Location Awareness in the Age of Google Maps

Rebecca Noone

First published 2024

ISBN: 978-1-032-17049-7 (hbk)
ISBN: 978-1-032-17050-3 (pbk)
ISBN: 978-1-003-25156-9 (ebk)

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DOI: 10.4324/9781003251569-1

The funder of the Open Access version of this chapter is University of Glasgow.

Routledge
Taylor & Francis Group
LONDON AND NEW YORK

1 The Lost Art of Location Awareness

Two Starting Points

Starting Point A: In 2018, I walked through the cities of London, Amsterdam, New York, and Toronto; and, as I walked, I stopped passers-by to ask for directions. I would ask how to get to the near and the far away: local sites that so often sit patiently in the background, such as libraries, markets, or parks; and those iconic city attractions that proudly stamp their presence over tourist brochures, like the Tate Modern or Heineken Experience.

More specifically, I would ask the people I stopped to draw directions for me, offering them paper and pen. These moments produced a series of hand-drawn vernacular maps; line drawings that translated an abstracted spatial memory to paper. Some drawings are minimal layers of lines, Xs, text, and arrows while others are dense spatial indexes—some plain and direct, while others scrawled and perhaps disorienting. Together, the hand-drawn spatial scores plotted out a route in a *here* to *there* of location awareness.[1]

Starting Point B: In 2019, Professor Bradford Parkinson and his collaborators received the esteemed Queen Elizabeth Prize for Engineering to honour their role in developing the now seemingly ubiquitous Global Positioning System satellite navigation network, better known simply as GPS.[2] The Elizabeth Prize, one of the top prizes in engineering, is just one of Parkinson's many awards—the touted "hero of GPS" also boasts a Marconi Prize and the Draper Award, among many others.[3] Parkinson's accolades hardly come as a surprise with GPS now seemingly sutured into the fabric of navigation. Operating on both a global and individual scale, GPS facilitates the tracking of fleet shipments and coordinates deliveries, while it also helps orchestrate everyday wayfinding when enabled through mobile mapping platforms like Google Maps.[4]

But amidst the celebration of a world forever changed by this locative technology, Parkinson was circumspect. Apart from the Queen Elizabeth Prize feting, Parkinson was making headlines for his misgivings about GPS's widespread application. In an interview with Tom Whipple, Science Editor at *The Times*, Parkinson concedes that while he is proud of GPS as a technological

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development, the pervasive use of GPS-enabled mobile mapping platforms like Google Maps needed to be approached with caution and not blanket celebration. In the words of Parkinson, "There are downsides; every advance has that. The fact is that people don't know how to read maps anymore."[5] As summarised by Whipple, Parkinson "worries about the lost art of map reading as people turn to GPS-powered maps on their smartphones."[6]

The Lost Art of Reading the Map

For Parkinson, the emergence of GPS in everyday navigation practices causes a deficit of map reading skill. Now the map simply *knows* and does the navigational work. For Parkinson, the location awareness of GPS opened up a new type of vulnerability: What if the GPS system should be jammed? Or hacked with intentionally misleading information? Or infiltrated for surveillance? Not being able to read a map left an opening for susceptibility to so-called malicious interventions by some "bad actor" who can take everything down in one "bad faith" manoeuvre.[7]

Parkinson's suspicion reflects his own background in militaristic intelligence and defence. As part of the US military, Parkinson helped develop a global navigation system using extra-planetary satellites—this became the foundation for the GPS of today. In 1973, Parkinson became the first Director of NAVSTAR GPS to build out intelligence "on the ground."[8] Like other geolocative technologies Graphic Information Systems (GIS), GPS enmeshed the specificities of precise location tracking in a totalising vision of the world, expressly designed for the purposes of military tactics.[9] As GPS became commercial and consumable, embedded in cars, phones, pet collars, and toys, its knowingness became commonplace. Nonetheless, it carried with it this omniscient precision of locational information charged with a command over what Caren Kaplan terms, the "target subjects."[10]

Today, Google Maps is perhaps the most prominent example of GPS presence in everyday life.[11] It is one of the most used digital mapping platforms with almost 2 billion monthly users and nearly 70% of the digital mapping market share (followed by Waze, which Google acquired in 2013).[12] Google Maps uses GPS's "location-enabled" technology to help locate, route, recommend, and coordinate. GPS literally positions people on Google Maps between one metre and thirty metres of their exact location (though Google's official measurements of accuracy are difficult to track).[13]

GPS is also fundamental to how Google builds and operates its map. In the background, Google uses GPS to help organise the spatial information it accumulates and assembles. For example, Google Maps uses GPS to locate and pin Google Street View images to Google Maps.[14] Google operators and software extract rich spatial details from Street View imaging—like addresses of businesses, one-way streets, or traffic lights and stop signs—and input these details into Google Maps located via GPS coordinates.[15] The Elizabeth Prize recognised Parkinson and his role in GPS precisely for this

ubiquity and embeddedness of the locative technology—the same embeddedness spurring Parkinson's concern.

While the Frankenstein conceit—the inventor penitent for their creation—may seem prosaic, Parkinson is not alone in his anxieties about compromised navigational skills and mobile map dependencies. Parkinson joins a chorus of concerns, including the laments of journalist Michael Harris, who in his 2015 book, *The End of Absence: Reclaiming What We've Lost in a World of Constant Connection*, argues that pervasive GPS (namely mobile maps) means that *we don't know how to be lost anymore*, let alone how to read a map. According to Harris, plugging into GPS's network of spatial intelligence has resulted in what he considers a loss of basic human survival skills of finding one's way.[16] Additionally, Harris bemoans what he sees as the dearth of playful serendipity that animates intuitive, rather than computational, navigation—a worry echoed in Stephen Petrow's 2018 road diary in the *USA Today* titled "I was a GPS Zombie. Here's what happened when I went back to paper maps and serendipity."[17] Petrow recounts his adventures of hitching his way across America without a mobile map with the goal to "relearn" how to "connect with people" in the process—a testament to all the experiences that are supposedly missed when finding one's way with satellite navigation systems.[18] For Parkinson, Harris, and Petrow, GPS and its attendant mobile applications are disconnecting us from our environment rather than helping us move through it.

Another feature of the satnav lament is the suggestion that GPS has fundamentally altered neurological processing, producing a cognitive lack of *awareness* about location. In 2017, Cari Romm, writing for New York Magazine's *The Cut*, warned that "using Google Maps Too Much Really Does Mess with Your Sense of Direction."[19] The previous year Greg Milner for *The Guardian* penned the headline: "Death by GPS: are satnavs changing our brain?" to pathologise cognitive function at the hands of convenient mapping tools.[20] Importantly, the common enemy throughout this handwringing is not simply GPS as a global system, but also mobile maps such as Google Maps, Waze, and Apple Maps, as an individual experience of these systems. As such, not using these mapping platforms, or going rogue on road trips, is something that interrupts the ubiquity of systems, or as Romm suggests, sets a course for retraining one's brain. But this presumes that one can opt out of using digital mapping systems and platforms lock stock, without accounting for what Jean-Christophe Plantin is Google Maps increasingly infrastructural role.[21]

Parkinson's commentary—like that of Romm, Petrow, and Harris—is made newsworthy precisely because it converts the narrative from "GPS as convenient tool of location awareness and navigation" to "GPS as a trap." Terms like "zombie" and "death by GPS" imply a threat to survival at the hands of insufficient navigational skills. But implicit in this criticism is the assumption that navigation is "an innate skill" and, moreover, navigation is a normative cognitive function under threat. The individual is then likely to be duped by bad actors, as Parkinson suggests, or lose connections with their

