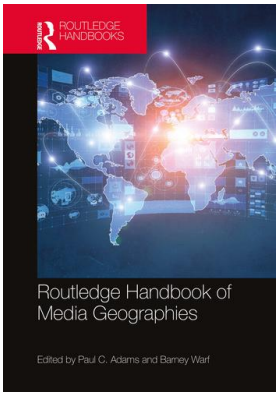

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GEOGRAPHIES OF LOCATIVE APPS

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A large part of what makes a smartphone "smart" are its built-in location-based services: its ability to locate and be located. As researchers such as Frith (2015) have noted, the smartphone is a form of locative media, enabling the co-construction of "hybrid" physical–digital spaces and places through its geolocative infrastructures and mobile affordances. Researchers have also considered the smartphone to be an ever-more ubiquitous example of "geomedia" (McQuire 2016) or "spatial media" (Leszczynski 2015; Kitchin et al. 2017). With smartphone ownership reaching saturation-point in the Global North and growing rapidly, albeit unevenly, in advanced *and* emerging economies globally (Silver 2019), location-based apps and services, as well as the user-generated location data they elicit and collect, have become both big business and increasingly central to social governance.

In this chapter, we examine the geographies of locative apps—that is, their spatial infrastructures, affordances and emerging cultural economies rather than the mapping of global geographies of mobile app usage.[1] Our examination covers three themes: First, we trace the historical developments leading to the rise of mobile media and "hybrid" spatiality. Second, we discuss the spatial affordances and infrastructures of location-based apps and services and how these have contributed to an expanding location economy. Our final theme addresses the shape and nature of the emergent location industry and, in particular, its implications for privacy. We outline how locative apps and services have been central to the emergence of mobile geolocation as a tool of continuous surveillance, while offering in conclusion some prospective pathways to a more equitable (locative) data future.

The rise of mobile media and hybrid spatiality

In the mid-2000s, a body of research began to emerge bringing focus to the shifting spaces and spatialities engendered by networked and mobile media. Couldry and McCarthy's (2004) edited collection *MediaSpace* was a notable early work that highlighted the increasingly complex entanglements between media, space and place. Published in 2004, four years before the release of the second-generation iPhone 3G, which—with its app-rich environment and embedded GPS—would reconfigure the contours of what constitutes a "smart" phone, Couldry and McCarthy's book featured the mobile phone only marginally, as one among many media forms and artefacts (re)shaping physical, virtual and social space in the

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early 2000s. Building on the concept of *mediaspace*, Humphreys's (2007) article on Dodgeball, an early location-based mobile check-in service launched in 2004 but defunct by 2009, gave critical insights into how location was emerging as a central driver within mobile ecosystems and mobile social networks in the mid–late 2000s. Unlike contemporary location-based mobile apps, which largely automate the capture of location information through a smartphone's built-in GPS or other location-capture infrastructure as we discuss below, Dodgeball required users to manually submit their location via text message, which would then be broadcast to the user's social network, again via text message (Humphreys 2007, 343). What Humphreys's year-long study of Dodgeball showed was that location-based mobile social networks had the potential to "strengthen, modify, and rearrange how urban public spaces and social connections are experienced" (2007, 344) thereby creating "third spaces" that sit between the virtual and the physical and that foster "habitual, dynamic, and technologically-enabled face-to-face interaction among loosely tied groups of friends" (2007, 355).

At around the same time, de Souza e Silva (2006) proposed the term "hybrid spaces" to describe how mobile technologies, like the mobile phone, were blurring the boundaries between virtual and physical spaces and places, and simultaneously reconfiguring both. By 2011, de Souza e Silva and Gordon had identified a new form of "location awareness" that they called "net locality," which they described as being "about what happens to individuals and societies when virtually everything is located or locatable," as well as "what individuals and societies can do with the affordances of this location awareness—from organizing impromptu political protests to finding nearby friends and resources" (p. 2). Here too, and like Couldry and Humphreys, Gordon and de Souza e Silva (2011) stress the hybrid spaces and places constructed in and through net locality: "location-aware mobile technologies," they maintain, "can change the way we experience both physical and digital spaces by configuring a new hybrid space, which is composed by a mix of digital information and physical localities" (p. 56).

