

Digital Geographies

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Abstract

Digital Geographies has emerged as a nascent but vibrant field of study within the discipline. This entry charts the recent emergence of the term, describes current work's focuses, and provides core topics likely to guide the field as it continues to grow and develop. The entry argues that influences on Digital Geographies work are from Critical GIS and Cartography, Science and Technology Studies, and Urban Data Science, among others. It highlights current practices and application areas like critical data studies, feminist digital geographies, political ecologies of the digital, work on smart cities and sensors, and algorithms and AI. Throughout, "the digital" is kept an open question, one to which a variety of approaches have produced and will continue to produce important research at the intersection of technology, society, environment, and self.

Keywords

algorithmic governance

Critical Cartography

critical data studies
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digital political ecologies
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Science and Technology Studies (STS)
smart cities/urbanism
sousveillance
“the digital”

Body text

1. Introduction

The second half of the 2010s has seen the rapid growth of work broadly conceived under the banner of ‘Digital Geographies.’ This nascent but remarkably impactful area explores the ways in which the ‘digital’ modulates and mediates space and place. Digital geography’s interrogations of spatial media have served as a productive analytical umbrella for the interdisciplinary conversations of critical data studies, algorithm studies, platform studies, media studies and internet studies. Concretely, Digital Geographies illuminates the socio-technical assemblages that comprise infrastructures and media such as smartphones, location-based services, GPS, the Internet of Things (IoT), autonomous vehicles, social media, autonomous aerial vehicles, and apps -- all of which intermediate space and time socially and materially. From the perspectives of practitioners, the technologies that produce new digital spaces simultaneously provide data brokers with a spatial framework for their data -- for example, to target a segmentation analysis - the process of dividing users into specific market segments via collected data, or to generate new insights into long-standing social and political problems. Despite the relatively recent declaration of the importance of Digital Geographies as an organizing and epistemological domain, it stems from a long history of work on GIS, spatial data infrastructures, web-mapping and spatial media. In particular, it builds from the work exploring the co-constitution of social, political, and economic milieu with software, code, data, algorithms, and related objects and artifacts. Digital Geographies draws these disparate concerns under a coherent umbrella in the form of multiple edited volumes and special issues, speciality/research groups, and broad disciplinary shifts. This entry covers some of the most important forerunners of Digital Geographies, current trends in Digital Geographies, and future directions that research in this area may go.

2. Early Engagements, Digital Predecessors

2.a. Critical GIS & Critical Cartography

Key continuities and ideas from Critical GIS and Critical Cartography persist in the ongoing development of Digital Geographies. On one level, many of the same researchers who previously identified with and published under those banners have now taken up the mantle of Digital

Geographies, for example Jack Gieseking and Jeremy Crampton have both published influential works of Critical Cartography and Digital Geographies. The reasons for this shift reflect both a new turn towards “the digital” within the discipline of geography and a continuation of long-standing engagements with the social, economic, and cultural implications of technologies and their associated milieus. Digital technologies and platforms have permeated both the practices of daily life and research. For example, smartphones have become nigh ubiquitous - current estimates suggest 2.71 billion devices in use globally, or approximately one smartphone for every three people alive. These devices offer a variety of services that include everything from wayfinding (Google Maps), to travel (Uber, Lyft), to the distribution of work (Fiverr), to the finding of romantic partners (Tinder, Grindr). Most significantly, their use has tied many of these activities to the creation, extraction, and interpretation of spatial information. To understand the significance of this shift, Digital Geographers have drawn from Critical GIS and Critical Cartography’s epistemological critiques of GIS and maps as well as politically-and-socially-engaged GIS practices such as those informed by feminist, anti-racist, queer, and heterodox political-economic theories. As an example, both Brian Harley’s work on deconstructing the map and Sarah Elwood’s work on participatory and community mapping are used by Matt Wilson in his discussion of the “new lines” researchers must draw to understand current technological and societal trends. Critical discourse has been forced to evolve as mapping technologies become more accessible and the web has allowed for crowdsourced mapping efforts, such as Open Street Map. These new platforms, technologies, and types of data produced allowed new actors to participate in mapping projects (both intentionally and as objects of surveillance through extracted social media and other data) and has required digital geographers to confront a host of new objects for study and new arenas for engagement. In these ways, the social and technical were, and remain, co-constitutive; an entangled milieu of affordances and foreclosures.