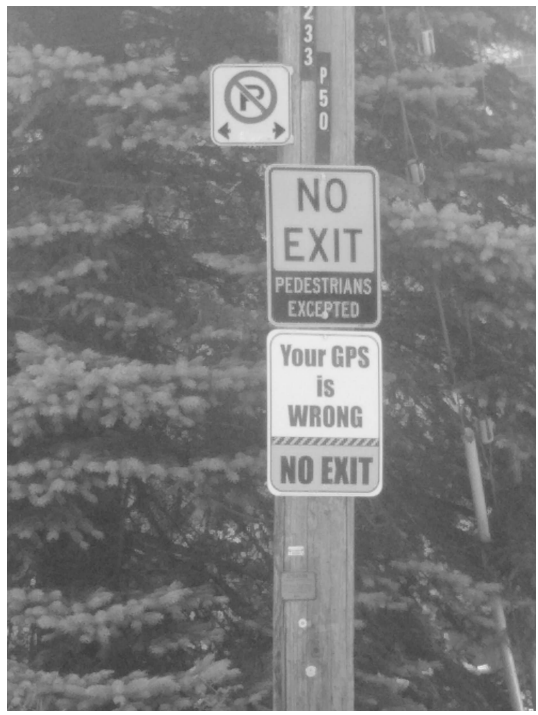

Figure 1.1 "Your GPS is wrong. No Exit" sign posted by neighbourhood residents in Toronto. Photo by Emily Maemura.

environment, as Harris fears. Seduced by the ease of digital maps and bereft of spatial awareness, we can neither be lost nor found (Figure 1.1).

A Sense of Direction

Regardless of how one might feel about their sense of direction, how one navigates space is always a question of processing, sorting, and directing a multitude of information with and without digital maps. Jason Farman calls this multifacted practice of being in space a "practice of sensory-inscription"—which he defines as the "proprioceptive sensing" of the immediate environment in tandem with one's embodied and socio-cultural situation.[22] For Farman this type of sensing is a form of "implacement" that is "culturally inscribed and contextually specific."[23] In other words, a sense of direction follows multiple routes. Therefore, the continual coordinating within a sense of direction reflects Annemaree Lloyd's theorisation of information practices oriented by a personal "information landscape."[24] Information landscapes are the interconnected information systems and tacit forms of knowledge, layered with community practices and contextual reasoning that are all part of

negotiating a situation or an environment.[25] Proprioceptive sensing unfolds within the complexities of information landscapes.

Situating the information landscape of location awareness in the context of mobile technologies and screen cultures, Nanna Verhoeff argues that the digital map interface and the city are "dialogic encounters between visual, virtual, material and physical domains, and as such operate as space—the time-binding set-ups or dispositifs of performative navigation."[26] Instead of zombies or deskilled navigators, Verhoeff activates the digital map user as engaged in what she calls "performative cartography" in which information on and off screen become an interplay of meaning, braided in the gestures, the interfaces, the movements of navigating the city. Moreover, the digital map works alongside the other features of the mobile phone including messaging, taking photos, tagging locations, augmenting other forms of information. Interfaces and their translations to digital maps reflect Alexander Galloway's understanding of interfaces as *processes* in and of themselves, rather than simply objects.[27] It follows that a sense of direction is a weaving of multiple strands of phenomenal processes, occurring simultaneously and perhaps in paradox. It is an unfolding practice rather than a declarative knack.

Rescaling a sense of direction to the everyday navigations of situated and structured knowledge upholds Doreen Massey's conception of space: that space is *relational* rather than *dimensional*.[28] Massey argues that "if 'space' as a dimension is anything at all, it is the dimension of coexisting actors, the dimension that precisely enables (and requires) their multiplicity."[29] Key to space's dimensionality are the variable relations to power. As such, spatial experiences are co-existently situated and embodied practices and strategies that both absorb and refuse the hegemonic systems of power imbalance.[30] For Fran Tonkiss, this means navigating space while contending with differential experiences of *being seen* in space or feeling safe.[31] These spatial tactics play out empirically in actions like having a personal shortcut, but it can also be taking the *long way* to feel safe on busy streets, or taking a shortcut to feel safe in not being seen. These routings change and adapt based on who circumscribes this path, and when and where they do it.

Understanding space as uneven and differently coded is important for thinking about the production of senses of direction. For example, Katherine McKittrick's Black geographies conceptualise a poetics of space activated in the practised resistance to pervasive racist geographies. She writes that "Black women's lives are underwritten by ongoing and innovative spatial practices that have always occurred, not on the margins, but right in the middle of our historically present landscape."[32] McKittrick illustrates how racism is central to how space is thought of and imagined, while contemporaneously Black geographies are deeply embedded in spatial meaning-making and practices of occupying space.[33] These inform one's sense of direction and movement through space. The presumption of a "lost sense of direction" loots space of its very histories, narratives, and positions.

By reterritorialising a sense of direction as occurring within an information landscape—a landscape produced through the tensions of structure and embodied geographies and the "proprioceptive" sensing of place—it becomes clear that one does not easily relinquish directional skill at the hands of Google Maps. The goal of the book is to bring to the fore a politics often lost in these popular critiques of Google Maps—popular critiques like "Google Maps has ruined our sense of direction" and "no one can read a map anymore!" Rather than navigate the platitudes of vanquished senses of direction or gained conveniences, this book tracks another way through the spaces Google *maps* and the attendant assumptions that location awareness is a stable, unidirectional phenomenon. Moreover, Google Maps is a sticky social object that carries with it the histories of other mapping projects that have been used to delineate boundaries in the name of property, assign valuation and accumulation, and target "from above."[34] Despite all Google's claims to mapping innovation, wrapped up in fantasies of location awareness, so much of Google's drive for location awareness reinforces already entrenched power structures and the relations to place they engender. The book dredges out the functions and fictions of a Google-positioned location awareness—its claims as a public resource, to promises of self-sufficient exploration, to templating representations of space, to indexing value—that organise and orient relations to space on and off the map.

Orienting Location Awareness

In 2006, Malcolm McCullough argued that information is increasingly about you and about *where* you are.[35] This information tailoring became increasingly poignant with the emergence of smartphones, shortly following McCullough's declaration. Mobile media carried with it the promise of information access about *anywhere*—one could be anywhere![36] And while this idea of accessing information anywhere might suggest a collapsing of space and a non-specificity of location, Eric Gordon and Adriana De Souza e Silva's 2011 book, *Net Locality: Why Location Matters in a Networked World,* argues that location plays a central role in how information is organised and navigated online.[37] They contend that net locality, or location awareness, in the age of mobile computing is foundational to how "we *navigate* information" and moreover "the way we expect to be *navigated*."[38] But instead, in this age of mobile computing, location remains important. Broadly speaking, location awareness is part of accessing place-based information and also spatialising and locating search queries. This is what Gordon and De Souza e Silva refer to as the "re-territorialisation" of space because "we are where our devices are."[39] Instead of a non-specificity of placeness, smartphones marked what Gerard Goggin and Larissa Hjorth have termed "the locational turn in mobile technology."[40]

While location has come to signal precision of place—a specific site of being—location is also an indefinite concept of relating to space and place; at

once informative of, transcended by, or used interchangeably with presence and positionality. As Adriana de Souza e Silva and Jordan Frith argue, location in the context of locative media like digital maps, and beyond, exists in a tension between "fixed geographical coordinates" and "complex multi-faceted identities that expand and shift according to the information ascribed to them."[41] Indeed, Anne Galloway and Matthew Ward, and Minna Tarkka, among others, have all argued that location and location awareness are active and dynamic rather than a static point on a map that folds in time, infrastructural arrangements, and sensory perceptions.[42]

