a reading of external datasets embedded within the digital map, such as local council tax banding and official Police crime statistics for the postcode—both state legitimated outputs that she implicitly trusts the digital map to report. Here, she looks at the StreetView imagery to gain an initial sense of place and then draws on external data embedded within the digital map to confirm or amend it. In doing so, her account resonates with Dodge's (2018, p. 950) assertion

that "more extensive digital geographies will feed into map-making and changing mapping practices in the next few years." Her account also suggests that the meanings associated with place through the use of a digital map are open to revision and change (contra Power et al., 2012; Thatcher, 2013).

As well as digital maps informing choice of site (where to go), they also inform choice of route. For example, Pete notes that "you can tell if somewhere is run down, a bit rough, the kind of place maybe you wouldn't want to be walking through" by looking at a digital map. He recalls visiting a town he had not been to before and planning to walk "from the train station to the other side of town," adding that when he "looked on StreetView [it] affected [his] decision not to walk through [the town centre at night]…because it's not a brilliant place….' Here, Pete's use of the technology and interpretation of its content resonates with Thatcher's (2013) argument that future pedestrian routing technologies may direct users away from areas that are algorithmically classified as being 'risky,' the difference being that Pete makes this classification subjectively. Here, the sense of place Pete gained through a digital map was steeped in a subjective set of associations and classifications (meanings) that he had stored in memory (like Kelly and Pam above). These memories were based on past experiences and practices of walking through urban space in other areas. In reflecting on the map content and the meanings he applied to it from his memories, Pete noted they informed his decision to choose another route. Thus, digital maps influence the distribution and movement of bodies in space, e.g., where people go and how they get there. However, it is not just material practices that are influenced by digital map use—more abstract experiences of urban space are equally at stake too.

One experience anchored in digital maps use is a sense of security. At times this can be based on using digital maps as simple geolocative allocative resources, to feel secure in knowing where one is located, and in being able to wayfind independently without relying on other people as Paula explains:

> When I go to Manchester for meetings, which is a strange place, I use Google Maps…it lets me feel safe and more confident not having to ask people…[because I have] got a back-up.

Here, the digital map need not be used, but can be ready-at-hand, as a smartphone app and referred to at any time. It provides a sense of independence (of not having to interact with or rely on others) and confidence in being able to oneself if needed. However, this sense of security (independence from relying on others) requires access to a smartphone and web connectivity as stable material arrangements. This latter point is raised by Dave, who explains that being "able to quickly and easily pull a [digital] map of where I am to be really kind of comforting," especially when away from home in a different city, for which he adds that it "gives [him] a sense of security…that [he is not] not really that lost." In this, digital maps not only provide reassurance that he can locate himself and navigate to where he wants to be (cf. Roth et al., 2017), but that they also provide a sense of "where things are in relation to me, how far I am from things." Here, the sense of security provided by digital maps is one reassurance and location—requiring access to digital maps and a device to access them as relevant material resources that inform sense of place.

For others, the sense of security provided by digital maps connected with far deeper-rooted existential sense of ontological security. Claire, for example, uses digital maps when visiting other cities as part of her work for the university. They provide reassurance in locating herself and enable her to make sense of places in advance of going. Claire adds that this means she can adhere to her employers' green impact policies on staff travel expenses by choosing a particular mode of (public) transport. Thus, it places her in a position of 'good employee'—maintaining her continuous narrative of ongoing employment as a stable condition that offers her the ontological security (Giddens, 1991) that life will go on as normal and not be challenged by her getting lost. For this, Claire explains that having access to a digital map means:

> I am more confident using buses in areas I'm not familiar with….I knew the bus stopped near the bus station, but I didn't know where…[so I] got my little iPhone out and got a discreet view of how close I was getting….[It's] good for the university because it means I am less likely to use taxis, which are more expensive, and it is better for green impact….[So] having a digital map gives me the reassurance of knowing I know where I am, or I know how far I am from where I need to be, or if I miss the stop I know how to get to where I want to be.

Together, the above accounts have shown that people trust digital maps and the datasets embedded within them. This relies on understanding the information they provide is indexical and accurate. The accounts also show that choices of site and route and the practice performances tied to them can all (in part at least) be shaped by digital map use. Here, senses of place, personal safety, reassurance (including not having to rely on others), and ontological security (in continuing an ongoing stable narrative) combine as different senses of security that people gain from using digital maps. In this, digital map content is not fully coercive or structuring of action. Rather, people are agentic in making senses of place and gaining senses of security by drawing classifications and associations (meanings) stored in memory traces and applying them to digital map content. However, for urban planning it is important to understand that digital maps and the data embedded within them do serve to mediate the ways in which people use and move around in urban space.