As the often uncomfortable and ill-defined intellectual trading zone between mainstream GIScience and critical human geography, Critical GIS has had a deep and lasting impact on the development of Digital Geographies’ core concerns. Within Critical GIS there has been a particularly salient set of feminist and anti-racist engagements with GIS - such as Nadine Schuurman and Geraldine Pratt’s work on transcending binaries of insider and outsider when critiquing GIS technologies. When taken with the emergence of new actors like indigenous populations mobilizing newly accessible techniques and technologies such as smartphones and open-source mapping software, there is now strong focus on how the digital is experienced outside of normative societal paradigms such as expert systems and colonial subjectivities. Debates around new technologies, normative societal paradigms, and (post)colonial subjectivities are prominent within data sovereignty research, an area that examines the entities that claim ownership over certain datasets like locations of indigenous burial grounds. This research further examines the scales and actors involved in data dissemination. Through these societal and technological changes, Critical GIS’s long-standing focus on the political-economic and social impacts of new GIS technologies has been opened to a broader range of considerations within Digital Geographies. No longer strictly focused on ‘GIS,’ Digital Geographies allows for researchers to study and participate in the range of means through which technologies enable, frame, mediate, and constrain actions and knowledges. Digital geographies encompasses, among other things, how youth populations use social media to form queer communities, how said communities are surveilled through social media platforms, and how algorithms interpret and target various data signifiers to construct a digital queer identity within a database.

Critical Cartography is a related set of critiques that emerged within Western institutions in the late 1980s that called into question the authority of the map and challenged what was and was not included in its production. Digital geographies extends beyond the cartographic specificities of this field to include objects of inquiry like database schema, software-sorted geographies, locational privacy, and digital economies, while retaining the shared interest in how new technologies represent people, places, knowledges, and objects within quantified regimes of data creation, dispossession, and analysis. Digital Geographies has been influenced by an ongoing, broader critique of the power, influence, and even the nature of digitization and the act of datafying. For example, critiques of the hermeneutic role maps play in classification have influenced work on data ontologies, while a shift towards thinking of maps as ontogenetic processes rather than static objects has similarly influenced work on the ways that information flows between bodies, databases, and algorithms within large scale digital infrastructure. Similarly, Digital Geographies explores the processes by which programming (and programmers) translate spatial 'things' into topological rulesets relying on big data, linked data, and new data structure standards.

2.b. Science and Technology Studies

Digital Geographies has reinvigorated interest in work under the broad umbrella of Science and Technology Studies (STS), and in particular, the work that mobilizes feminist STS insights. Such work has had a similar influence upon Critical GIS and Critical Cartography; however, within digital geographies it has been taken up in ways that expand STS's more longstanding concerns to include intersectional situated knowledges and positionalities. For one, digital geographies is well-attuned to the co-constitution of technology and society, a key STS insight. However, drawing on third-wave feminist interventions, digital geographies have had a keen interest in how overlapping identities and subjectivities produce new spaces and relationalities. Jack Gieseking's work has been formative for such ideas.

The second set of foundational overlaps with STS literature is in digital geographies' questioning the formation and circulation of truth statements. Digital geography, drawing again from critical GIS and critical cartography, frames this concern as one of *legitimacy*, and specifically, the different social and political relationalities that must be invoked or contested in order to establish the soundness of an idea or representation. This work ties together the questions raised by critical GIS and cartography scholars over the limits and power of representations in maps with questions and concerns over the representational power and accuracy of new forms of spatial data, such as social media posts. Much work in this area has acknowledged the notion that cartographic and quantitative forms of knowing and representing have greater sway in public policy and science circles. This is, of course, not natural or inevitable, but instead emerges from the particular role that science has played in Euro-American intellectual histories and geographies. Thus, digital geographies researches, critiques, and offers conceptual alternatives to how the proliferation of digital technologies has entailed re-asserting epistemological framings that privilege quantitative, cartographic, realist, and Cartesian epistemologies. For example, the participatory development of alternative database ontologies which take into consideration the complex relations a group may have with their environment are one output of such an approach.