Following on from this groundwork, much of the research on mobile media in the mid 2010s, like that of Frith (2015), Farman (2012) and Timeto (2015), stressed the collaborative, co-constitutive, and hybrid digital/physical form of placemaking occasioned by location-aware technologies and practices. Exemplifying the hybrid placemaking capabilities of socio-spatial mobile media that researchers were drawing attention to in the early–mid 2010s was the Livehoods project (livehoods.org), launched in 2012 (Cranshaw et al. 2012). Livehoods developed map-based visualizations of geotagged social media data drawn from Foursquare and Twitter, making visible the "geosocial overlay" of cities (Mitchell & Highfield 2017). While interest in mobile technology from design and human-computer interaction (HCI) predates this period (Jones & Marsden 2006), it was around this time that locative media applications became more common and sophisticated (Bilandzic & Foth 2012).

In parallel with the rise of hybrid socio-spatial affordances of mobile applications and tools, the mobile phone also enabled lay people to engage in geographic and planning based activities that were previously only accessible to experts with GIS training. This trend was called "neogeography" by Di-Ann Eisnor of Platial Inc., to describe a notion of "geography without geographers" (Foth et al. 2009, 103). The emergence of neogeography around 2005 saw the opening-up of geospatial technologies both to the general public and to academic disciplines beyond geography, particularly in the humanities, and was often couched in a rhetoric of democratization (Mitchell 2017). However, as Leszczynski (2014) has compellingly argued, neogeography was itself implicated in attempts to "monetize" spatial data and the geoweb, and its discourse of "newness" effectively worked to "depoliticize spatial media" (p. 70). While the term is not used as frequently these days, what remains current are the underlying tensions between the "democratization" and "monetization" of spatial technologies and data.

Alongside these changing socio-spatial mobile practices, critical to the emergence, widespread adoption and mainstreaming of this hybrid digital–physical engagement with location was the rise of the mass-market GPS-enabled smartphone following the 2008 release of the iPhone 3G. The second-generation iPhone was certainly not the first to have built-in GPS—the Benefon Esc! released nearly a decade earlier in 1999 was the first commercially available GPS-enabled phone (Mitchell & Highfield 2017). It did, nevertheless, establish GPS as a standard mass-market feature for smartphones and, with the launch of the App Store the same year, set the foundations for geolocation as an enabling platform for the app economy. As Frith (2015) notes, the three elements that have played key roles in defining and shaping location-based services are "location awareness, mobile internet, and app stores" (p. 42). Since then, location has not simply become embedded in our mobile phones, but also in the global digital data economy. Harvested through smartphone apps, often without the user's full awareness or informed consent, the personal location data of everyday users of mobile media have become highly monetizable and are today routinely sold and on-sold through third-party location monetization companies for various ends—from advertising to providing better public amenities to surveillance.

Since the early days of hybrid socio-spatiality, Wilken (2018; 2019) identifies that smartphone-enabled location-based services have moved through three "generations" or "iterations." Where the first generation required users to actively check-in, as in the case of Dodgeball, the second generation involved more "passive" or "ambient" disclosure of location on the part of the user, while the third, and current, generation is characterized by "ubiquitous geodata capture" (Wilken 2018, 25–26). In almost every case, Wilken (2018) notes, first- and second-generation services became defunct by the mid 2010s, replaced by the third-generation location-based services that now dominate the smartphone and app economy, and in which location has become fully integrated—from the interface to the "algorithmic processing, database population, monetization efforts and so on" (p. 26). In this process, geolocation has become, in effect, "a fully domesticated socio-technological assemblage working to connect and mediate bodies, places, platforms, and devices, and in doing so generating vast data stores of personal geographic information" (Mitchell 2020). In the following section, we outline the spatial affordances and infrastructures of locative apps and services and how these have contributed to a new spatial quality of interaction as well as setting the conditions for Wilken's "ubiquitous geodata capture" or what Kitchin (2015) has called "continuous geosurveillance."

The spatial affordances and spatial infrastructures of locative apps and services

In a seminal early work on the rise of "cyberplace" through networked communication, Wellman (2001) notes that the introduction of the mobile phone changed the way phone calls were likely to begin. Where a call to a fixed-line phone might occasion the question "Who is this?" a call to a mobile phone changed the fundamental question to "Where are you?"—a shift that, according to Wellman (2001), illustrates how "the context of place does matter" (p. 239). This relatively small change is also indicative of a new spatial quality of interaction with widespread repercussions. These repercussions have registered even more strongly with the advent of smartphones that incorporate a range of location-based services that can take advantage of new spatial affordances (Bilandzic & Foth 2009). Fröhlich et al. (2007) distinguish between four types of mobile spatial interaction: (1) applications that facilitate navigation and wayfinding; (2) mobile augmented reality applications; and (3) applications to create or (4) access information attached to physical places or objects.