Beyond moments of receiving location-aware information, using mobile phones also engages location-specific processes of sorting and selecting. As Jordan Frith and Didem Özkul argue mobile technologies like smartphones, as well as Walkmans, iPods, and barcodes, can be a means to "negotiate a certain type of control over their spatial experience."[43] Pinning locations from one's holiday abroad, sharing location details for safety, or triangulating location tags on photos to jog a memory, are just some of the ways by which, to adopt Germaine Halegoua's term, we "re-place" space through Google Maps.[44] Here re-placement is not a takeover of spatial sensemaking, but as Halegoua writes, "re-placing is a set of practices that manage the seemingly fragmented and overwhelming conditions that the networked urban subject experiences and routinely acts within, then re-embeds these conditions within meaningful spatial and temporary contexts."[45] Or, to put it another way, location awareness does not evaporate when one uses a mobile map, but is augmented, annotated, or even affirmed. In this way, using mobile maps like Google Maps is not a wholesale surrender of individual awareness but is, what Sarah Barns identifies as selective and iterative engagement with space.[46] Digital mapping brings to the fore the elasticity of location awareness. Indeed, location awareness is expansive as it binds together the fragments of experiences of moving through the world.

We all carry with us personal location awareness, activated in mundane and urgent ways that put us in place and ensure safe passage. In many cases, this location awareness is tied not only to navigating space but also to navigating spatialised relations to hegemonic forms of power, or what Doreen Massy terms power geometries.[47] Power geometries show how power manifests spatially, through who claims a right to space, who is "out of place," and who assumes safety in that space. These power differentials reflect the structures and systems of white, patriarchal heteronormativity. Spaces like cities are sites that Sarah Elwood dubs "divisive socio-spatialities" which she argues become amplified in increasingly mediated spaces premised on white supremacy, settler coloniality, and heteronormativity.[48] These translate to other forms of location awareness, like that described by Rinaldo Walcott in his account of walking through Toronto as a queer Black man and the anticipations of being read as "out of place" by police.[49] It can also be found in Isabel Waidner's *Sterling Karat Gold* where the title character, Sterling, practices a routine scanning of the area around their estate in Camden to

clock that which threatens their passage as a queer, non-binary person. And, as Waidner's story imparts, this location awareness can also be knowing where care is, where the refuge is, and where one can find solidarity in resistance.[50]

Location awareness is a relational and responsive means of moving through space. It is affective, embodied and tied to survival. Location awareness is not simply an affordance of the map, it is its fault lines that serve a presumed standard experience of space. The types of location awareness like that of Walcott and Waidner dislodge the worry of losing a sense of direction to Google Maps. Location awareness is also the way to contend with the gated-off fantasies of public good, self-sufficiency, spatial legibility, and accurate representation that Google's brand of location awareness perpetuates.

Programming Location Awareness

Google Maps' locational prowess and its rise as what technology writer Andrew Hawkins declares is "go-to navigational tool of our time" was not inevitable;[51] but, as Scott McQuire, Rowen Wilken, Mark Graham and Martin Dittus have respectively shown is the result of large-scale investments in the development and acquisition of technologies, processes, and protocols of translating space to data.[52] The product of these ventures is an expansive database of geographic and location-based information, from satellite imagery to street maps, to 360-degree panoramic views of Street View images, real-time traffic updates, and route planning for pedestrian, car, bicycle, and public transportation read through the kaleidoscope of Google Maps' location awareness.

As Scott McQuire observes, "when Google Maps began in 2005, Google was a late entrant to the field."[53] Other forms of early personal digital navigation are in the form of MapQuest (owned by AOL), Yahoo! Maps, and Windows Live Local (the precursor to Bing Maps). These maps came with the novelty of turn-by-turn directions provided as text and symbols beside the graphical map, marking an easy visual reference for each point in pathway decision-making. Additionally, one could print off the directions and bring them along with them—to carry their individualised route while in transit, prototyping what would become normalised with the advent of the mobile digital map.

Under the direction of Bret Taylor, Maps' co-creator, Google Maps was to reorient the map around one's ever-changing position rather than a from a single, static place, tailored to an information search within a specific moment.[54] In 2003, Taylor managed an early Google project known as "Search by Location" that "finds" a location with the entry of a ZIP code and a keyword. While this search system was an early and albeit less functional Google Maps (one that Taylor describes as "practically a useless project"[55]) what was key to Search by Location was the centrality of location paired with search—and imagining of the world as searchable. The idea was that the map should not be static, like the traditional paper map or the printed

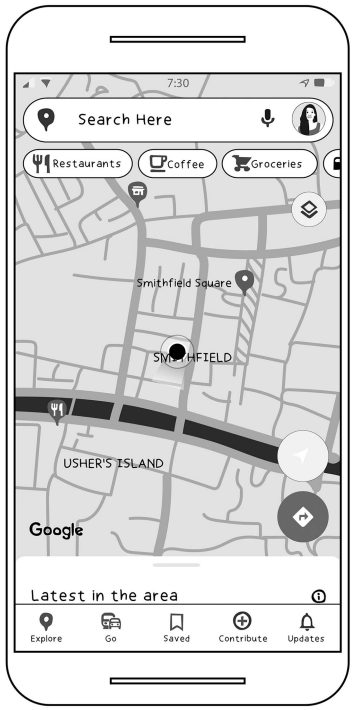

Figure 1.2 Illustration of Google Maps' interface. Illustration by Colin Medley.

off directions—but dynamic. That map was to be interactive in content and form, addaptive to adding new information, zoomable, rotatable, and endlessly scrollable. This dynamic interaction with the map marks a shift away from the map as page and towards the vector map and its aggregated tiles that make the representation of space responsive and searchable. How one interacted with the map and *saw themselves on the map* mattered. (Figure 1.2).

To achieve this vision, Google acquired several other geomedia startups, along with their developers—including Brian McClendon, Lars and Jens Rasmussen and Mark Grady—to lead the development team of Google Maps.[56] Indeed, many of the features and affordances synonymous with the Google Maps of today were developed "out-of-house" and acquired by Google. Companies such as Where2Technoglies, Keyhole Corp, Zipdash, and SkyBox Imaging became enmeshed into the Google Maps interface.[57] Part of Google's manoeuvring was to make these not only available to subscribers of previous platforms but to the public through the desktop for free.[58] Google's acquisition of companies such as Keyhole seemed to grant access to spatial data and representation, and the location awareness that it afforded.

Keyhole's main product was *Earth Viewer*, a digital mapping database of satellite images. Keyhole's vector organisation of its locational data, portioned

out via glimpses through the door (as its company name suggests), was part of how Google Maps came to claim to complete coverage.[59] Skybox was an interface-scrolling technology. Skybox helps Google standardise the experience of using the digital map—what it felt like to smoothly move through the earth. Together, Google could stick images together, enabling them to seamlessly be scrolled through and zoomed in and out of, turning the static digital map into one that is easily moved through. It was responsive and adaptive, enabling a sense of boundless "exploration" with the scroll function.[60] ZipDash uses GPS to track vehicles and analyze speed and traffic conditions. Initially it was developed for highways in Los Angeles, San Diego, Seattle, San Francisco, and Phoenix.[61] ZipDash was a peer-to-peer network for sharing traffic conditions, reflective of the age of other systems like Napster and Kazaa, but tied to "wireless location-specific information. Using cellphones to deliver information and advertising to users in specific locations."[62] Location awareness was enacted through this gesture of pinching and scrolling, zooming in, total views, and ability to know the best route. Keyhole, Skybox, ZipDash, among other spatial computing programmes became part of how Google Maps platform that gave *everyone* access to *everywhere*—thus entrenching its status as a "public" resource as well as helping to standardised expectations for what looking at a digital map looked and felt like, combining the visual language of vectors with a responsive interface and the endless scroll.