Tying the previous two together, feminist engagements in STS have always critiqued the veneer of scientific/technical objectivity and neutrality. Such critiques from Judy Wajcman, Sandra Harding,

Sheila Jasanoff, and others, are widely engaged within the broader geographic discipline. Digital geography has picked up this thread in two ways. First, it advances these debates by drawing attention to Big Data, algorithmic governance, and related data practices that have emerged in the late 2000s and 2010s. The digital geographies literature shows that new socio-technical practices cannot be separated from the new spatialities that they co-constitute: spaces from which they emerge, spaces that they produce, spaces that transduce through technology, and so on. These new “code/spaces” are saturated with relations of power that frame both experiences of those spaces and the knowledges that are produced about/through/by them. Second, digital geographies locates the claims of objectivity and neutrality across a range of scales, from urban and national administration and politics, to the individual bodies that are produced in and through digital mediations of the social. These inherently spatial concerns link individuals and collectives with their “dividual” selves as abstracted through data, destabilizing claims to objectivity and neutrality. By “dividual” selves we mean the algorithmic production of representations of phenomena like people or places, based on digital traces like web surfing patterns, online purchase histories, locational logging, and detected modes of transportation through a place. In other words, invoking feminist notions of positionality, standpoint, and situatedness, work in digital geographies leverages the multiple scales at which epistemologies and lived experiences take shape.

2.c. Urban Data/Science & networked urbanism

New approaches to Urban Science and networked urbanism, including big data and the Internet of Things (IoT), have also contributed to Digital Geographies. This has occurred in at least two conceptual refrains. First, the past decade has seen the rise of a form of often-urban data science built upon sensors, algorithms, and visualizations. Data visualization and environmental modeling techniques, and their quantitative methodological corollaries, raise a tension between enthusiasts and critical scholars. Businesses, the popular press, and academics often focus on the beneficial aspects of these new forms of data acquisition, processing, and analysis - in the form of big data, artificial intelligence, and a host of other buzzwords. Second, other scholars direct critical attention towards the limits, biases, and ethical considerations they raise. This tension, while echoing earlier Critical GIS debates, differs in many ways: the tension here facilitates constructive conversations about what technologies can and should - or should not - do; it also involves multi-billion-dollar businesses collecting massive amounts of data about individuals and groups, for profit; and the actors involved in these tensions are often far more powerful than GIS companies were in the 1990s and early 2000s. From the critical scholarship standpoint, the processes around Urban Science and networked urbanism represent more pernicious interventions into lives and political economies.

Digital Geographies draws from all of these strands. As a loose orientation toward the sociotechnical systems constituted by and through the use of digital objects, Digital Geographies necessarily includes highly quantitative approaches of analyzing both people and environments through data. At the same time, drawing on its roots in Critical GIS, Critical Cartography, and feminist Science and Technology Studies, Digital Geographies is always-already a critique of said practices - a reflexive questioning that includes both theory and praxis.

3. Digital Geographies Now

Digital Geographies has emerged as a central focus for research into the ways that space and place mediate and are mediated by digital technologies. The nascent field has in a few short years generated officially recognized groups in both the Royal Geographical Society and the American Association of Geographers, and a host of articles referencing the concept. Regardless of what 'it' is at the moment, Digital Geographies is rapidly growing and sits at an important intersection of how theory and praxis, and empirics and critique, are always co-constitutive within the sociotechnical milieu. In this section, the entry briefly outlines current work in six areas wherein 'the digital' intersects with Geography: critical data studies, feminist digital geographies, political ecologies of the digital, smart cities and sensors, algorithms and artificial intelligence, and computational infrastructures. These are not a definitive list of research areas, but reflect some of the core questions that have come out of the various meetings, articles, and reports on Digital Geographies at this time.