Navigation and wayfinding are arguably among the most-used location-based services that smartphones offer. Two years after its launch in 2005, Google Maps debuted on the first iPhone (Gibbs 2015). Instant wayfinding capabilities at people's fingertips heralded a new era of never being lost again, although 20th century urban theorists such as Benjamin (1978) and Debord (1981) along with more recent researchers (Traunmueller et al. 2013; Foth 2016) have stressed the importance of becoming lost or disoriented to spatial experience. Since Google Maps went mobile, new features have been added, such as turn-by-turn GPS navigation, the visualization of traffic congestion, and restaurant and business reviews and their busy times. The ability to access such codified spatial knowledge—in many cases knowledge built on location data contributed by users—began changing how people navigate and negotiate the city, and contributing to what Graham (2005) has termed "software-sorted geographies."

Another popular but controversial feature added to Google Maps in 2007 is Street View. Offering users not only map-based navigation but also a series of interactive panorama photos taken from many streets across the world, Street View also raised privacy concerns. Street View—and more recently Live View—are also examples of mobile augmented reality (AR) applications (Aurigi & De Cindio 2008; Craig 2013), the second category of mobile spatial interaction. Mobile AR describes an interactive location-based feature that overlays images of the physical world with digital information rendered in real-time and in a spatially accurate 3D position. While Layar was an early mobile AR browser (Liao & Humphreys 2015), it was not until the 2016 location-based game Pokémon Go that mobile AR became widely popularized (Paavilainen et al. 2017), feeding into research on the spatial affordances and geographies of urban game play (Colley et al. 2017; Leorke 2019).

The third and fourth categories of mobile spatial interaction broadly cover locative apps for creating and accessing data attached to physical places or objects. One of the earliest examples was Urban Tapestries—a mobile location-based platform to connect people with the places they inhabit through their stories, experiences and observations (Silverstone & Sujon 2005). The spatial affordances of such locative apps have enabled a number of experimental implementations, ranging from location-based storytelling and location-based social interaction to crowdsourced urban maintenance.[2]

These spatial affordances are enabled through the variety of spatial infrastructures for location capture that are embedded within the smartphone *and* our environment. Location capture today is most readily associated with ubiquitous GPS functionality on smartphones. This tendency to reduce geolocation or location capture to GPS alone, however, obfuscates less immediately apparent mechanisms for smartphone-enabled location tracking (including WiFi, mobile communication cell towers, and Bluetooth) that often work in concert, rather than in exclusivity. Far from halting location tracking, disabling a smartphone's GPS can uncover the plurality of hidden data capturing infrastructure through which an ever-more granular account of mobile phone users' outdoor *and indoor* movements is constructed.

Pioneering technologies, like satellite navigation systems/GPS or the Global System for Mobile Communications (GSM), paved the way for *trilateration* and *triangulation*—geometric calculations enabling receivers of satellite and cell tower signals to determine their own position based on signal frequency, strength, timing and/or angle from multiple emitters. GPS and GSM became commercially available in the 1980s and 1990s. In 2000, the US lifted the intentional accuracy reduction of GPS for civil and commercial use. These developments incentivized joint efforts to standardize location access to overcome the decade's high fragmentation across devices and smartphone operating systems (OSs), for example via the J2ME Location API first released in 2003.

Today, Apple and Google, which together control virtually the entire global smartphone OS market (Statcounter GlobalStats 2020), by default rely on a combination of GPS and cell tower triangulation, known as Assisted GPS. However, these methods become inaccurate or entirely unavailable inside buildings, tunnels, underground, or in areas with a low cell-tower density. GPS also quickly drains smartphone batteries, and tech-savvy or privacy-aware users disable it. Urban areas, home to the majority and most sought-after data subjects, require continuous and granular location data to maximize economic value for targeted advertising or the optimization of digital products and services.

A growing ecosystem of short(er)-range radio transmitters is exploited to this end, forming a fine-grained mesh of fixed, known locations against which to determine movement patterns using triangulation. This includes WiFi access points and low-cost, low-energy beacons based on Bluetooth that the smartphone identifies by quietly broadcasting its presence without initiating a formal connection that would alert the user. These installations proliferate in shopping centers, airports, office buildings and in public spaces—in town squares and on high streets. To make indoor location-tracking cheaper and more ubiquitous (and more covert), Google patented the use of existing power infrastructure inside buildings for indoor sub-room positioning (c.f. patent by Patel et al. 2013).

