Searching for Common Ground (Again)[1]

J. Thatcher[1], L. Bergmann[2], D. O'Sullivan[3]

[1]University of Washington Tacoma, 1900 Commerce Street, Tacoma, WA 98402
Email: jethatch@uw.edu
[2]University of Washington, Box 353550, Seattle, WA 98195
Email: luke.bergmann@gmail.com
[3]University of California Berkeley, 504 McCone Hall #4740, Berkeley, CA 94720
Email: dosullivan@berkeley.edu

Abstract

At over twenty-five years old, GIScience has been successful academically and institutionally. However, its relationship to one of its 'natural' homes, the discipline of Geography, has often been troubled and uncertain. We suggest that from the founding of GIScience, its close association with Geographical Information Systems (GIS) has contributed to an acceptance of an absolute coordinate space encoded as (x, y[, z, t]) as both a relatively unproblematic and dominant representation of geographical space. We briefly consider how this situation may have arisen, perhaps as an unintended consequence of an originally tactical disciplinary positioning move. However, our purpose here is *not* criticism, but to highlight the many other more minor strands within GIScience, which can provide fertile common ground for renewed conversations between GIScience and Geography. We suggest congruences between less dominant strands of research in GIScience and theoretical concepts in Geography, as an invitation to constructive collaborations.

1. Introduction

"GIScience," as a term, is around a quarter of a century old. It has become institutionally and academically valorized through multiple conferences, journals, and textbooks. We argue that from its inception as distinct from GISystems (GIS), GIScience (GISci) has been framed in ways that have partially delimited the spatial thinking that occurs within it. Specifically, by framing GISci as fundamentally concerned with "spatial information" and "spatial analysis" of such information (Goodchild 1992, 2006), GISci has tended to accept space as absolute, transforming it into data whose 'atomic' units are measurements within a coordinate system of the form (x, y [, z, t, etc.]) (Goodchild et al. 2007), and de-emphasizing alternative conceptualizations of space, time, and process. While this reflects GISci's construction as a "science of *geographical information*" (Goodchild 1992: 38, emphasis ours), we suggest that, in taking a specific concept of spatial information as given, GISci may have unnecessarily distanced itself from broader research in computational geography and in geographic thought.

To make this argument, first, we briefly examine how GISci was framed in an important early conceptualization, focusing on definitions of geographic information. Next, we provide evidence suggestive of continuing ties between these early framings and ongoing research in the field. Finally, we suggest that a reconsideration of the conceptualizations of both space and spatial processes found in broader computational and quantitative geography as well as some theoretical realms of (human) Geography could be valuable to GISci.

[1] Our title is a nod to *A Search for Common Ground* (Gould and Olsson 1982) and the follow up *A Ground for Common Search* (Golledge et al. 1986) which were among the last attempts to bridge the philosophical divides between quantitative and 'critical' geography before the 1990s 'science wars' and, more recently, 'critical GIS'.

2. A Science of Geographical Information

Accounts parsing the histories of GIS and GISci are available elsewhere (e.g., Clarke and Cloud 2000; Schuurman 2000; Mark 2003). If we accept the 1994 definition of GISci offered at the founding of UCGIS which points to "the development and use of theories, methods, technology, and data for understanding geographic processes, relationships, and patterns" (in Mark 2000: 51), then the distinction between 'research about GIS' (development) and 'research with GIS' (use) is clear from the outset (Goodchild 1992: 2006). However, here, we focus on articles by Mike Goodchild from the early 1990s which are perhaps the most influential in the emergence of a 'self-conscious' "science of geographical information" (Goodchild 1992: 38). In emphasizing this strand of GISci's history, we can present only a partial story[2]. Our intent is not a "just so" history, but an analytic reflection on what some consider its foundational moments (see Mark 2003 and elsewhere) and their influence.

This dominant strand suggests that GISci should take "geographical information" as given and as the natural focus of a new science. Even as it was intended to signal a difference between the rote handling of spatial data and the scientific endeavor that motivated such inquiries, to avoid the community being reduced to the "United Parcel Service of GIS" (Goodchild 1992, 31), a focus on understanding spatial data has remained dominant. GISci *has* fostered explorations into what spatial information might consist of (Couclelis 1992; Raper and Livingstone 1995; Goodchild *et al*. 2007; Galton and Mizoguchi 2009), as well as how it might be stored and analyzed; yet, most work in GISci remains far more circumscribed by assumptions about how space can be represented in data than is desirable for GISci to be more "cross-disciplinary" (Mark 2000). While other strands are found in the GISci literature the claim (under the heading 'Geographical Reality') that "the fundamental element of geographical information is the tuple $T = <x, y, z_1, z_2, ..., z_n>$" (Goodchild in Frank and Goodchild 1990) goes largely unchallenged, even as it has since been elaborated (Cova and Goodchild 2002, Goodchild et al. 2007). The limits of this singular perspective have long been recognized. Andrew Frank (in Frank and Goodchild 1990) points to *Graphs*, *Cognitive spaces* and *Imaging schema* as other spatial concepts worthy of expression in data models. Even so, Goodchild's formulation remains dominant (but see Miller and Wentz 2003).