3.a. Critical Data Studies, data colonialism, and data justice

Since at least Oscar H. Gandy Jr.'s 1993 *The Panoptic Sort: A Political Economy of Personal Information*, and arguably much before, there has been research into the ways in which data is created, extracted, and commodified (foundational works include Foucault's 1978 and 1979 lectures collected in *The Birth of Biopolitics*, Walter Benjamin's work on the telephone and radio, and Avita Ronell's *The Telephone Book*). At present, some of this research describes itself as Critical Data Studies, a term coined by Jim Thatcher and Craig Dalton in 2014. Since then, the term has instigated a language for critical engagements with the production, accumulation, and dispossession of data within modern digital systems.

The term *data colonialism* in particular is a useful metaphor recently developed to elucidate the dispossession that occurs between individuals and the data they generate through their everyday lives. In response to this process, researchers and activists have looked into ways to resist information commodification both by refusing to participate in data generating systems, and by attempting to reclaim possession of data once it has been created. They combine these efforts with the development of alternative processes for creating and using data. For example, activists have subverted surveillance systems, turned them back on those in power, and performed acts of sousveillance. Linnet Taylor's work in this area has focused on the creation and use of data for justice. While, like Digital Geographies, 'data justice' might be a difficult term to precisely define, Taylor, along with other scholars like Virginia Eubanks and her "Our Data Bodies" project, have begun to move Critical Data Studies from the realm of critique of systems towards their active contestation and resistance; the latter project builds around building community understanding for how data is currently collected, stored, and used to influence a variety of public programs, such as fair access to housing, while also offering community-driven alternatives to such systems..

3.b. Feminist Digital Geographies

Building on the theoretical foundations and momentum outlined above, explicitly *feminist* digital geographies are framing contemporary and future debates in the field. As described by Elwood and Leszczynski in an influential piece, this literature draws geographers' attention to issues of epistemology first and foremost - signalling the enduring influence of STS - but also to the production of bodies, subjectivities, normative frames of social and environmental interactions, and masculinities/femininities. A common approach questions the ontological stability of the body, in

favor of thinking through how bodies become legible to systems of techno-politics, and are re-drawn in the process. That is to say, the process of datafying bodies *produces* their loose digital corollary that is in turn acted upon by systems of governance and sociality. Feminist digital geographies is interested, then, in the ways phenomena are recorded in digital systems, and how that process transforms our knowledge of the phenomena. For example, in these formulations, the “gendering” of technology involves not just a process of embedding masculinist normativity -- as bifurcated from the “female” -- into technologies; it is instead re-thinking “masculinism” itself as ordering a diverse array of positionalities and epistemes that touch as well on racialization, classism, and heteronormativity.

Nascent feminist digital geography research has devoted significant attention to queer-ness: both the way we can understand digital geographies as queer, and the ways that queer subjectivities and epistemologies come into tension with digital infrastructures. For one, early engagements with the digital translated anew the Cartesian logics of mind/body into online/offline, digital/embodied binaries that queer studies is productively disrupting. More recently, contributions from queer theory accentuate the intersectionality, multiplicity, indeterminacy, and porosity of the digital. This, of course, has disparate implications for different kinds of bodies, subjectivities, and epistemologies, with queer individuals finding an uncomfortable yet productive analytic and political vehicle in the digital. On the one hand, digital systems often require objects’ categorical exclusivity and Cartesian legibility, qualities in tension with queer and non-binary bodies; on the other, scholars have found digital systems sufficiently malleable to facilitate the capture and representation of diverse epistemologies and lived experiences. Alongside these critiques and experimentations, queer digital geographies accentuate s the continuing masculine and heteronormative practices of knowledge production within the academy, adding to an already large and long-standing - yet growing - chorus of voices calling for greater diversity in geographers’ modes of knowledge production. To be sure, this critique is not limited to queer or feminist digital geographies, but still factors strongly into their debates.