Efforts are also made to overcome inaccuracies or blank patches in this ecosystem, as well as the user's location privacy settings, by integrating standard motion-sensor data from the phone's gyroscope, accelerometer and magnetometer to accurately determine distance, direction, speed, or activity type in relation to a known geographical coordinate or indoor position (c.f. Google Patent by Norta et al. 2007). The enhanced location-tracking capabilities of these sensors tend to be underestimated. Narain et al. (2016) demonstrate how a driving route can be identified through "zero permission sensors" (p. 397)—data for which the OS does not require user permission before it can be collected—with 30–50% accuracy by comparing the generated route pattern to public road information. While this may seem insignificant, combining the data with other covert location-tracking mechanisms significantly increases this accuracy. Such approaches pose a significant threat to users' privacy (Narain et al. 2017).

Finally, advances in computer vision created new opportunities for *visual localization* methods, where algorithms allow for the estimation of a device's position by comparing the spatial features of a live photo or images captured via the phone's camera feed to those from a previously built database of geotagged images (c.f. Google patent by Steinbach et al. 2017). Any assumption that disabling GPS, WiFi or even Bluetooth on the smartphone will halt location tracking is misguided considering these ongoing efforts. In January 2018, Google phones were collecting location information inferred through nearby Bluetooth beacons even as Bluetooth was deactivated, as long as the location history feature was turned on (Yanofsky 2018). In August 2018, an Associated Press (2018) investigation found some Google services tracked location even *after* location history was turned off—testament to the economic value of location data and the lengths to which companies like Google will go to capture it. The plethora of indoor positioning startups, many targeting retailers (AngelList n.d.), points to a growing location economy, to which we now turn.

The location economy: Location intelligence, geoprivacy and surveillance capitalism

Alongside developments in location-aware technologies and location-based mobile services, a young but growing third-party "location intelligence" industry has emerged. Often also referred to as location analytics or location monetization, this industry reconfigures the

geographies of locative media. In recent years, Foursquare—which was developed in 2008 by one of the founders of Dodgeball as a gamified check-in app and which is often considered to exemplify the idea of the "hybrid" spatiality of locative media (Frith 2013; Saker & Evans 2016)—has pivoted explicitly to become a location intelligence company (Martineau 2019), taglining itself "The Trusted Location Data & Intelligence Company." And yet, as Smith (2019) has noted, with its focus on "user-centric studies of audience geocoding" and large "mainstream location-based platforms such as Google Maps and Foursquare," much of the existing literature on locative media "neglects the important but often invisible role of third-party advertising servers and analytics industries that capture and analyse location data for a variety of political and commercial applications" (p. 1044). The availability of vast swathes of personal location data generated through smartphone apps and services has set the groundwork for a new kind of "geodemographics" that shift the focus from the generic postal code to the highly specific, and more personally intimate, "geocode" (Smith 2019, 1045). These "second-order" geodemographics enable new forms of algorithmic marketing and refined marketing metrics that can assess "audience 'lift'" achieved through intensively geo-targeted advertising (Smith 2019, 1045).

Gauging the size and contours of this industry and the market for personal location data is difficult since location data brokers and analytics firms do not always advertise themselves as such. Moreover, the app-based transactions between an individual's smartphone, the location-based app they are using, and a third-party location-monetization firm that the app may be sharing that individual's location with is hidden from the user. A 2018 report from Sudo Security Group (2018), a company developing a privacy enhancing app to track location tracking, found that many of the top free apps in Apple's App Store (including popular weather, parking and coupon apps boasting user bases of over 100 million) contained tracking code from one or more of 12 identified third-party location intelligence companies. The group also analyzed the pop-up justification that each app displayed to request access to a user's location data, finding that many apps did not disclose that granting location access meant the resulting data would be shared with or on-sold to third parties. Market reports for the location services and intelligence industries invariably indicate strong and continuing growth. The Geospatial Media and Communications (2019) *Location Intelligence Market Report* for 2019, for instance, states that the market for location data "has grown from nearly US$ 9 billion in 2014 to around US$ 22 billion in 2018 in terms of market size," and it is expected to double from 2018 to 2022. The report continues that the location intelligence industry "can be sub-divided into four major categories: a) hardware, b) software/platforms, c) 'location data and map content,' and d) 'solutions and services,'" with the latter two categories growing at the fastest rate and currently "account[ing] for nearly two-thirds of the market" (p. 3).

