[GS-03-013] Epistemological critiques

Abstract

As GIS became a firmly established presence in geography and catalysed the emergence of GIScience, it became the target of a series of critiques regarding modes of knowledge production that were perceived as problematic. The first wave of critiques charged GIS with resuscitating logical positivism and its erroneous treatment of social phenomena as indistinguishable from natural/physical phenomena. The second wave of critiques objected to GIS on the basis that it was a representational technology. In the third wave of critiques, rather than objecting to GIS simply because it represented, scholars engaged with the ways in which GIS represents natural and social phenomena, pointing to the masculinist and heteronormative modes of knowledge production that are bound up in some, but not all, uses and applications of geographic information technologies. In response to these critiques, GIScience scholars and theorists positioned GIS as a critically realist technology by virtue of its commitment to the contingency of representation and its non-universal claims to knowledge production in geography. Contemporary engagements of GIS epistemologies emphasize the epistemological flexibility of geospatial technologies.

Keywords: critical GIS, epistemology, ontology

Author & citation

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Explanation

1. Definitions

Epistemology is an axis of philosophical inquiry that asks the question, how can (or do) we know the world? Epistemology is concerned with knowledge production. It entails the conceptual frameworks by which theories about the world come to be accepted as sound or ‘true’, as well as methodologies that are considered legitimate and appropriate for making sense of the world in any community of practice.

Epistemology is closely related to yet must be differentiated from **ontology**. In the philosophical tradition, ontology poses the question, what exists? It is a meta-theory of all

the phenomena, both material and conceptual, that are seen to validly exist in the world. Ontology thus specifies what it is possible for reality to be – this involves not only objects and qualities in the world, but also their legitimacy.

If ontology asks what exists?, then epistemology asks how do we know that what exists, exists?

2. Epistemologies of "The Grid"

The development of geographic information systems (GIS) has its roots in spatial science, which designates the particular way in which the quantitative revolution took hold in geography as it swept across the social sciences in the 1960s. As GIS gained a foothold in the discipline throughout the 1960s-1980s, and catalysed the formation of a new scientific community of practice (GIScience) in the 1990s, these developments caused concern amongst critical human geographers, many of whom rejected the logical positivism and brute empiricism of the quantitative revolution (see Leszczynski, 2009a, 2009b; Schuurman, 1999, 2000).

Logical positivism is an epistemology that equates knowledge production with the nomothetic quest to formalize laws based on verifiable (empirically discernible), valid (demonstrably true via logical or mathematical deduction), and replicable (observations and results are reproducible) "facts" (Ayer, 1959). Logical positivism flattened social ontologies, seeing society as merely an analogue of the natural world. Proponents of logical positivism sought to formalize not only natural laws, but also to codify and predict social phenomena (such as human behaviour). This was underwritten by the conviction that the methods of the natural sciences not only could but should be applied to the study of social phenomena. Human beings were seen to obey rules of regularity, always acting rationally – and thereby predictably – as economic maximizers (homo oeconomicus). For critics of logical positivism, the reduction of society to "pure science" was a failed enterprise, giving way to the threat of nuclear annihilation (the atomic bomb) and of environmental degradation. This conflation of natural and social worlds under logical positivism not only erased the distinct unboundedness and irreducibility of social phenomena, but in the case of GIS, was seen to further divorce phenomena from their social context, reducing them to mere predictable and quantifiable patterns that could be subsumed within an epistemology of "the grid" (Taylor, 1990, 1991).

"The grid" captures logical positivism’s quest for regularity (and thereby predictability) through the fundamental segmentation of space. Segmentation – or lineation - functions to render the world discretizeable, measurable, and open to linear regulation (Dixon and

Jones, 1998). In this ontology, space is understood as merely a featureless, transparent, and passive isotropic (flat) surface that serves as a container for discrete empirical objects. The notion of grid epistemologies suggests that the only valid objects of knowledge are those that can be placed within the intersecting lines of longitude and latitude on a map. For human geographers, this was understood to dismiss cultural accounts of abstract, non-physical objects (such as emotion, sense of place, and social relations), which were devalued against the privileging categories for conceptually organising the world to accommodate the discretization and classification of concrete entities in physical space (Jones, 2003). However, this critique of GIS as bound to "grid epistemologies" was highly deterministic, seeing GIS necessarily a technology of “locating and segmenting a complex, relational, and dynamic social reality” (Dixon and Jones, 1998: 251). In other words, the thrust of these critiques overcoded GIS as a necessarily positivist technology – a tautological conclusion which held GIS to be inescapably positivist because it was (in terms of its epistemological and technological antecedents) positivist.

