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Cartographic calculations of territory

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Abstract
Two themes dominate this year's report: calculation and territory. Both of these are larger issues than cartography itself, but cartography has been increasingly drawn into their ambit such that we might tentatively identify *cartographic calculations of territory*. Ranging across a wide set of problems including colonial, political and racial mappings, not to mention indigeneity and philosophical concerns of ontology, calculation and territory mark out a wide swath of cartographically informed work.

Keywords
calculation, indigeneity, ontology, racialized landscapes, territory

I Introduction

Two themes dominate this year's report: calculation and territory. Both of these are larger issues than cartography itself, but cartography has been increasingly drawn into their ambit such that we might tentatively identify *cartographic calculations of territory*. Ranging across a wide set of problems including colonial, political and racial mappings, not to mention indigeneity and philosophical concerns of ontology, calculation and territory mark out a wide swath of cartographically informed work. This is not to foreclose other inflections of this phrase such as 'calculative cartographies of territory' to center around the productive role of mapping, or possibly 'territorial cartographies of calculation' to highlight how calculation employs mapping. All of these are possible avenues into the complex relationships between mapping, calculation and territory.

II Calculation

The issue of calculation has been taken up by an increasing number of scholars over the last few years, both from a more general perspective of the problem of number (and space) and the more specific relationship between mapping and territory (Elden, 2007a; Hannah, 2009). Elden notes that 'mathematics and its relation to philosophy is making something of a return in human geography, and yet not as a straightforward rerun of the quantitative revolution' (Elden, 2008: 2645).

But there is a further consideration here, namely the way that numbers and counting have become central to the way the world is understood. If the idea of the singular item, the unit, is not yet number as Aristotle contended, and as Elden notes in his discussion of Heidegger 'it is only with the second that there is truly number' (Elden, 2006b: 130) – see also the same point in Sallis: 'one is not regarded as a number: only what can be counted, a number of things, is

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a number, the smallest of which is therefore two' (Sallis, 1999: 8) – then there are further implications for mapping as information theory. When Claude Shannon developed his theory of information in the 1940s (Shannon, 1948) his work was picked up by the cartographer Arthur Robinson and then developed into the map communication model, as I have discussed in more detail elsewhere (Crampton, 2010). What is significant here is that, for Shannon, information was defined as two, a binary, because it is what allows you to make a decision, and that because information is countable you understand mapping as being successful by how much signal it transmits. Thus mapping is a process at its essence of arithmetic information (not knowledge or meaning) which is maximally transmitted from a cartographer to a user via the map. And the underlying intention of mapping is to differentiate between the binary of truth and error.

In a recent article Leszczynski considers what this means for GIS: 'by virtue of the need to reduce everything to a mutually exclusive binary pair (0–1), formalization is always simultaneously classification' (Leszczynski, 2009b: 360), and to the extent that this is rejected by 'poststructuralist' critical geography then a divide will exist between the two. Formal ontologies in GIScience 'remains inherently quantitative by virtue of being numeric ... arithmetic ... and inherently mathematical' (p. 360) which 'trumps' any qualitative (ie, critical) approach (p. 361). Nevertheless a range of authors remain interested in qualitative GIS as a major new collection attests (Cope and Elwood, 2009). There Wilson (2009) explicitly questions how qualitative and critical work is related, and he offers a genealogy of the 'conflicted insider' who uses GIS and yet has a critically informed techno-positionality.

Amoore (2006) argues that calculative algorithmic technologies are also part of the everyday war on terror in which the cartographic imaginary ('axis of evil', 'failed states', here/there, safe/risky) is paramount. For Rose-Redwood (Rose-Redwood, 2010) street addressing is part of the apparatus of state calculation, while Zeiderman argues that in Colombia, where security has become a pre-eminent concern, the calculation of spaces of risk is a primary way in which populations and subjects are constituted (Zeiderman, 2010). Work has also focused on the relation of calculability to geography, for example in the way that states govern by calculating the demographic trends of their populations (Crampton and Elden, 2006; Elden, 2006a; 2007a) and cartographic calculation of racialized territories (Crampton, 2006).

What is sometimes called critical quantitative geography has received attention. Trevor Barnes and Matthew Hannah guest-edited two special issues of *Society and Space* a decade ago (Barnes and Hannah, 2001; Hannah, 2001; Sheppard, 2001). More recently, the *Professional Geographer* has published two issues on critical quantitative geography, as has *Environment and Planning A* (Kwan and Schwanen, 2009). Can the 'bridge' between the quantitative and critical be spanned? Barnes (2009): yes, because it is only there for historical reasons. Leszczynski (2009b): no, because of a basic philosophic divide.