Another key part of Google's mapping trajectory was to build a searchable representation of the world. In 2010, Google integrated Google Maps into its search engine meaning that whatever was entered into the Google search engine was visually located with an embedded map at the top of the search results,[63] providing a direct link to the Google Maps application or webpage. According to Joel Kalmanowicz, Project Manager at Google Maps, one in every five searches is location related; and on mobile, almost one in every three searches is location related.[64] Location awareness was a process of information sorting and data organisation, mediated by information about space.

More than just a map, it could be a platform for other services that require location-based information. Soon after its launch in 2005, Google released Google Maps Application Programming Interface (Google Maps API) as a free model for software and platforms to use. Google Maps' API enabled people, most notably businesses, to design maps using Google Maps' template, and personalise them to their respective personal and commercial interests.[65] This (initially) "free" API meant that it was easy to access. It quickly became the go-to mapping software for people and businesses, effectively universalising digital mapping protocols and means by which location and data were connected.[66]

Google Maps' API was part of the democratisation of the geolocation industry which was until then specialised in geographic research and for the military. Gordon and de Souza e Silva write that Google's API meant that "the specialised domain of the GIS programmers became the domain of

everyday users."[67] And, indeed, Google Maps' open-source API became the most used mapping API. And while this idea of "the nonexpert" mapping became entangled with the democratising of the map, Jean-Christophe Plantin identifies that it is this seemingly free and easy-to-use API that facilitated the centralisation of Google Maps' infrastructure and effectively the enclosure of its systems.[68] The Google Maps API extends the reach of Google through its base map and its related software. This is part of how the map becomes woven into other platforms, extending the interface of the map to other applications such as car-sharing platforms, delivery services, and real estate sites.[69]

Google frames location awareness beyond simply locating and being located through its map. Location awareness is part of the democratisation narrative of digital maps, with *you* at the centre.[70] Google Maps stakes its claims to a democratic map through claims to access and personalisation—the promise that everyone can use the map anywhere in the world.[71] And even better, one doesn't have to find oneself on the map to begin navigation (*you are here*), the map identifies that location and tailors the map accordingly. Google's My Maps feature, according to Google Maps' About Page, helps users "easily create custom maps with the places that matter to you."[72] The democratic map is made democratic via your position and interests. Moreover, Google Maps offers interaction and participation through its Local Guides program, adding reviews and verifying information *local to you* such as store hours and business closures. The map situates representation of the world as an activation of territory rather than a representation.[73]

Reorientating Location Awareness

Beyond a technical function, Google's promise of location awareness is a cultural claim encoded with imaginaries about space and mapping. These include the object-based imaginaries about the map's operations—the proficiencies of map production, the accuracy of the image itself, and the experience of reading and applying the maps' directional acumen—as well as the fantasies of world buildings, including the promise of the democratisation of cartography, the ease and fluency of finding one's way, and the prowess to build a complete map of the world. Crucially, imaginaries are more than benign ideas but active modes of organising and directing in the world, baked into sociotechnical systems like Google Maps. Claudia Strauss argues that imaginaries are not necessarily themselves common social practices and ideas but "*make possible* common practices" as well as "effect a shared sense of legitimacy" within those practices.[74] The project of location awareness is a project that assumes a total map is possible but also assumes that one can invest in and claim space through the map.

According to Lucy Suchman, imaginaries are an active part of both designing and using technologies because they are always informing and mediating the relationship between what a technology presents as doing and

what it does.[75] It subsumes information and fills a vacuum of available information. For example, Taina Bucher uses "algorithmic imaginaries" as a framework for examining the algorithmic cultures of Facebook—ways of thinking about how algorithms are popularly conceived in the absence of concrete, publicly available, and broadly understandable information on algorithms.[76] Understanding algorithms as a cultural artefact rather than a purely technical one means being attuned to these affective dimensions of algorithms—how they are talked about, promoted, *imagined*. Imaginaries follow the same bearings on the map.

Imaginaries can be restrictive and binding, as much as they can be expansive and elastic. Benedict Anderson's concept of imagined community identifies how imaginaries structure values of the collective that might undermine a sense of collectivity by stratifying who and what belongs to "the community."[77] So while imaginaries might appear to be held in common, they also structure and inform the cleavages of social life, becoming a type of implicit cultural model of the world. In this sense, imaginaries are operatative and affective. To take up Lauren Berlant, imaginaries ensare a politics of publicness, as both the *feeling* of connection as well as the *unfeeling* of normativities.[78] In this sense imaginaries both prevent and produce deliberations towards a just future or "a collectively invested form of life."[79]

Lilly Irani and Ruha Benjamin have respectively critiqued the imaginary of *innovation* for its laminations as an inevitable driving force set on improving life. Irani demonstrates how fantasies of innovation as collective good is a conceit that, in turn, renders necessary the exploitation of a globalised workforce.[80] Also in critique of inflated innovation, Benjamin has shown how chasing the new and the innovative to manage social ills becomes an easy way to overlook the structural racism at the helm of these systems.[81] The result is an uneven distribution of innovation's so-called benefits yet a blanket assertion that innovation is a wholesale good.

Turning to imaginaries of spatial technologies, Lisa Nakamura dispels the fantasy that spatial and immersive technologies enable new modes of awareness and orientation.[82] For example, Nakamura questions Meta's vision that virtual reality headsets are a technology capable of "promoting empathy" such as showcasing the destruction of Hurricane Maria in Puerto Rico to people who did not experience the natural disaster. Nakamura shows that this use of VR further instils distance from the remote "other" and turns social urgency and the geopolitics of aid into spectacle. Nakamura demonstrates how such VR technologies are used to collapse space, and doing so, make new claims on knowing the world. In other words, imaginaries organise and orient who belongs. Imaginaries can structure how one relates to or feels about technology; and imaginaries also conceal the social arrangements supporting technologies and their systems.

Beyond the technological imaginary, imaginaries inform relations to space and thoughts about space. These form what Doreen Massey terms the "geographical imagination" or the implicit and explicit conceptualisations of

space. In *World City*, Massey demonstrates how an imaginary of London as a financial centre, where wealth is concentrated, often erases the lived reality of being poor in the city. These imaginaries shape assumptions about what engagement with space looks and feels like. These "implicit geographies" of place are ultimately parts that are "made to stand in for the whole."[83] Geographic imaginaries, like technological imaginaries, organise and orient—they classify and categorise space as well as assume some trajectories are inevitable.

For Sara Ahmed, orientations can be a lens through which to consider the relation between spatial experiences and power since orientation shapes the relationship between space and action. Ahmed takes up orientation as a type of "queering of phenomenology" or a means to think through how bodies are "straightened" and "directed" by constructed norms and pervasive spatial logics but also how resistance to these is an orientation.[84] Ahmed writes that orientations "shape not only how we inhabit space but how we apprehend the world of shared inhabitancies, as well as 'who' or 'what' we direct our attention toward."[85] Combined, orientations are the actions and phenomena of spatial imaginaries, of being in and moving through, while the organisations become the geographic ontologies of space, the contours, the boundaries, and the openings. Location awareness operates within this territory.