These theoretical frameworks are making inroads into diverse empirical foci. “ Smart cities” exemplify some of these debates’ empirical implications. Here, feminist digital geographies have offered important parameters for thinking about how “smartness” shapes the urban. Namely, smart cities programs have often allowed technologists to frame urban problems in ways that can be solved through *a particular form of technology*: for example, technologies that count, that operationalize fiscal values, and that fall neatly into Cartesian representational logics. For example, traffic congestion might be framed as “solvable” by installing real-time sensors to modulate traffic signals, rather than being framed as resulting from driving-centric planning, lack of public transit, or too few dedicated bicycle lanes. This sort of knowledge politics reinvigorates the marginalization of (many) women’s life-worlds, queer epistemologies and lived experience, and intersectionally-oppressed voices, among other marginalizations. In their stead, smart cities programs usually operationalize a technicist approach to governance rooted in data colonialism, faith in digital solutions, and de-politicized urban interventions.

3.c. Political Ecologies of the Digital

Digital geographies has also recently examined how the material geographies of socio-technical systems play out in variegated ways across space due to the infrastructural, ecological, and economic systems on which they depend. Although such work builds upon earlier studies of the Internet's material geographies, recent work has specifically engaged a political ecology focus in order to better articulate the complex strands through which regions, their people, laws, and digital technologies all coalesce to support new digital platforms.

In particular, early work in this area has focused on the production and consumption of energy as a means of opening for consideration socio-technical assemblages that emerge in and around certain places at certain times. This work considers both the quotidian and the global scales, tracing arcs from individual lives to the large scale processes of global capitalist systems. For example, James McCarthy and Jim Thatcher's work has examined how the database structure used to produce the World Bank's solar energy potential sites elided from consideration indigenous and informal land use rights. Other work has focused on the growing field of precision agriculture. Alistair Fraser has done important work in this area, highlighting how shifting relations of ownership within precision agricultural systems (such as, moving from owning a tractor to renting the platform which runs said tractor) have produced a 'data grab' that mirrors the 'land grab' by capitalist interests occurring across the global south. Jathan Sadowski's work on how these same systems further enmesh agricultural production within systems of ground rent is also a significant example. These and other works in the area have sought to look behind the sui generis solutionism narratives produced by technology boosters and to, instead, produce grounded understandings of how 'the digital' produces and is produced by the socio-material, historical relations of a place.

3.d. Platforms and Infrastructures; Smart Cities and Sensors

Platforms and the infrastructures on which they rest and through which they manifest have also been an area of interest to research in Digital Geographies. This research draws upon and furthers work engaged with smart sensors and smart city initiatives, such as the work done by Shelton, Zook, and Wiig on the 'actually existing smart city' versus the narratives of exceptionalism on which said cities and sensors are often marketed and sold, a distinction which allows for the critical examination of the disjuncture between media and corporate representations of smart cities and the futures they promise and the daily, lived experiences of those within them. Prominent work in this area describes how cities are understood through code, sometimes known as "The Programmable City," and the dominance of a new formal science for understanding cities. Of particular importance is work that has focused on the experience of 'smartness' and new forms of sensors in the global south, such as Ayona Datta's influential work on smart urbanism in India.

3.e. Algorithms and AI

Digital Geographers have also examined how algorithms construct and enable space and place, sometimes known as algorithmic governance. For example, algorithms can construct identity at national and other borders through sorting routines that anticipate possible risky outcomes, rather than by making predictions. Outcomes include an "algorithmic citizenship" based on how an individual's identities are both constructed and mediated through algorithmic analysis. Consideration of ethics and fairness in algorithmic design, as for example with

automated facial recognition, has led to policy changes. In 2019, San Francisco banned government bodies (but not businesses) from using facial recognition software within the city.