All of this, however, does raise the question of what is calculation, and more specifically how can it provide insight into strategies of territory, appropriations of space and the role of mapping? As yet there is no general history or genealogy of calculation and geography, although both Foucault and Heidegger have been influential. The ongoing translations of Foucault's lectures (especially Foucault, 2003; 2007) dealing with space and governmentality as the 'species population' have been fruitful for a number of writers interested in spatial orderings (Alatout, 2006; Elden, 2007b; Legg, 2008).

Foucault's *The order of things*, which delves into the way that the seventeenth and eighteenth centuries (the 'Classical' age) developed a knowledge of order, has also been influential. Taxonomies are important here (exemplified

by Linnaeus but also Comte de Buffon) but it is the concept of mathesis 'as the science of calculable order' which draws on algebra (Foucault, 1970: 73) that is picked up (Elden, 2002; 2006b; 2007a). Mathesis (which can be qualitative as well as quantitative) provides a calculative ordering principle. As a range of authors have pointed out, working both within geography (Black, 2008; Hannah, 2009) and outside it (Hacking, 1982; 2002; Scott, 1998), the rise of the modern 'calculating state' and 'state-istics' (Hacking, 1990; Shaw and Miles, 1979) derive from calculable orders. Cartographically, this is taken up as the way space is 'geo-coded' through mapping and the rise of thematic mapping to know, control, and govern territories (Pickles, 2004; Rose-Redwood, 2006; 2008a; 2008b; Steinberg, 2005; 2009).

Martin Heidegger has also proved to be a influential figure on the multiple questions of number, 'machinization', calculation and technology. His emphasis on calculation overlaps that of Foucault (for a discussion of the influence on Foucault see (Milchman and Rosenberg, 2003), but he is motivated by a more ontological concern. Heidegger reacts sharply against what he sees as the Cartesian calculative tradition of *res extensa*, of the world as objects with spatial extension. For Heidegger, appropriating being as objects in space is dangerous because we emphasize beings rather than being (ie, being-in-the-world). Humans are not objects with properties; unlike inanimate objects their being is a question for them. As we shall see below, this criticism can also be applied to recent work in computer and GIScience 'ontology'.

More precisely, the danger is that we already approach the world in a predetermined, calculative manner; where to be, is to be calculable:

> This calculation is the mark of all thinking that plans and investigates. Such thinking remains calculation even if it neither works with numbers nor uses an adding machine or computer. Calculative thinking computes. It computes ever new, ever more promising and at the same time more economical possibilities. (Heidegger, 1966: 46)

If calculative thinking computes, what does it compute and why is that dangerous? For some critics the AAG-supported book *The geographical dimensions of terrorism* exemplifies the danger (Cutter *et al*., 2003). The book – which did not even have the terms 'Islam' and 'Middle East' in the index (Stewart, 2005) – missed the geopolitical dimension of terrorism (de Blij, 2004), and instead seemed to treat the world as a set of calculable threats. These threats are then amenable to quantitative risk analysis of the sort commonly undertaken in the natural world (eg, tornadoes, hurricanes, floods). Mappings of nature as risk also form the subject of Wood and Fels' new book (2009). Although they somewhat problematically oppose 'nature' to culture, their eight slices through the relation (nature as resource, nature as grandeur, nature as risk, etc) do illuminate some of the major ways mapping appropriates its subject matter, especially in popular outlets like the *National Geographic*. A new edition of *Power of maps* is also forthcoming (Wood *et al*., 2010). For Bruce Braun (2003) this is a question of 'risk culture', which draws on Beck (1992) but at the same time locates risk in geographically specific settings. Rather than there being a separable realm of nature Braun sees '*cultures of nature* [which] are rarely, if ever, innocent' (Braun, 2003: 179, added emphasis). There are interesting overlaps here with science studies and actor-network theory (ANT) 'centers of calculation' and visualizing the spatiality of risk (Barry, 2006; November, 2008) and Foucaultian-inspired 'mappable landscapes of expectation' (Hannah, 2006) that predict risk and dangerousness (Foucault, 1988).