Both geographies and orientation get at the question of who and what is at the centre of Google Maps' spatial imaginaries and claims to organise spatial information to make it understandable and accessible.[86] This book asks: what are the orientations and geographies baked into this claim and the relations to space they forestall and foment? And while this book mostly uses the language of Google Maps to speak about digital mapping projects, this is not meant to be at the exclusion of other geo-related Google products like Google Maps and Google Earth, or other geomedia from Apple Maps to OpenStreetMaps. While they have different uses, different functions, and different looks, there is a through-line of presumed global totality. The goal of the book is to challenge the claims of objectivity and universalism of spatial representation while considering the prototyping and spatial conditions that make these claims seem possible. The automation of spatial decision-making is an issue not of getting lost but of losing the organisation of space to a private, consumption and ownership model of big tech. Google Maps positions computational location awareness as the organising principle of the local rather than the local—a site of situated knowledge—as the organising principle of location awareness. These reveal spatial formations that happen out of sight but are practised in the everyday experiences of moving through spaces.

The Art of Location Awareness

The ideas I explore in this book developed from an arts-based research project about wayfinding inspired by a work by artist Stanley Brouwn titled

this way brouwn.[87] In 1961, Brouwn walked the streets of Amsterdam, approaching other pedestrians and asking them for directions to nearby sites such as the centrally located Dam Square or City Hall. He offered the helpful stranger a piece of paper and a pen for them to draw their spatial instructions. Brouwn performed the actions of *this way brouwn* over and over—quietly accumulating drawings of directions.

In *this way brouwn*, Brouwn's material is space—the tuning into space and the experience moving through the city's forms and contours. Brouwn's interruptive action has the imaginative possibility of depicting a moment when one locates oneself and communicates that sense of location through drawing and narration. Looking at the markings now, they appear as a series of lines, nodes, and incomprehensible scribbles. Each drawing represented a set of directions, with their own internal orientations and geographies, imagined in a spontaneous exchange. Put together, they are a spatial record of how to get from A to B in a complex, information-rich environment. These rudimentary maps are not for perfect navigation or even for being a comprehensive representation of space. While Brouwn exhibited this work and published a selection of maps as part of a book, these drawings of space do not come together to compose a total map of Amsterdam; but, instead, by often repeating routes, Brouwn's visual transcriptions destabilise the idea of a total space if not the simple futility of defining a single (or optimal) route through space.

Brouwn's art plays with the possibility of art being woven into the commonplace, like asking for directions. Tomas Schmitt calls Brouwn's work a set of "real actions" that reflect ordinary encounters,[88] while curator Claire Lehmann calls them "quiet actions that are not necessarily legible as art to an onlooker."[89] As a piece of performance art, it is relatively *quiet*, demanding little attention; but nevertheless, it is an interruption of the streets' taken for granted flows. As a series of objects—the drawings—they are curious and evocative but relatively unusable as a map or re-performable as a set of directions beyond the moment of exchange. Instead, the drawing leaves one wondering: Where is the starting point? How does one decipher the lines? What does that x represent? Instead, the site-specificity of each encounter serves as a reminder of the mediated experiences of the world in a movement that both abstracts and deeply personalises experiences of the surround.

Over 50 years after Brouwn began performing *this way brouwn*, a project he performed on and off until his death in 2017, I reactivated the performance. I describe this project in the opening lines of the chapter. I start with a similar act of asking for directions in London, Amsterdam, New York, and Toronto. I requested people draw directions for me using the paper and pen I provided. In my version of *this way brouwn*, I collected hundreds of drawings from these moments of spontaneous spatial sense-making and on-the-spot navigation.

Like in *this way brouwn*, these encounters were deliberately subtle situations, meant as a type of disappearing event. In some sense, they echo the work of

Guy Debord and the Situationists International who sought to move through the world with the intention of awareness, engaging with the density and multiplicity of spatial encounters.[90] However, the flaneur is also an unreliable narrator, as Fran Tonkiss argues, "the flaneur in the nineteenth century linked forms of spatial practice with a certain kind of masculine subjectivity."[91] This subjectivity was effectively a masculine entitlement to see everything without seeming out of place for looking. In response, I temper the flaneur with the irreverence of what Robert Filliou terms good-for-nothingness to acknowledge that limitations and absurdity of mapping as a means to disrupt an instrumentalisation of the map.[92] The maps are, for the most part, not transferrable beyond the encounter nor are they even transposable in space. Instead, they make sense in tandem with the experience of asking for directions and watching the abstraction of space unfold in a drawing. Nor, are the maps the only way to get to the destination, nor promise to be the best or the fastest. Often, I was told, this route was the clearest to explain or the easiest to follow. Sometimes, the drawings depicted what I found to be *the wrong* route or details might be confused and disorienting.

At the same time, I was becoming a repository for people's confessions about using digital maps like Google Maps. People would speak to their use of Google Maps followed up by a passing "shame on me, I should know," or sometimes there was apologising for using Google Maps with statements such as, "sorry, I have to use Google Maps, it is easier this way." Or there were moments of "thank goodness for Google" since Google knew the way or "do you not have Google Maps?" as a comment about interrupting their day. In other words, the stuff around the drawings was just as fascinating as the drawings themselves. It was the fragments and idiosyncrasies that both made the exchanges memorable and animated the spaces. These events also destabilised the idea of a complete view of the city even mediated via Google's directions. These directions improvised a reading of space that interpreted and reinterpreted Google Maps or parsed out aspects of Google's directions while devising a different reading of space on top of those directions (Figure 1.3).

The drawings and encounters initiated a line of questioning I build upon throughout this book. However, the research itself is limited to a specific cultural context: four Euro-American cities that are socially and culturally diverse while also deeply implicated in colonialism and its ongoing violence. These cities do not represent a universal wayfinding experience even though they are often cities where Google Maps tests its products (such as Immerisve View in London). Additionally, the perceptions, directions, and gestures that manifest in the city streets cannot be adequately captured in a picture, nor can the meaning of their movements be circumscribed in a text. Google Maps is not available everywhere and the full suite of Google Maps' affordances and products is only available in a small percentage of cities, among which these four cities belong. My focus on these cities is therefore profoundly limited in a way that reflects the bias inherent in Google Maps' global mapping projects: these four cities are centres of global economic power; they