3. GIS as a Representational Epistemology

Rather than overdetermining GIS as necessarily positivist, a second wave of critique overemphasized the representational conventions of the technology as the reason for why it should be deemed epistemologically objectionable (Elwood, 2006b; Leszczynski, 2009a, 2009b). This critique, advanced most vocally by John Pickles (2004), was concerned with the ways in which the visual sophistication of modern geovisualization enabled by GIS underwrites an always increasing verisimilitude ("likeness" or "realness") of spatial representation. This is seen to make it ever more difficult for a lay audience to distinguish between the real world and abstractions of it, because the visual complexity of geovisualization makes it every more persuasive. The representational fidelity of GIS scenes – whether this be the spatial field accessed through the graphic user interface (GUI) of a GIS or a hardcopy map output – are epistemologically associated with a visual regime that exceeds the simplicity of the spatial analyst’s grid. Rather, for critics such as Pickles (2004), GIS engenders an epistemology that is bound up with a system of vision that renders the earth transparent and fully penetrable. The world becomes knowable through visual practices of generating subsequent "abstractions upon abstractions" encoded as discrete knowledge objects (the “bits and bytes, 1s and 0s” of code; Pickles, 2004: 162). This is supported by the layer model of GIS, in which thematic data is separated out onto separate layers whose display order may be manipulated by the GIS user. Pickles’ argument was that GIS does not merely mirror the world inside the computer but that this complex visual layering writes the "real" world similarly discrete, subject to abstraction and circulation as code, infinitely addressable, and manipulable. As per Geoff Bowker (2000), to write (or code) the database is to write the world.

With the rise and advent of big data, including spatial big data, we can see evidence of the kind of abstraction, circulation, and decontextualization of natural and social phenomena pointed to by Pickles (2004) in his epistemological critique of GIS. Louise Amoore (2011;

Amoore and Hall, 2009) has for example extensively documented the ways in which bodies and subjectivities become disassembled into discrete bits and bytes of data fed into a series of algorithms at various sites of contact between individuals and the apparatuses of the state (e.g., borders, airport security, courtrooms, prisons). Society increasingly relies on both these processes of social abstraction and algorithmic analytics to predict crime patterns, the likelihood of reoffending, and other forms of antisocial behaviour. In addition to embodied subjects (and subjectivities) being abstracted, social relations are likewise subsumed within data regimes wherein analytics are leveraged to determine gang affiliation or the likelihood of the spread of social and political unrest through social networks (see Leszczynski, 2016).

While the encoding of the natural and social worlds as data warrants critique and challenge, the critique of GIS as objectionable by virtue of being representational (i.e., a technology that enables representation) is polemical. It isolated GIS as the sole vehicle of representation in geography, absolving critical theory of its own involvement in representing – and writing - the world (be it as base and superstructure, spectacle, simulacrum, or other theoretical construct). As per Gayatri Spivak (1988), we can never not represent. In other words, we are always re-presenting (reproducing, passing along, performing, picturing) or representing (speaking for, serving as proxies), whether this be in social theory, physical geography, or GIScience. Indeed as Nadine Schuurman (2002b: 260) has astutely noted, “social theory is not a sufficient filter for all geographic knowledge. [While] it offers a means of explaining and interpreting space, [it] does not offer the ability to model different scenarios in data intensive environments.”

4. Epistemologies of GIS Representation

Charges of positivism (‘epistemologies of the grid’) and representationalism (‘representational epistemologies’) challenged the epistemologies of GIS, critiquing the modes of knowledge production to which GIS was understood to be bound. But in a third wave of critique, rather than rejecting GIS because it is representational, scholars accepted GIS as involved in representation but questioned some of the ways in which GIS is used to represent spatial phenomena. For example, in their collaborative work as part of the Northwest Lesbian and Gay History Museum Project, Brown and Knopp (2008) acknowledge that GIS affords opportunities for visualizing LGBTQ subjects who have typically remained absent from mapping, with GIS representation serving as a vehicle for writing them into the geovisual record. However, the formal ontologies of the digital universe of GIS architectures mandate discretization (Schuurman, 2006). This means that insofar as GIS allows us to know the world through representation, the kinds of "things" that it may effectively represent are circumscribed by its architectures. Phenomena that may be represented with GIS – and thereby "known" in the epistemological sense – are those that are measurable, quantifiable, predominantly static, and preferably discrete. Therefore, while it is possible to represent LGBTQ subjects in space as discrete data events (points on a map), GIS is not effective at representing sense of space, attachments to places and spaces, or the

"queerness" of space precisely because these are non-quantifiable, unmeasurable, liquid, unbounded and emotional phenomena (Brown and Knopp, 2008).