At issue here is how our current geospatial technologies of GIS and digital mapping are calculating space. The basic model of the world in GIScience texts is: points, lines, areas, surfaces, and volumes. This scheme draws on ways of understanding space that were formally put

together (but far from invented) by people such as J.K. Wright (Wright, 1944). Even the name of the leading GIS software, ArcGIS, refers to the vectorized name for a line (an 'arc'). In this Cartesian scheme of *res extensa* points make up lines, lines make areas, and surfaces make volumes. Consequently territories are extended, enclosed areas. Yet GIScience technologies can change and should not be approached essentially, as Leszczynski points out in some important new work (Leszczynski, 2009a; 2009b; 2009c); furthermore it may be that GIS as a practice is largely qualitative (or at least not as quantitative as people assume) and that it too has a positionality (Pavlovskaya, 2006; 2009).

III Territory

Geographers have long been concerned with territory and its interlocking issues: boundary-making, territoriality, regions, the politics of place, nationalism, irredentism, transnationalism, globalization and political geography. The recently published (and mammoth: 12 volumes!) *International encyclopedia of human geography* includes entries on all of these topics (Kitchin and Thrift, 2009). Historians of cartography have also produced work that considers issues such as maps and empire (Godlewska and Smith, 1994; Edney, 1997; Akerman, 2009), boundaries and indigenous land claims (Turnbull, 2005; Wainwright and Bryan, 2009) and territory (Akerman, 1995; Michael, 2007). How surveyors such as the famous Cassini family thought out and appropriated space is also part of the story (Godlewska, 1999; Farish, 2009) as is Olsson's decades-long work grappling with geometry and the cartographic line (Olsson, 1991; 2007).

What is different here? Many newer works explicitly foreground calculation as a strategy of territory. 'Calculative studies' asks not so much about the spaces produced, but about the relationship between calculation as a territorial strategy and the production of space. That is, what is it about rationalities of calculation that produce space in the way they do?

Two things in particular can be highlighted:

(1) Territory is not always a bounded space with a primarily sociopolitical meaning (as, for example, defined in the Elsevier *Encyclopedia*; Delaney, 2009) but includes a range of meanings such as agricultural lands, parts of regions, land expanses, and even ploughed fields. Nor were borders and boundaries always of first importance in defining territory, nor was it always a 'container' (Elden, 2009; 2010).

(2) Territory has a history. The relationship between calculation and territory is dynamic, and authors have taken this up in a number of ways.

Painter has invoked 'cartographic anxiety' to refer to the fear of territory unbound (Painter, 2008) (transgressed borders, politics of regionality). Hannah has a sustained critique of such number-producing enterprises as the census in both the USA and Germany (Hannah, 2000; 2001; 2009). His analysis of the German census boycott movements is valuable for a number of reasons. Drawing closely on the work of Foucault, Hannah argues that calculation is an issue of power/knowledge, and he offers an important genealogy of calculable territory. This is defined as 'making legible' for purposes of intervention (compare Cosgrove, 2001; Scott, 1998) which he understands as a Foucaultian art of government. Hannah suggests a model of calculable territory that gathers together six components: griddings of space; boundary-making; the legible built environment; and three types of knowledge tied to territory – sociodemographic census data; geodemographic; and fleeting, transactional records (what Dodge *et al*., 2009, have called 'software-sorted space'). Implicit here are a range of cartographic and GIS-related implications, not least of which is the increasing emphasis on databases, rather than visual representation. Foucault's discussions of governmentality are also deployed in

the work of Rose-Redwood on street addressing (Rose-Redwood, 2006; 2010) and Starkweather (2009) who analyses the way overseas residents are tied to notions of territory in the US census.

Histories of the cartographic calculation of territory (and historical studies of territory) are offered in a number of works (Kosonen, 2008; Pearce, 2008; Safier, 2008; Strandsbjerg, 2008; Wolfart, 2008; Komara, 2009; Petrella, 2009; Elden, 2010). Many of these are concerned with how maps frame and classify the world in order to comprehend and control it, especially 'wild' or unconquered territories. An entertaining example is provided in a biography of the early twentieth-century explorer Colonel Percy Fawcett (Grann, 2009). Fawcett's 'training' as an explorer at the Royal Geographical Society emphasized the calculative practice of 'autopsis' – the recording and classifying of everything around him. It is also an illumination on western explorers and indigenous peoples. (Fawcett disappeared in the Amazonian jungle in the 1920s in search of the 'lost city of Z'.)