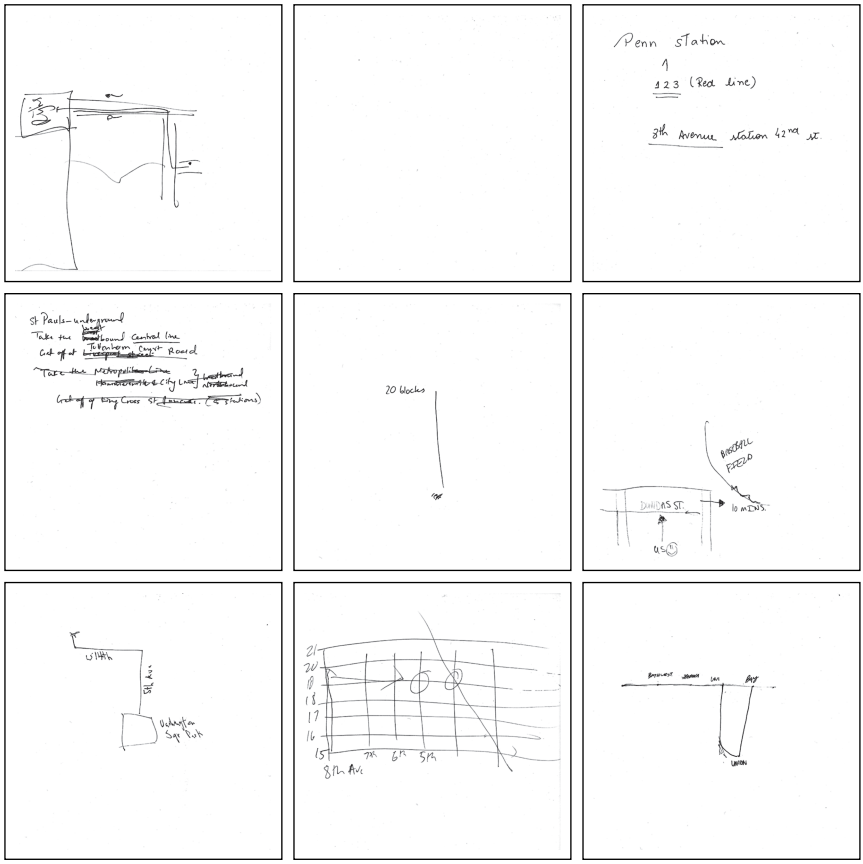

Figure 1.3 A selection of nine drawn directions collected by the author from Amsterdam, London, New York City, and Toronto.

are hubs of both digital and physical infrastructure; they privilege navigation by English speakers. This book highlights how these kinds of spaces, which have been built to uphold the dominance of whiteness and "the West," have come to serve as models for "the city" within Google Maps' infrastructure. London, New York, Toronto, and Amsterdam are often painted as global or multicultural cities, a discursive framing that optimises difference and flattens the experiences of the people who live there. It also obscures the barriers to access these cities put in place that disproportionally harm racialised, trans, queer, poor, and other marginalised people. The complexities of these experiences and how they are reflected and refracted through wayfinding strategies are not addressed in the primary data collected for this book, but critical race, queer, and feminist theories play a grounding role in the book's intervention in Google's spatial imaginaries. Parsing out the discourses and

practices of Google Maps in relation to these moments of asking for directions is a means to plot out the geographies and orientations baked into its location awareness. It calls to mind the productive tensions of location awareness. While the act of asking for directions is limited, the residual encounters offer an opening to question Google's own incomplete and fragmentary representation.

Location awareness becomes the mechanism through which Google Maps diffuses its global mapping project, a benign consciousness set against the well-known exclusions in the act of mapping. While there are records of Google's corporate acquisitions process of buying and developing tools in the ongoing process of building a universal map, the nuts and bolts of the process are still mostly opaque. Google Maps provides little insight into how its algorithms work to search for directions and plan routes.[93] Google's safeguarding of its proprietary and commercial algorithms has been widely criticised for the ways by which the secrecy naturalises its information control and what it makes invisible in the process.[94] Google obscures its processes of mapping—like its algorithmic search logics—to seem naturalised and reified,[95] often erasing the human labour,[96] and the environmental footprint of Google's social and material mechanisms.[97] Instead, Google asserts its goals through carefully controlled online declarations, blackboxing how their systems work and obscuring lines of ownership through restructuring.[98] There is still much to glean from the little information that is shared and the discourses that help shape the so-called black box.[99] And there are many studies that follow this route of analysis through Google's limited public-facing records that investigate forms of "surveillance capitalism";[100] the perpetuation of oppressive and racist systems through algorithmic logics;[101] the reification of class divides perpetuated by Google's now-defunct Google Glass initiative;[102] and, Google's proprietary logic that will map public infrastructures like roads while also concealing their own data infrastructures like data centres. These all point to the ways that dissecting the actual code is not the only way to critique Google Maps—their discourses and their operations are also revealing.

Interrogating these imaginaries and the ontologies they reify is a practice reflected in Karin Fast and Pablo Abend's methodology of geomediatisation realism. For Fast and Abend, geomediatisation realism "entails the call to *de-center* the media by looking at the practices and operations surrounding geomedia rather than concentrating on the properties or functionalities of a set of discrete objects or technologies."[103] So while Google might not share the coding of their map, it reveals values encoded in its map and mapping software in other ways. The language and rhetoric Google and Google Maps employ are constituents of how the map presents and is present in the world. These discursive manoeuvres are built into and made visible through the Google Maps application interface, in the Google Maps "About" webpage, its official blog The Keyword, where product managers provide product updates, and in Google's product developers' presentations at their annual product conference, Google I/O. The rhetorical manoeuvres enmesh

mundane forms of wayfinding in a technological imaginary of enhanced everyday life for an idealised "user" that helps position Google Maps as a public service and not a commercial platform, how it helps make space easy to understand and easy to navigate in its map flexibility, and how it produces reliable ordering of place. The maps promise to be an objective reference for public service, a neutral tool that makes space legible, a platform for a self-sufficient user who can explore anywhere, and an adaptable map, amenable to any technical glitches; but these are plaited with mapping practices that make the promises possible or at least believable.

Location Awareness in the Age of Google Maps

Location Awareness in the Age of Google Maps proposes a critical language for discussing location awareness without lamenting a sense of direction surrendered to Google Maps. The chapters of this book run through four registers of Google Maps' location awareness directive: public good, self-sufficiency, legibility, and error. The first two chapters consider the *geographies* of a location awareness mediated by Google Maps, considering how publicness and individual claims to space are organised within Google Maps' visions of totality. The next two chapters take on the question of legibility and error to consider how Google's location awareness orients what a readable and precise representation of space looks and feels like, and the double bind of being on the map. Each chapter opens with a vignette from my experience of asking for directions. The retelling of these encounters anchors a starting point for the concept.

Chapter 2, "Geographies of Public Good," examines how Google Maps leverages itself as a public mapping service through its promise of a universal map that organises what counts as public while silmultaneously grafting onto public resources. The chapter begins by establishing how Google promises to map the world through its project Ground Truth. Ground Truth orchestrates multiple types of externally and internally collected mapping data from sources such as satellites, government survey maps, as well as Google's ambitious Street View Project. Street View is a central part of how Google builds out its map as well as how it performs and arranges publicness.[104] This chapter digs into one of Street View's public mapping projects facilitated through its partnership with Aclima, an air pollution sensor manufacturer based in San Francisco, California. In this project, Google Maps attaches pollution sensors to Google's Street View cars for a street-by-street picture of the city's air quality. This initiative, titled Project Air View, is used to "measure" and "analyse" as well as visualise these values on Google's Environmental Insights Explorer dashboard. Google plugs this data into Google Maps navigation function to suggest "cleaner" routes for travel. However, a closer visual analysis of Google's air quality dashboards for the cities of Oakland, CA and Houston, TX reveal that Google's data reinforce segregated ordering of place based on techniques of digital redlining. The

comparison of maps demonstrates how Project Air View's maps reproduce racist measurements of "risk" which serve to further entrench discriminatory organisation of cities, effectively organising who is included in calls to publicness. Google's public calls for sustainability reflect what Berlant terms "individual acts of consumption and accumulation,"[105] and uphold what Max Liboiron argues are the discriminatory goals of pollution.[106]

From there the chapter considers Google's organisation of publicness at the site of the data centre. Here the chapter digs into Google practices of what Shannon Mattern terms a "grafting" onto other public resources.[107] The data centre manifests this tension in the imaginary of Google as a public resource—it organises which spaces are helped and harmed while it takes from the public and it calls for the public to invest in them. The limitations of Google Maps' publicness are animated through how the data centre exists on the maps and the ways ordinary people try to publicly talk back to Google Maps via the Google review system. In closing the chapter, I review how data centres *on* Google Maps become spaces to review Google *through* Google Maps—an ouroboros of public review. It looks at the ways that location awareness is both a tactic of sharing information and also a method of obscurement that is about hiding which areas count and which ones do not, according to the terms of the map.