For Brown and Knopp (2008), however, that GIS is limited to the representation of discretizeable, measurable, and temporally finite phenomena in Cartesian space does not inform an understanding of GIS technologies as seeking to impose Cartesian rationality upon the world and to overcode the world as "grid." In other words, just because the inherent "queerness" of place cannot be represented in or through GIS does not mean queer space does not exist outside of geovisualization as charges of positivism would have it. Rather, the substance of Brown and Knopp's (2008) critique is that insofar as GIS is a technology (and epistemology) of representation, it is epistemologically rather inflexible.

A number of feminist critiques of geographic information systems and technologies similarly addressed the ways in which GIS represents instead of rejecting it outright on the basis that it represents. In particular, 1990s feminist critiques engaged GIS by way of visual epistemologies, emphasizing – and challenging – how and what spatial technologies "saw," and how the objects of vision were privileged within geographic knowledge production. For example, Rocheleau et al.'s (1995) analysis of remote sensing imagery of the Dominican Republic, the authors evidence the ways in which women's work – in the form of small-scale patio gardens extremely high in biodiversity – was completely elided by 1995 remote sensing technology that could resolve only larger interventions on the landscape such as industrial-scale agriculture, which represented a man's mark on the Earth (noting that industrial agriculture in the Dominican Republic is almost exclusively run, and worked, by men). This critique is articulated in a similar vein as Brown and Knopp's (2008): the issue is not that GIS is a technology of representation, it rather that these particular practices of representation are masculinist and/or heteronormative.

5. GIS as a Critically Realist Technology

As a result of these waves of subsequent epistemological critiques of GIS, many of which misunderstood the technology and objected to its role and presence in geography, GIScience scholars and theorists made a concerted effort to clarify the ontology of their objects and the epistemology of their subject. In particular, they pushed back against charges of logical positivism. Schuurman (2002a) and Raper (2005) did so by positioning GIS to be a critically realist technology. Critical realism is a philosophy that is committed to an empirical though relational ontology (e.g., causality is contingent) and to epistemologies that acknowledge knowledge to be socially produced. Importantly, critical realism maintains a distinction between social and scientific ontologies, recognizing that society is an "open system" that is different from the "closed system" of the scientific laboratory. Similarly, social phenomena are acknowledged to be inherently unbounded and thereby irreducible to a finite or discrete universe.

For theorists such as Schuurman and Raper, GIS is critically realist in the sense that while

GIScientists and practitioners see mapping and analysis practices initiated in a GIS environment as associated with the real-world objects that are represented in its interfaces and map outputs, those representations are understood always as abstractions of phenomena rather than as indicators of causality. Whereas empiricist conceptions of the world under logical positivism presume the fixity of representation, GIScientists recognize the space-time contingency of GIS representation: a map is a snapshot of select phenomena at a moment in space. While a realist philosophy understands representations initiated in a GIS environment as communicating at least some portion of external reality (Hallisey, 2005; Sismondo and Chrisman, 2001; Schuurman, 2002a, 2006; Raper, 2005), it does not privilege sensory data as the only entry point for knowledge production. Indeed, per a critical realist positioning of GIS, there is a world beyond that which may be represented via any representational medium, including but by no means exclusive to GIS. GIS is but one means of modeling the world; as per the famous adage, all models are wrong, but some are useful.

6. Flexible Epistemologies

In addition to clarifying the epistemological positionality GIS, elsewhere, GIScience scholars have emphasized the epistemological flexibility of GIS of geographic information systems and technologies. For example, in her work with neighbourhood organizations on the south side of Chicago, Elwood (2006a) found that non-profit community groups were using GIS map outputs as flexible spatial narratives that communicated particular stories about their neighbourhoods. The non-profits were using GIS to not only tell stories about their communities, but to communicate those narratives in ways that aligned with the scientific language of municipal governments. For example, maps of a community survey of vacant buildings could be used to campaign for urban redevelopment funds for neighbourhood regeneration. Maps of inner-city food deserts could be used to illustrate the need for grocery stores to serve socio-economically disadvantaged communities. In other words, GIS is not as representationally inflexible as earlier critiques – such as those advanced by Brown and Knopp (2008) – suggest.

The proliferation of a vast array of new geospatial technologies such as mobile mapping applications, open-source and collaborative mapping platforms such as OpenStreetMap (OSM), and native geotagging functionalities further attest to the flexibility of GIS as a system of knowledge production. These more recent developments have opened up possibilities for multiple spatial perspectives to be simultaneously represented (Warf and Sui, 2010). For example, Wikimapia, an editable online map of the world, allows for contributors to digitize overlapping and imperfectly aligning boundaries for the same neighbourhood. Another interesting example of the epistemological flexibility afforded by crowdsourcing geographic information are the maps of crowdsourced city boundaries produced by Alasdair Rae (2016; http://www.statsmapsnpix.com/2016/10/crowdsourced-city-boundaries.html).