For Brenner and Elden (2009: 355) 'territory is best conceived as a historically and geographically specific form of political organization and political thought'. While Westphalia is often invoked as the origin of territory as a political bounded space, especially in international relations theory (the 'territorial trap'; see Agnew, 1994; Teschke, 2003) it is perhaps part of a series of steps such as the Treaty of Tordesillas (1494), and the Mercator projection (designed to calculate rhumb lines) (1569). National geographic societies such as the Royal and the American were hugely influential not only in supporting explorers like Fawcett, but in mounting excursions of academics in both America and Europe (Heffernan, 1996; Clout, 2004) and the global mapping projects that drew on them such as the millionth map (Pearson and Heffernan, 2009). A cartographic history of geographical societies, explorers, and territorial strategies remains to be written (though see Schulten, 2001; Monk, 2003; Clout, 2008; Morin, 2008), even as the 'Bowman Expeditions' are resurrected (Herlihy *et al*., 2008) and foreign policy 'realists' appeal to Mackinder (Kaplan, 2009).

Reversing the question, how is the state itself modified and reformed through territory? Brenner and Elden (2009) argue that this question is importantly foregrounded in the work of Henri Lefebvre: 'on our reading of Lefebvre, then, the concepts of state, space and territory are ineluctably intertwined: each term reciprocally implies the others, both analytically *and* historically' (p. 364). Therefore, for them Lefebvre's tripartite divisions of space into the perceived, conceived, and lived should not be read as independent (with maps and GIS falling only under the 'conceived') but all three are bound together as territorial practices with material outcomes related to everyday lived experiences (they offer the example of the Israeli wall project). Cartographically, we may say that any time state spaces and territories appear natural or self-evident (a process of 'mystifying and masking'), then real critical historical analysis needs to occur. Transparent spaces are a political illusion.

For one thing, territory is not just horizontal. Considerations of the volumetric are infrequent but have been taken up in different ways by the cartographer Mark Monmonier, the architect Eyal Weizman, and the philosopher Peter Sloterdijk. Often airspace is missing from maps but control and occupation of this 'territory' – what Weizman calls 'the politics of verticality' – is critically important to states, often for military reasons (Weizman, 2007). Monmonier discusses aeronautical charts as an extension of national territory and how the skies have been differently partitioned over time (Monmonier, 2010). Sloterdijk's writings on what he calls 'airquakes' and dangers from the atmosphere are extremely suggestive in this schema (Sloterdijk, 2009a; 2009b). Finally, one might also consider the way the body is the site of boundary-making and as territoriality. Here the emphasis falls

more on calculating and territory than literal maps (although there is a long history of mapping bodies in, for example, map-art, and also the struggles over the 'geo-body' (Winichakul, 1994). How do bodies interplay with boundaries? Longhurst (2006), for example, recounts the story of a woman who wanted to film her birth for a pornographic film and how this was seen as crossing a moral boundary inscribed on the pregnant body.

Territory need not be enclosed and bounded. Where, for example, is the territory of Schengenland? Although one might initially point to the areas occupied by the member states, in a real and material sense it also extends into North Africa in an instance of 'border externalization' (Nessel, 2009). This is because economic migrants continually attempt to cross the border in Morocco (where Spain has two small city-exclaves, one at Ceuta and one at Melilla) and on the European mainland, which has resulted both in significant loss of life and an external border guard agency (FRONTEX). Thus the 'effects' of the territory extend beyond its borders (no surprise in a globalized world of course) but also increasingly *within* the state with a concomitant need for internal surveillance (Alatout, 2006; Amoore, 2006; Zurawski, 2007).

In this light virtual spaces continue to attract attention. Martin and Simon (2008) argue that the US Department of Homeland Security operationalizes its efforts into a 'virtual ontology' of threat, which produces spaces of risk in everyday life. This has been a massive area of interest drawing on Agamben's idea of the permanent state of exception (Agamben, 2005), although it as yet remains cartographically untheorized.

IV Ontology and indigeneity

Two areas where cartographic calculations of territory are apparent are computer/GIScience 'ontology' and indigenous mappings. In many ways these represent opposite ends of the spectrum of territorial strategies. GIScience ontology takes as its focus how objects and things are spatially constituted – eg, what counts as an 'eminence' or high-ish segment of the terrain (Smith and Mark, 2003; Sinha and Mark, 2010). It typically draws on the Aristotelian tradition of ontology as 'objects with properties' (ie, predicate or substance ontology). The philosopher Barry Smith has brought this philosophy into GIScience – he is located at SUNY Buffalo where he holds a position in the National Center for Geographic Information and Analysis (NCGIA). There is now a large and increasing literature on GIS ontology (some 40–50 articles a year since 2006); for an introduction, see Schuurman (2006; 2009). Other influential work includes Agarwal (2005) who provides a sterling rallying cry, definition, and exemplars of 'ontology' to GIScience (and cites 20 different publications by Smith). Smith and Mark (2001) investigated formal geographic entities and categories as they manifested in folk or naïve knowledges among non–geographers, which they argued was an essential step toward geographic representation (eg, in maps and GIS). Fonseca *et al*. (2002) provided a GIS architecture to integrate different spatial data, while Couclelis (1992) also emphasized early on the need to take account of how people conceptualize the world if it is to be represented. This research helped establish the current emphasis on 'folksonomies' and semantic categories.