As our everyday mobile-mediated experiences of space and place are increasingly commodified through the ubiquitous collection of personal geodata by locative apps and services, the meaning of location and our relationship to it also changes. Thatcher (2017) has highlighted the intensifying commodification of everyday life brought about by the location-based app industry, to the extent that the term *location* now registers both the "everyday experience of being in a particular place at a particular time," and an emergent meaning of *location* as "digital commodity" (p. 2704). For developers of location-based apps, Thatcher continues, "location"—as a term and concept—"promises the ability to tie an individual's intentions and socio-economic information, as revealed through data mining, to a relatively precise spatio-temporal coordinate tuple of latitude, longitude, and timestamp" (p. 2704).

There is growing evidence to suggest that this distinction between location as (digitally mediated) experience of place and as digital commodity is beginning to collapse, or, rather,

that there is increased public awareness of the variety of ends to which personal location data is being put to work within the data economy. In 2018, two major international news outlets—the *Wall Street Journal* and *New York Times* (*NYT*)—published investigative reports into the smartphone app location data industry, with the discomforting headlines "Your location data is being sold—often without your knowledge" (Mims 2018) and "Your apps know where you were last night, and they're not keeping it secret" (Valentino-DeVries et al. 2018). The latter article reported that 17 of 20 apps tested by the *NYT* sent user location data to some 70 businesses. One app that the *NYT* article drew attention to was The Weather Channel app—this in turn spurred legal action, with the City Attorney of Los Angeles bringing a lawsuit against The Weather Channel for "deceptively" using its app to "amass its users' private, personal geolocation data" (Kelly 2019). Location is seemingly becoming a new legal frontier for governance and regulation, with a number of lawsuits and class actions being launched in recent years, including the Electronic Frontier Foundation (EFF) (2019) filing a class action against US telco AT&T for on-selling user location data to third parties such as "bounty hunters, car dealerships, landlords, and stalkers" without authorization. In 2021, the Federal Court of Australia ruled that Google had misled consumers about how the company collected and used personal location data, in a case brought by the Australian Competition and Consumer Commission (ACCC) (2021)..

As location becomes an increasingly dominant player in the platform and app economy, and as minor and major scandals relating to excessive tracking, leaks, hacks and inadvertent exposures of personal location data through smartphone apps and location-based services become more frequent,[3] the question of privacy has come to the fore in debates and discussion around locative media. These heightened threats to privacy have been well acknowledged and researched for at least two decades, with successive studies of mobile phone users' attitudes to privacy highlighting location as holding particular personal sensitivity (Barkhuus & Dey 2003; Zickuhr 2013; Martin & Nissenbaum 2019; Riedlinger et al. 2019). Taken as a whole, these studies not only reinforce the risks that location poses to personal privacy, but also that locative media require users to constantly negotiate tradeoffs between convenience and privacy. Granting a weather app access to a phone's GPS, for instance, can automate the provision of a weather forecast for the phone user's current location, making it more convenient than manual location input. In the current app economy, however, it is more likely than not that this exchange of location information will extend far beyond a transaction between app and user, and that the user will have no way of knowing the extent to which their location data has been traded and re-traded across the location economy.

Given the intensification of the location economy along with the changing practices, infrastructures and affordances of location in the era of smartphones, new attunements to the spatial aspects of privacy have come to the fore and, in recent years, there has been recognition of "geoprivacy" (Leszczynski 2017; Mitchell & Highfield 2017; Keßler & McKenzie 2018) as an emergent form of privacy of particular concern both for smartphone-using publics and for public administrations. According to Leszczynski (2017), a "broadened concept" of geoprivacy can and must "account for the emergent complex of potential privacy harms and violations that may arise from a number of nascent realities of living in a (spatial) big data present," including the capture of individuals' personal location data and their spatio-temporal movements, the circulation of these data in and through the location economy, and the difficulties individuals face in controlling these "highly personal flows of spatial information about themselves in networked device and data ecologies" (p. 237).