Chapter 3, "Geographies of Self-Sufficiency," moves from public service to individual acumen mediated through Google Maps' location awareness. In this sense, location awareness becomes a means to organise space through individual claims to space. This chapter drills into exploring and experiencing the central promises of the map. Exploration and experience operate as technological prerogatives that absorb space in the name of control. This chapter considers how in organising space around the explorer prototype, Google Maps extends a colonial sanctioning of space. Here the chapter draws parallels with Jas Rault's analysis of *transparency* as communication technologies that leverage promises of accessing the truth in the name of entrenched colonial administration.[108] Rault's framework re-orients *exploration* as a tool of settler possession and entitlement. In this context, simultaneous to the promise of exploration is ongoing negotiations of space based on what Garnette Cadogan describes as personal and political "cognitive maps of safety and danger" organised around calculations and geographies of risk.[109] Google's coded depoliticisation of spatial mobility (it's for everyone! To go anywhere!) reifies mobility as a mode of power and exploration as the means to attain it. Building a whole mapping infrastructure around the positionality of unbridled access erases so many experiences and reinforces unjust enclosures of space.

Through an examination of how Google situates itself in a specific trajectory of mapping, to how it upholds a geography of entitlement to everywhere without considering the social and structural forces that make space differentially available and unavailable. Through affordances of mapping businesses

and best experiences, the map orders space along a single axis of consumption. The chapter closes with an examination of interventions into Google's mapping. What these critical modes of access demonstrate are the hard limits to Google Maps' view of "the universal" and how geographically insufficient Google Maps is in the face of all the radical spatial practices beyond the map. It questions a location awareness premised on a self-sufficient prototype.

Chapter 4, "Orientations of Legibility," is an analysis of how Google Maps directs an imagination of space as a simple surface to be read and managed. The chapter traces some of the cracks in the Google Maps edifice of legibility by first considering and how mapping helps to stabilise and coalesce meaning. From there it moves to the project of legibility, which is a project of making space *appear* governable. The chapter considers the process of taming spaces in the context of other mapping precedents from the London Tube Map to Kevin Lynch's project of prototyping the imageable city.[110] Google Maps continues these processes through its project of location awareness that works to both template and contain space, subsuming the fantasies of what makes a city legible.

This chapter locates how the ease of navigation is wrapped up into these systems of abstraction in the name of legibility. It considers the tension of fixity and flux within Google's templating of legibility. Fixity draws on what Didem Özkul theorises as the imposition of the algorithmic fix,[111] while flux reflects what Nanna Verhoeff terms the "performative cartography" of navigating with screen-based interfaces that complicate the "visual regimes" of navigation.[112] The chapter considers this tension in light of a project based on asking directions and the types of spatial scores produced during these encounters. It then moves to Google's latest project "Immersive View" and its attempt to model ways of reading space whilst claiming new modes of legibility. In drawing attention to the punctures in Google legibility, the goal of this chapter is not to fill the holes but instead to stand in the fractured fantasy that space can be held.

Chapter 5, "Orientations of Error," examines Google Maps' conditions of accurate spatial representation based on what is present on and what is absent from the map. The chapter looks at erasure from the map. In 2008, Buffalo, New York residents noticed that Google Maps labelled their area Medical Park, referencing a series of development projects instead of their community.[113] It considers how Google manages presence and absence from the map and how these constitute mapping error and accuracy. Looking at Google Maps as a form of establishing which neighbourhoods count and which ones don't, this chapter considers how the slippery definitions of absence and presence, and reflects what Anna Lauren Hoffmann terms the "discursive violence"[114] of data inclusion tactics that are entangled in systems of digital coloniality and imperialist capitalism.[115]

The chapter closes with Google's formalised projects of inclusion, namely their project of Street View mapping the favelas of Brazil and their Plus Codes project, Google Maps' ongoing practice of spatial data collection that

"gives addresses" to those who "don't have an address."[116] Drawing on the work of Toks Dele Oyedemi, the chapter closes with a reflecton on "digital inclusion" in the context of data colonialism.[117] I consider how Plus Codes centralises Google Maps as a core infrastructure of capital flows by giving people addresses that are only legible to the Google Maps platform. to help facilitate the expansion of the Google Maps project. Through an examination of Google's Plus Codes projects, this chapter considers the hidden costs of data inclusion and data legibility tactics entangled in systems of digital coloniality and imperialist capitalism.[118]

This book navigates the frictions of Google's mapping project delivered through promises of seamless location awareness. It considers the unequal distributions of mobility and fixity, public good and risky publics, and missed turns and missing places. Google Maps does more than just locate spatial information but *organises* location awareness as a standard rather than an ever-changing relation to space. As this book shows, the stakes of using Google Maps—and the stakes of Google Maps becoming such a dominant navigational tool—are not just about getting lost and being found. Rather, the stakes are about how Google Maps allocates value to space, making claims to it, in the name of constructing its universal map.

Google Maps' promises of publicness, legibility, self-sufficiency, and accuracy operate through stratification in the name of location awareness. Rather than a universal map, Google Maps builds what Leanne Betasamosake Simpson calls "incomplete worlds on incomplete knowledge."[119] The consequence, Simpson writes, is that "we risk relocating the very oppressions we are trying to liberate ourselves from."[120] It is not that a sense of direction is distorted via the lens of Google Maps, but that that Google Maps' location awareness is a distortion of publicness, access, legibility, and precision. But set against Google's information project of totalising location awareness are people refusing this universalising vision in profound and mundane ways, challenging Google Maps' renderings and positionings while also using Google according to one's own terms. This book sits in this tension in the name of expanding what location awareness in the age of Google Maps includes and what it takes for granted.

Notes

1 Noone, "Locating Embodied Forms," 635–644; Noone, "Navigating the Threshold." From the art project *From Here To*. For more, see: https://www.thereroutingproject.org/from-here-to-rebecca-noone.
2 Along with Professor James Spilker, Hugo Fruehauf, and Richard Schwartz. Parkinson also won the Marconi Prize, another prestigious award for engineering, in 2016.
3 Myers, "Bradford Parkinson"; Carey, "Stanford Engineer Bradford Parkinson"; Olson,"The 'Father of GPS.'"
4 For a history of GPS technology, see Paul E. Ceruzzi's *GPS* and J. Lee's Global Positioning/GPS entry in *International Encyclopedia on Human Geography*. See also Goodchild and Janelle, *Spatially Integrated Social Science*. For a feminist analysis

of the Geographic Information System see Kwan, "Feminist Visualization: Re-envisioning GIS."