7. Conclusion

This article has shown that digital maps mediate our knowledge and experience of urban space, and senses of security within it, even when not directly used. The article has shown that these senses of security, at times, may be false (maps can be wrong) and are often tied to people having access to relevant materials (e.g., smartphones when on the move). It has also shown that digital map use has altered the ways in which bodies are distributed in urban space in more material ways—ranging from where people choose to live, which jobs they take up, and the travel routes they take and mode of transport selected. In this, people have been shown to be agentic in drawing on memory traces to make sense of place through personal classifications and associations. Here, people trust digital maps to provide veracious representation of urban space. As indexical and continually updated allocative resources, they invest any external dataset incorporated within them (e.g., crime statistics or council tax banding) with the same level of legitimacy. Together, these factors lead the article to an argument that the senses of security provided by digital maps are reshaping the way urban space is experienced and used in several ways. This is important for urban planning, in so far as knowing how people are likely to use and make sense of cities is a central concern. To that end, this article provides two suggestions: (1) that a practice theory based approach is well suited for examining the wants, needs, and desires of people in contemporary cities—and by extension for planning urban space around people's experiences and uses of space that are increasingly mediated by digital technology; and (2) that digitally mediated senses of security should be considered as important aspects in examining the distribution and movement of bodies in space. As such, useful extensions of this article could include looking quantitively at the practices of key groups (e.g., home-buyers at a national level) and the extent to which digital maps have been used and trusted, and how extensively they feature in decisions of which home to buy across the country—and indeed between countries. Another focus could look to examine the competence required to make use of digital maps and evaluate how that might be incorporated into educational programmes. Furthermore, the article's framework could be used to compare the ways in which different digital technologies (not just digital maps) that feature in people's lives mediate their experiences of urban space and their performance of particular practices—notably by taking forward its argument that they do so by influencing people's sense of security.

Conflict of Interests

The author declares no conflict of interests.

References

Alvarez, L. (2016). Property regimes and the commodification of geographic information: An examination of Google street view. *Big Data and Society*, *3*(2), 1–13.

Anguelov, D., Dulong, C., Filip, D., Frueh, C., Lafon, S., Lyon, R., . . . Weaver, J. (2010). Google street view: Capturing the world at street level. *Computer*, *43*(6), 32–38.

Ash, J., Kitchin, R., & Leszczynski, A. (2016). Digital turn, digital geographies? *Progress in Human Geography*, *42*(1), 25–43.

Axon, S., Speake, J., & Crawford, K. (2012). 'At the next junction, turn left': Attitudes towards Sat Nav use. *Area*, *44*(2), 170–177.

Barford, A., & Dorling, D. (2007). Worldmapper. *Teaching Geography*, *32*(1), 29–36.

Barnes, B. (2001). Practice as collective action. In T. Schatzki, K. Knorr-Cetina, & E. von Savigny (Eds.), *The practice turn in contemporary theory* (pp. 17–41). London: Routledge.

Bettman, K. (2018). Air View is ready to expand to more places around the globe. *Google: The Keyword*. Retrieved from https://www.blog.google/products/maps/air-view-ready-expand-more-places-around-globe

Bhagat, A., & Mogel, L. (2008). *An atlas of radical cartography*. Los Angeles, CA: Journal of Aesthetic and Protest Press.

Bing. (2006). Virtual Earth 3D launches. *Bing*. Retrieved from https://blogs.bing.com/maps/2006/11/06/virtual-earth-3d-launches

Bing. (2017). Bing maps launches three new fleet management APIs. *Bing*. Retrieved from https://blogs.bing.com/maps/2017-12/bing-maps-launches-three-new-fleet-management-apis

Black, J. (2002). *Maps and politics*. London: Reaktion.

Board, C. (1972). Cartographic communication. *Cartographica*, *18*(2), 42–78.

Boulton, A. (2010). Just Maps: Google's democratic mapmaking community? *Cartographica*, *45*(1), 1–4.

Bryant, C., & Jary, D. (2001). Anthony Giddens: A global social theorist. In C. Bryant & D. Jar (Eds.), *The contemporary Giddens: Social theory in globalizing age* (pp. 3–42). Basingstoke: Palgrave.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. London: Sage.

Cosgrove, D. (1999). Introduction: Mapping meaning. In D. Cosgrove, *Mappings* (pp. 1–23). London: Reaktion.

Couldry, N. (2004). Theorising media as practice. *Social Semiotics*, *14*(2), 115–132.