Critically, over the same period, location has become central to what Shoshana Zuboff (2019) has termed "surveillance capitalism." Zuboff draws attention to the operational value

of smartphone-derived location data within surveillance capitalism, as well as its heightened personal sensitivities, both of which lie in the inherent reidentifiability of supposedly "anonymized" or "anonymizable" location data. Zuboff quotes Princeton computer scientists Arvind Narayanan and Edward Felten as summing up location's simultaneously unique and uniquely sensitive selling-point: namely, that "there is no known effective method to anonymize location data, and no evidence that it's meaningfully achievable" (Zuboff 2019, p. 244). The current geosurveillant–geocapitalist moment we find ourselves in is not an unforeseen one. As early as 2003, Dobson and Fisher (2003) warned that advances in GIS and GPS technologies heralded the potential for a dystopian future based on real-time location control of humans—a form of bondage "extend[ing] far beyond privacy and surveillance" (p. 47). In their deliberately provocative paper, they called this looming form of location control "geoslavery," describing it as a "real, immediate, and global threat" (p. 47). Although the very worst excesses of Dobson and Fisher's vision of potential human bondage through location control may not (yet) have eventuated, as Obermeyer (2007) has suggested, the growing entanglements between geosurveillance, consumer capitalism and governance have brought about a form of "volunteered (geo)slavery," requiring "new approaches to address spatial data privacy" and greater public awareness (p. 2).

Nowhere has this increased value of and heightened sensitivities around location data been more apparent in recent times than in the varying approaches countries took in developing contact-tracing apps in early 2020 during the COVID-19 pandemic (Morley et al. 2020). Where countries such as Poland, South Korea, India and Taiwan developed contact-tracing apps that tracked the location of smartphones, spurring global debates over privacy and reidentifiability, other apps, such as Australia's CovidSafe app and the contact-tracing framework developed by Apple and Google, stressed their *non-collection* of location data as a critical component of their privacy-protecting frameworks. One contact-tracing app—North Dakota's Care19 app—was even found to be sharing user location data with Foursquare, in violation of its own privacy policy (Morse 2020). In another contemporaneous example of the coextensivity of surveillance capitalism, the location intelligence industry and smartphone-derived personal location data, Mobilewalla—a "consumer intelligence" company that purchases app-generated location data from aggregators and claims "80–90% device coverage in the US"—published a report on the demographics and movements of Black Lives Matter protesters in cities across the United States (Doffman 2020). These very recent examples draw focus to a growing public awareness of how everyday digitally mediated locative practices are intimately tied to the location economy. They also signal the regulatory attention now turning to location intelligence and the location economy, particularly as they function as a supporting pillar within surveillance capitalism.

Conclusion

Locative apps and location-based services have quickly advanced to be taken for granted by many people in everyday life. The commercial frameworks many of these services are embedded within rely on location data being put to work within a vast (location) data economy. We stress that the "geographies" of locative apps, as we are defining them here, are the result of intertwined practices, affordances and infrastructures that shape and reshape our experience of place and space, our awareness and recognition of ourselves as data bodies and bodies of data, and our understandings of and attitudes towards (geo)privacy. Location-based services are a fast-paced field, and reactive policy strategies and regulatory instruments tend to lag behind the latest technology developments. However, transdisciplinary

approaches recognizing the continued importance of hybrid space propose progressive and desirable pathways to avoid purely dystopian outlooks and outcomes. Leszczynski (2019) highlights geolocation's *affective* capacities that work to "perturb, animate, align, mobilize, organize, dis/assemble—other things, both human and other-than-human alike" (p. 208). Engaging with affect, Leszczynski continues, helps us to "grappl[e] with what geolocation 'does,' how it 'does' what it does, and to what ends" (p. 208).

Geolocation, as experienced through locative apps and services, can present—often simultaneously—an unwanted intrusion into personal privacy, a welcome perception of safety and security, and an opportunity to enact and engage with hybrid spatiality. Working through the affects, ambivalences and ambiguities of geolocation can help us find desirable pathways for a more caring and just spatially aware and spatially enabled society. Current and future research and development into promising concepts such as privacy-by-design (Langheinrich 2001), sousveillance (Mann et al. 2003; Foth et al. 2014), good data practices (Daly et al. 2019) and data sovereignty (Lynch 2020; Mann et al. 2020), as well as tactics and strategies for resisting geosurveillance (Swanlund & Schuurman 2018; Seidl et al. 2020), offer potential trajectories to ameliorate the negative consequences of the location economy.

Notes

1 Although outside the scope of this chapter, important research that maps the geographies of internet and mobile app use across the globe has been done by Lim et al. (2015) and Wu and Taneja (2016), among others.
2 See, for instance, *Mobile Narratives* (Wiesner et al. 2009), *TrainYarn* (Camacho et al. 2015) and *FixMyStreet* and *FixVegas* (Foth et al. 2011).
3 For reporting on recent location-data leaks and exposures on various apps and platforms see, for instance, Graham (2020) on Venmo, Hern (2018) on Strava, Whittaker (2019) on family tracking app Family Locator, and Martin (2019) on a range of dating app location-data leaks.

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