5 Whipple, "GPS Creator Bradford Parkinson." See also Parkinson's discussion of how he "really doesn't like having his location tracked" in Olson, "The Father of GPS."
6 Whipple, "GPS Creator Bradford Parkinson."
7 Whipple, "GPS Creator Bradford Parkinson."
8 Carey, "Stanford Engineer Bradford Parkinson."
9 Chow, "Age of the World Target"; Parks and Kaplan, *Age of Drone Warfare*; Virilio, *War and Cinema*.
10 Kaplan, "Precision Targets," 693–713.
11 McQuire, "One Map," 150–165.
12 Graham and Dittus, *Geographies of Digital Exclusion: Data and Inequity.*
13 McQuire, "One Map," 154.
14 Madrigal, "How Google Builds ITS Maps."
15 This is elaborated on in Chapter 2 with a discussion of Google Maps' Project Ground Truth. Also see McQuire, "One Map"; and Madrigal, "How Google Builds Its Maps."
16 Harris, *End of Absence*.
17 Petrow, "I Was a GPS Zombie."
18 Petrow, "I Was a GPS Zombie."
19 Romm, "Using Google Maps."
20 Milner, "Death by GPS?"
21 Plantin, "Google Maps as Cartographic Infrastructure," 489–506; Plantin et al., "Infrastructure Studies Meets Platform Studies," 293–310.
22 Farman, *Mobile Interface Theory*; Farman, "Map Interfaces."
23 Farman, "Map Interfaces," 88; drawing on Casey, *Getting Back into Place,* 36–37.
24 Lloyd, *Information Literacy Landscapes*; Lloyd, "An Emerging Picture," 570–583.
25 Lloyd, *Information Literacy Landscapes.*
26 Verhoeff, *Mobile Screens,* 134.
27 Galloway, *The Interface Effect*.
28 Massey, *For Space*.
29 Massey, *World City,* 22.
30 Massey, *Space, Place, and Gender*, 1994; Massey, *For Space*.
31 Tonkiss, *Space, the City, and Social Theory,* 23.
32 McKittrick, *Demonic Grounds,* 60.
33 McKittrick, *Demonic Grounds.*
34 For more on how maps produce knowledge, see: Harley, *New Nature of Maps*; Drucker, *Graphesis*; Eades, *Maps and Memes*.
35 McCullough, "Urbanism of Locative Media," 26–29.
36 Goggin and Hjorth, *The Question of Mobile Media*, 3–8.
37 Gordon and de Souza e Silva, "Net Locality." See also de Souza e Silva and Frith, "Locative Mobile Social Networks," 485–505.
38 Gordon and de Souza e Silva, "Net Locality," 13, my emphasis.
39 Gordon and de Souza e Silva, "Net Locality," 2, my emphasis.
40 Goggin and Hjorth, *The Question of Mobile Media*, 3–8.
41 de Souza e Silva and Frith, *Mobile Interfaces in Public Spaces*, 10.
42 Galloway and Ward, "Locative Media;" Tarkka, "Labours of Location: Acting in the Pervasive Media Space."
43 Frith and Özkul, "Mobile Media beyond Mobile Phones," 294; drawing from Özkul, "Location as a Sense of Place," 2015.
44 Halegoua, *The Digital City.*

45 Halegoua, *The Digital City*, 6.
46 Barns, *Platform Urbanism*.
47 Massey, *Space, Place, and Gender*.
48 Elwood, "Digital Geographies," 221.
49 Walcott, *On Property*; Fiske, "Surveilling the City."
50 Waidner, *Sterling Karat Gold*.
51 Hawkins, "Deep Dive into Google Maps."
52 As argued in McQuire, "One Map" and *Geomedia*; Rowan Wilken, "The Business of Maps," and Graham and Dittus, Geographies of Digital Exclusion.
53 McQuire, "One Map," 154.
54 Gannes, "Ten Years of Google Maps, From Slashdot to Ground Truth: Ten episodes from the dawning days of Google Maps."
55 Bret Taylor Quoted in Gannes, "Ten Years of Google Maps."
56 Gentzel, Wimmer, and Schlagowski, "Doing Google Maps," 151–152.
57 Muehlenhaus, *Web Cartography*.
58 Cowley, "Google Snaps Up Keyhole," *InfoWorld*.
59 Google, "Keyhole Markup Language."
60 Muehlenhaus, *Web Cartography*; Presner, Shepard, and Kawano, *Hypercities*.
61 Chowdhry, "History of Google Acquisitions"; Wilken, "The Business of Maps."
62 John Markoff, "That's the Weather."
63 Graham and Dittus, *Geographies of Digital Exclusion*.
64 Joël Kalmanowicz on Google for Developers, "Google Maps APIs."
65 Presner, Shepard, and Kawano, *Hypercities*.
66 Graham and Dittus, *Data and Inequity*; McQuire, "One Map."
67 Gordon and de Souza e Silva, *Net Locality*, 20.
68 Plantin, "Google Maps as Cartographic Infrastructure."
69 Loukissas, *All Data Are Local*.
70 See also Presner, Shepard, and Kawano, *Hypercities*; Shekhar and Vold, "Geographic Information Systems," 91–125; Bray, *You Are Here*.
71 Thiagarajan and Akasaka, "Building a Map for Everyone."
72 Google Maps, "My Maps."
73 Kitchin et al., "Conceptualising Mapping," 6.
74 Strauss, "The Imaginary," 330.
75 Suchman, "Anthropological Relocations," 3.
76 Bucher, "The Algorithmic Imaginary," 39–40.
77 Anderson, *Imagined Communities*.
78 Berlant, *Cruel Optimism,* 11.
79 Berlant, *Cruel Optimism*, 11.
80 Irani, *Chasing Innovation*.
81 Benjamin, *Race After Technology*.
82 Nakamura, "Feeling Good About Feeling Bad," 47–64.
83 Massey, *World City*, 88.
84 Ahmed, *Queer Phenomenology*.
85 Ahmed, *Queer Phenomenology*, 3.
86 Reid, "How 15 Years of mapping the world makes Search better."
87 Brouwn, *This Way Brouwn*.
88 As quoted in van der Meijden, *This Way Bruown*, 96.
89 Lehmann, "Stanley Brouwn," 60.
90 Debord, "Construction of Situations," 29–50; Debord, "One Step Back," 25–28.
91 Tonkiss, *Space, the City, and Social Theory*, 100.
92 Filliou, *Teaching and Learning*.
93 Vaidhyanathan, *The Googlization of Everything*; McQuire, *Geomedia*; Noble, *Algorithms of Oppression*.

94 Lucas D. Introna and Helen Nissenbaum. "Shaping the Web: Why the Politics of Search Engines Matters." : 169–185;
Noble, *Algorithms of Oppression*.; Vaidhyanathan, *The Googlization of Everything*.
95 Noble, *Algorithms of Oppression*.
96 Gillespie, *Custodians of the Internet.*
97 Holt and Vonderau, "Where the Internet Lives," 71–93.
98 Zuboff, *The Age of Surveillance Capitalism.*
99 Bucher, "The Algorithmic Imaginary," 30–44.
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102 Noble and Roberts, "Through Google-Colored Glass(es)," 187–212.
103 Fast and Abend, "Introduction to Geomedia Histories," 2387.
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106 Liboiron, *Pollution Is Colonialism*.
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108 Rault, "Window Walls and Other Tricks of Transparency."
109 Cadogan, "Black and blue."
110 Lynch, *Image of the City*.
111 Özkul, "Algorithmic Fix."
112 Verhoeff, *Mobile Screens*.
113 Dewey, "How Google's Bad Data Wiped a Neighborhood off the Map."
114 Hoffmann, "Terms of Inclusion."
115 Mervyn et al., "Digital Inclusion and Social Inclusion," 1086–1104; Milan and Treré, "Big Data," 319–335; Gangadharan, "Downside of Digital Inclusion," 597–615; Oyedemi, "Digital Coloniality," 329–343.
116 Google Maps, "Learn about Plus Codes."
117 Oyedemi, "Digital Coloniality and 'Next Billion Users.'"
118 Mervyn, Simon, and Allen, "Digital Inclusion and Social Inclusion" and Milan and Treré, "Big Data from the South(s)."
119 Simpson and Maynard, *Rehearsals for Living*, 292.
120 Simpson and Maynard, *Rehearsals for Living*, 292–293.