4. Digital geographies moving forward

Given the rapid and continual proliferation of digital devices, media, and data, it is uncontroversial to expect Digital Geographies to continue to develop as an influential and important research area within the discipline. But, as noted above, Digital Geographies are always more than digital. All technologies are created, emerge, and exist within a milieu, subsequently shaping and being shaped by said milieu. The digital will always also be material, social, and cultural. For Digital Geographies, this will mean research that continually focuses at those intersectional moments between data and body, algorithm and identity, environment and economy, and a whole host of necessary inquisitional locii that emerge in the coming years. This entry has outlined some of the influences upon Digital Geographies and some of the areas of focus for research within the field; however, much like the data and algorithms discussed, its coverage has been necessarily uneven. As Digital Geographies continues to grow, it will do so in unforeseen directions, while retaining a clear focus upon those recursive moments where code and data enmesh with space and place.

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Cross-References

Critical Cartography; Critical GIS; Smart Cities; Feminist geography; Intersectionality; Network geographies; Political Ecology;

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Glossary

Cartesian: generally understood as the binary logic of one's mind being separate from their body, and by extension, an individual being separate from their social and natural environments.

Dividual: a view of a person engaging a technology, pieced together by data that a company might have about the *individual*. In other words, the end-result of a company trying to figure out who someone is.

Episteme: a set of knowledge deemed legitimate within a given knowledge-power system.

Epistemology: the study of systems of knowledge and what can be known.

Hermeneutic: the study and practice of a method of interpretation, specifically of texts.

Sociotechnical: the intractable connections between society and technology.

Milieu: a context, comprised of social events, current state of technology, and so on.

Dispossession: to remove someone or someone's ownership of an entity.

Ground rent: the payments made by one entity in order to access (live on, farm, etc.) a given property to the putative owner of said property.

Sousveillance: literally to watch from below. In *Digital Geographies*, refers both to the process of turning surveillant technologies back upon more powerful entities (such as filming a police officer with a smart phone) and of tracking oneself (such as counting steps taken for fitness purposes).

Networked urbanism: a loose collection of research seeking to integrate digital technologies and large, rich datasets into urban governance and lived environments, claiming that doing so can improve denizens' lives.

'Land grab': the large scale purchasing (or leasing) of swathes of land by corporations, governments, or individuals. Often refers to using asymmetries of capital to dispossess poor owners and consolidate holdings.

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Jim Thatcher is an associate professor of Urban Studies at the University of Washington Tacoma, an affiliate faculty with the graduate school of Geography at the University of Washington, and the director of the Spatial Models and Electoral Districting NSF REU site. His work examines the recursive relations among extremely large geospatial datasets, the creation and analysis of said data, and society, with a focus on how data has come to create, shape, and sustain modern urban experiences and environments. His work is often considered part of critical data studies or digital political ecologies and focuses on the process of commodification and exploitation within and through the production, extraction, and analysis of spatial data. He is the lead editor of a 2018 University of Nebraska book on the roles 'big data' has come to play within and across academic Geography and his second book, on the resistance to and power of data in our daily lives, is under contract with Pluto Press.



Ryan Burns is an assistant professor of geography at the University of Calgary, faculty affiliate of the O'Brien Institute for Public Health, director of the Engaging Open Data Research lab, and a board member of UC Cities: Global Comparative Urban Research. He works at the intersections of GIScience and human geography, interrogating the politics, inequalities, and spatial implications of new digital technologies. Empirically, he has investigated digital humanitarianism, smart cities, and open data platforms, in all examining how people, places, needs, and knowledge come to be encoded as data. He is Book Review Editor for *The Canadian Geographer* and sits on the International Advisory Board for *ACME: International Journal for Critical Geographies*.

Tracey Lauriault is an assistant professor of critical media and big data at Carleton University. Her work focuses on open data, big data, and open smart cities; with particular expertise in data infrastructures, spatial media and smart cities, and the assemblages of social and technological processes that form around such systems. She sits on the advisory board of the Carleton University Institute for Data Science and OpenNorth Canada, and is on the steering committee for Research Data Canada.

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