Crampton, J. (2009). Cartography: Maps 2.0. *Progress in Human Geography*, *33*(1), 91–100.

Crampton, J. (2010). *Mapping: A critical introduction to cartography and GIS*. Oxford: Wiley-Blackwell.

Crampton, J. (2011). Arthur Robinson and the creation of America's first spy agency. In A. Ruas (Ed.), *25th*

International Cartographic Conference: An enlightened view of cartography and GIS. Paris: International Cartographic Association.

Crampton, J., & Krygier, J. (2006). An introduction to critical cartography. *Cartography*, *4*(1), 11–33.

Dalton, C. (2012). *Mashing-up maps: Google geo services and the geography of ubiquity* (Unpublished Doctoral dissertation). University of North Carolina, Chapel Hill, NC, USA.

Dodge, M. (2017). Cartography I: Mapping deeply, mapping the past. *Progress in Human Geography*, *41*(1), 89–98.

Dodge, M. (2018). Mapping II: News media mapping, new mediated geovisualities, mapping and verticality. *Progress in Human Geography*, *42*(6), 949–958.

Dodge, M., Perkins, C., & Kitchin, R. (2009). Mapping modes, methods and moments: A manifesto for map studies. In M. Dodge, C. Perkins, & R. Kitchin (Eds.), *Rethinking maps: New frontiers in cartographic theory* (pp. 220–243). London: Routledge.

Douay, J. (2018). *Urban planning in the digital age*. London: ISTE.

Eastman, J. (1985). Cognitive models and cartographic design research. *The Cartographic Journal*, *22*(2), 95–101.

Eckert, M., & Joerg, W. (1908). On the nature of maps and map logic. *Bulletin of the American Geographical Society*, *40*(6), 344–351.

Edelman, B. (2015). Does Google leverage market power through tying and bundling? *Journal of Competition Law and Economics*, *11*(2), 365–400.

Edney, M. (2005). Putting "cartography" into the history of cartography: Arthur H. Robinson, David Woodward, and the creation of a discipline. *Cartographic Perspectives*, *51*(36), 711–728.

Gannes, L. (2015). Ten years of Google Maps, from Slashdot to Ground Truth. *Vox*. Retrieved from https://www.recode.net/2015/2/8/11558788/ten-years-of-google-maps-from-slashdot-to-ground-truth

Geller, T. (2011). Imagine the world: The state of online mapping. In M. Dodge, R. Kitchin, & C. Perkins (Eds.), *The map reader: Theories of mapping practice and cartographic representation* (pp. 185–192). Oxford: Wiley-Blackwell.

Giddens, A. (1984). *The constitution of society*. Cambridge: Polity Press.

Giddens, A. (1991). *Modernity and self-identity: Self and society in the late modern age*. Cambridge: Polity Press.

Golden Software. (2019). About us. *Golden Software*. Retrieved from https://www.goldensoftware.com/about

Google. (2017). Google Map Maker has closed. *Google*. Retrieved from https://support.google.com/mapmaker/answer/7195127?hl=en

Green, D., & King, S. (2000). Software. *The Cartographic Journal*, *37*(2), 149–150.

Haklay, M. (2013). Neogeography and the delusion of democratisation. *Environment and Planning A: Economy and Space*, *45*(1), 55–69.

Haklay, M., & Weber, P. (2008). OpenStreet map: User-generated street maps. *IEEE Pervasive Computing*, *7*(4), 12–18.

Hanchard, M. (2020). *Anchoring digital maps* [Data set]. https://doi.org/10.25405/data.ncl.12349772.v1

Harley, J. (1987). The map and the development of the history of cartography. In J. B. Harley & D. Woodward (Eds.), *The history of cartography: Volume 1: Cartography in prehistoric, ancient, and medieval Europe and the mediterranean* (pp. 1–42). Chicago, IL: University of Chicago Press.

Harley, J., & Woodward, D. (1987). *The history of cartography: Volume 1: Cartography in prehistoric, ancient, and medieval Europe and the mediterranean*. Chicago, IL: University of Chicago Press.

Herwig, C. (2016). Keeping earth up to date and looking great. *Google: The Keyword*. Retrieved from https://blog.google/products/earth/keeping-earth-up-to-date-and-looking

Hiscock, R., Kearns, A., MacIntyre, S., & Ellaway, A. (2001). Ontological security and psycho-social benefits from the home: Qualitative evidence on issues of tenure. *Housing, Theory and Society*, *18*(1/2), 50–66.