Two recent articles by Leszczynski (2009a; 2009b) indicate the very latest thinking in GIScience ontology and for my money present some serious challenges for critical geographers. First of all, Leszczynski is not sanguine about the GIS–critical encounter being resolved (though she finds value in the collision; a dialectics perhaps). This sets her apart from Barnes (2009). Second, GIS are structured as 'object-oriented architectures of formal ontologies' (Leszczynski, 2009b: 357) necessitating therefore a materialist examination of how GIS knowledges are structured as object ontologies (objects with properties). We need to investigate the databases,

what Schuurman calls 'database ethnographies' (Schuurman, 2008). Third, she tries to walk a fine line between saying that GIS are not essentialist (eg, positivistic) but that they pretty much are fundamentally and materially digital, numeric, and mathematical.

Given that, as she acknowledges, GIScience ontologies arose in attempts to create artificial intelligence and that this project remains unrealized at best (and doomed to failure according to the philosopher Hubert Dreyfus; Dreyfus, 1992) we might wonder what this means for GIScience. If this kind of 'ontology' – which is actually about entities or beings rather than the Heideggerian tradition that ontology is rather about being – is working for formally representing the natural world (those things for which their being is not a question), would it work for the human world? For Heidegger and those he has influenced human beings are not objects with properties. Yes, says Leszczynski, we know the real world is not like the GIS data structure, 'we just represent it as such' (Leszczynski, 2009b: 359). Dots on the map do not meaningfully represent the incidence of gay and lesbian spaces (drawing on Brown and Knopp, 2006); this is a limitation of GIS but 'we know' better. However, surely what 'we know' is not unrelated to the knowledges promulgated in and through mapping and GIS in the first place? And, if we do know different, why use GIS if it cannot handle it?

As Bryan has pointed out (drawing on Bernard Nietschmann), it is 'map or be mapped' (Nietschmann, 1995; Toledo Maya Cultural Council and Toledo Alcaldes Association, 1997; Bryan, 2009). Writers have investigated the way in which indigenous voices are represented (or not represented) and how. Harley's early work on indigenous maps is influential here, especially of the Columbian encounter (Harley, 1992), and the well-known expansion of the concept of the map that he and Woodward wrote into their *History of cartography* (Harley, 1987), but now a new generation of scholars has emerged (Gibson, 1999; Barrera-Bassols *et al*., 2006; Johnson *et al*., 2006; Lewis, 2006; Roth, 2009; Sletto, 2009; Wainwright and Bryan, 2009). Many remain sensitive to the problematics of 'community mapping' where westerners arrive with technology and money, before leaving again. During 2009, for instance, there was a controversy over the Bowman Expedition in Oaxaca, Mexico, which seemed to have produced its own 'divide' between supporters and critics (Dobson, 2009). An ongoing question then is how community mapping partnerships (and histories such as the *History of cartography*) proceed ethically, politically, and practically. This might well expand our notion of indigenous: for example, is OpenStreetMap an 'indigenous' project?

V Conclusion

It would be easy enough in all this to reject technology, including mappings, as another component of governmental rationalities or state surveillance. It would also be easy to see calculation as positivistic when it might equally be qualitative. Wilson's (2009) 'conflicted insider' points toward a possible positionality 'of performing research that is simultaneously about and with the techno logy' (p. 167). As Heidegger remarked in his essay on calculative thinking:

> It would be foolish to attack technology blindly . . . But suddenly and unaware we find ourselves so firmly shackled to these technical devices that we fall into bondage to them. Still we can act otherwise. We can use technical devices, and yet with proper use also keep ourselves so free of them, that we may let go of them any time. (Heidegger, 1966: 53–54)

What is characteristic of the work cited above, however, is how much of it is committed to a project of *historical critique*. These critiques reveal the degree to which territory is not solely a state-centered phenomenon, but 'a historically and geographically specific form of political organization and political thought' (Brenner and Elden, 2009: 355). Although we now know a

great deal about the productive practices of cartography and maps, and after reading and considering hundreds of articles over the last three years (and no doubt missing many fine pieces of work), it seems to me that this project is more important than ever.

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