Hoffman, S., & Stewart, C. (1993). Text-based routing: An affordable way ahead? In J. Parviainen & D. Reekie (Eds.), *Proceedings of VNIS '93: Vehicle navigation and information systems Conference Ottawa* (pp. 45–48). Ottawa: IEEE.

Hudson-Smith, A., Batty, M., Crooks, A., & Milton, R. (2009). Mapping for the masses: Accessing Web 2.0 through crowdsourcing. *Social Science Computer Review*, *27*(4), 524–538.

Ishikawa, T., Hiromichi, F., Imai, O., & Okabe, A. (2008). Wayfinding with a GPS-based mobile navigation system: A comparison with maps and direct experience. *Journal of Environmental Psychology*, *28*(1), 74–82.

Johnson, I. (2002). Contextualising archaeological information through interactive maps. *Internet Archaeology*, *5*(12), 1–45.

Kaplan, F., & Lenardo, I. (2020). The advent of the 4D mirror world. *Urban Planning*, *5*(2), 307–310.

Keates, J. (1996). *Understanding maps*. Edinburgh: Addison Wesley Longman.

Kitchin, R., & Dodge, M. (2011). *Code/space: Software and everyday life*. Cambridge, MA: MIT Press.

Knorr-Cetina, K. (2001). Objectual practice. In T. Schatzki, K. Knorr-Cetina, & E. von Savigny (Eds.), *The practice turn in contemporary theory* (pp. 175–188). London: Routledge.

Kort, W., & Gharbi, J. (2013). Structuration theory amid negative and positive criticism. *International Journal of Business and Social Research*, *3*(5), 92–104.

Lammes, S., & Perkins, C. (2016). An introduction to playful mapping in the digital age. In Playful Mapping Collective (Ed.), *Playful mapping in the digital age* (pp.

12–27). Amsterdam: Institute of Network Cultures.
Land Registry. (2014). Frequently asked questions: Does the title register show a history of ownerships and charges? *LandRegistry*. Retrieved from https://www.landregistry-titledeeds.co.uk/frequently-asked-questions/#collapseTen
Mapquest. (2017). JavaScript maps API v7.2 developer's guide. *Mapquest*. Retrieved from https://developer.mapquest.com/documentation/javascript-api
McConchie, A. (2015). Hacker cartography: Crowd-sourced geography, openstreetmap, and the hacker political imaginary. *Acme*, *14*(3),874–898.
Meyer, R. (2016, June 27). Google's satellite map gets a 700-trillion-pixel makeover. *The Atlantic*. Retrieved from https://www.theatlantic.com/technology/archive/2016/06/google-maps-gets-a-satellite-makeover-mosaic-700-trillion/488939
Microsoft. (2017). Getting started with Bing maps 3D. *Microsoft*. Retrieved from https://msdn.microsoft.com/en-us/library/bb259695.aspx
Milner, G. (2016). *Pinpoint: How GPS is changing technology, culture, and our minds.* London: W. W. Norton & Company.
Möellering, H. (2000). The scope and conceptual content of analytical cartography. *Cartography and Geographic Information Science*, *27*(3), 205–223.
Montello, D. (2002). Cognitive map-design research in the twentieth century: Theoretical and empirical approaches. *Cartography and Geographic Information Science*, *29*(3), 283–304.
Morrison, J. (1977). The science of cartography and its essential process. *Cartographica*, *14*(1), 58–71.
Münzer, S., Zimmer, H., & Baus, J. (2012). Navigation assistance: A trade-off between wayfinding support and configural learning support. *Journal of Experimental Psychology: Applied*, *18*(1), 18–37.
NASA. (2019). Navstar 1. *NASA*. Retrieved from https://nssdc.gsfc.nasa.gov/nmc/spacecraft/display.action?id=1978-020A
Newton, A., Gittings, B., & Stuart, N. (1997). Designing a scientific database query server using the World Wide Web: The example of Tephrabase. In Z. Kemp (Ed.), *Innovations in GIS 4* (pp. 234–248). London: Taylor and Francis.
O'Leary, M. (1997). MapQuest and Maps On Us: Top web map services. *Online*, *28*(5), 56–58.
Office for National Statistics. (2019). A quick guide to 1991 and earlier censuses. *Office for National Statistics*. Retrieved from https://www.ons.gov.uk/census/2001censusandearlier/aquickguideto1991andearliercensuses
Pendleton, C. (2010). The world according to Bing. *Computer Graphics and Information*, *30*(4), 15–17.
Perkins, C. (2008). Cultures of map use. *The Cartographic Journal*, *45*(2), 150–158.
Pickering, A. (2001). Practice and posthumanism: Social theory and a history of agency. In T. R. Schatzki, K. Knorr-Cetina, & E. von Savigny (Eds.), *The practice turn in contemporary theory* (pp. 172–183). London: Routledge.
Plantin, J. (2018). Google Maps as cartographic infrastructure: From participatory mapmaking to database maintenance. *International Journal of Communication*, *12*(1), 489–506.
Postill, J. (2010). Introduction: Theorising media and practice. In B. Brauchler & J. Postill (Eds.), *Theorising media and practice* (pp. 35–54). Oxford: Berghahn Books.
Power, M., Neville, P., Devereux, E., Haynes, A., & Barnes, C. (2012). Why bother seeing the world for real?: Google Street View and the representation of a stigmatised neighbourhood. *New Media and Society*, *15*(7), 1022–1040.
Putz, S. (1994). Interactive information services using World-Wide Web hypertext. *Computer Networks and ISDN Systems*, *27*(2), 273–280.
Rabari, C., & Storper, M. (2015). The digital skin of cities: Urban theory and research in the age of the sensored and metered city, ubiquitous computing, and big data. *Cambridge Journal of Regions, Economy, and Society*, *8*(1), 27–42.
Robinson, A. (1947). *Foundations of cartograhic methodology* (Unpublished Doctoral dissertation). University of Ohio, Athens, OH, USA.
Robinson, A. (1979). Geography and cartography: Then and now. *Annals of the Association of American Geographers*, *69*(1), 97–102.
Roth, R., Çöltekin, A., Delazari, L., Filho, H., Griffin, A., Hall, A., . . . van Elzakke, C. (2017). User studies in cartography: Opportunities for empirical research on interactive maps and visualizations. *International Journal of Cartography*, *3*(1), 61–89.
Schatzki, T. (1997). Practices and actions: A Wittgensteinian critique of Bourdieu and Giddens. *Philosophy of the Social Sciences*, *27*(3), 283–308.
Schatzki, T. (2001). Introduction: Practice theory. In T. Schatzki, K. Knorr-Cetina, & E. von Savigny (Eds.), *The practice turn in contemporary theory* (pp. 1–14). London: Routledge.
Schlichtmann, H. (1985). Characteristic traits of the semiotic system "map symbolism." *The Cartographic Journal*, *22*(1), 23–30.
Schuurman, N. (2000). Trouble in the heartland: GIS and its critics in the 1990s. *Progress in Human Geography*, *24*(4), 569–590.
Shapiro, A. (2017). Street-level: Google Street View's abstraction by datafication. *New Media and Society*, *20*(3), 1201–1219.
Shove, E. (2017). Matters of practice. In A. Hui, T. Schatzki, & E. Shove (Eds.), *The nexus of practices: Connections, constellations, practitioners* (pp. 155–168). London: Routledge.
Shove, E., Pantzar, M., & Watson, M. (2012). *The dynamics of social practice: Everyday life and how it changes*. London: Sage.
Speake, J. (2015). "I've got my Sat Nav, it's alright": Users'

attitudes towards, and engagements with, technologies of navigation. *Cartographic Journal*, *52*(4), 345–355.

Sui, D., & Goodchild, M. (2011). The convergence of GIS and social media: Challenges for GIScience. *International Journal of Geographical Information Science*, *25*(11), 1737–1748.

Thatcher, J. (2013). Avoiding the ghetto through hope and fear: An analysis of immanent technology using ideal types. *GeoJournal*, *78*(6), 967–980.

Thatcher, J., O'Sullivan, D., & Mahmoudi, D. (2016). Data colonialism through accumulation by dispossession: New metaphors for daily data. *Environment and Planning D: Society and Space*, *36*(6), 990–1006.

Tobler, W. (1970). A computer movie simulating urban growth in the Detroit region. *Economic Geography*, *46*(Supplement), 234–240.

Turner, A. (2006). *Introduction to neogeography*. Cambridge, MA: O'Reilly Media.

UK Data Service. (2019). Census boundary data. *UK Data Service*. Retrieved from https://census.ukdataservice.ac.uk/use-data/guides/boundary-data.aspx

Wilmott, C. (2020). *Mobile mapping: Space, cartography and the digital*. Amsterdam: University of Amsterdam.

Wood, D., & Fels, J. (1986). Designs on signs/myth and meaning in maps. *Cartographica*, *23*(3), 54–103.

Wright, D., Goodchild, M., & Proctor, J. (1997). GIS: tool or science? Demystifying the persistent ambiguity of GIS as "tool" versus "science." *Annals of the Association of American Geographers*, *87*(2), 346–362.

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