It is difficult to 'prove' this argument, without close reading of key contributions. Here, we present preliminary bibliometric analysis of four leading GISci journals[3], using Web of Science data. CitNetExplorer's citation-network clustering technique (van Eck and Waltman 2014) identifies seven large clusters of research (although we name only six) (Fig 1). There is little here to suggest a sustained research theme of alternative models of space. As Mark and Frank note, "except for geodesics on cost surfaces, non-Euclidean geometries have not made significant inroads into mainstream geographic models" (1996, 17), a claim substantially true today, which also hints at the crux of the problem: the lock-in effects of existing GIS, regardless of the efforts of GIScientists (Miller and Wentz 2003). Of course, computation does require reduction and abstraction of events to textual, numeric, or otherwise programmatically understood representations (Ullman 1997, Drucker 2009). We are not suggesting that one particular spatial representation is "wrong," as that work has been

[2] For example, during the same period, the more open-ended 'spatio-temporal reasoning in geographic space' (Frank et al. 1992), was emerging and soon to become the Conference on Spatial Information Theory (COSIT).

[3] We retrieved 3109 items from *Cartography and Geographic Information Science*/*Systems*, *Geoinformatica, International Journal of Geographical Information Science*/*Systems* and *Transactions in GIS* between 1990 and 2016, which cited a further 2511 items. Clustering these and removing uncited items yielded 3973 items.

fruitful. Rather, we suggest this understanding of space has been prioritized in GISci since its founding.

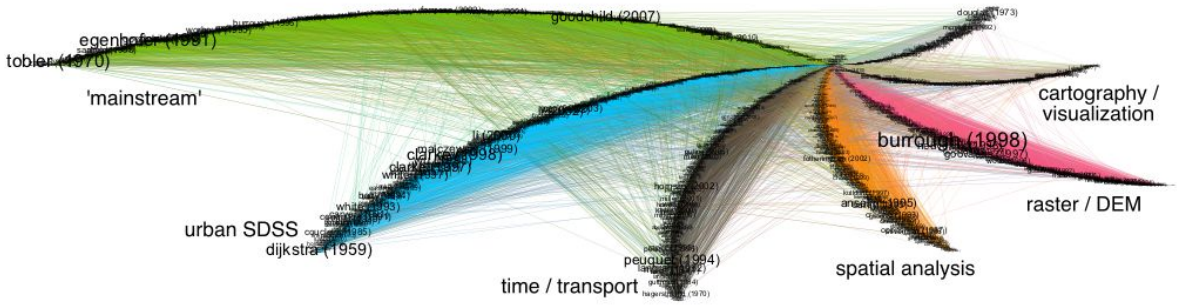

Figure 1. Research clusters for 3973 articles in GIScience.

3. FInding Common Ground (Again)

If GISci is really never again to be "quite the comfortable retreat for the technically minded" (Goodchild 2006, 687) then, while avoiding the oft-revisited, sometimes unproductive debates between and amongst GIS/ci and Critical GIS practitioners (Wright *et al.* 1997; Pickles 1995), we would suggest that there are many lines of research in contemporary GISci that align well enough with theoretical frameworks and concepts in geography to provide firm ground for renewed, closer and above all *constructive* engagement between the fields. A preliminary sketch of this ground is provided in Fig 2.

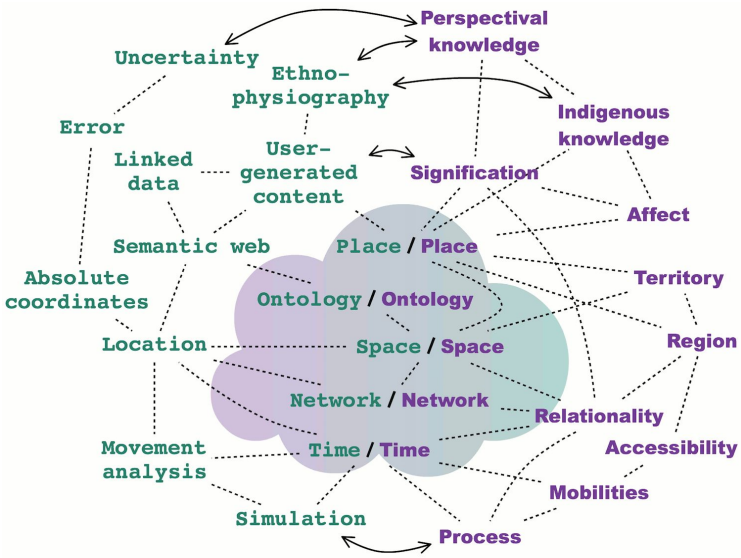

Figure 2. A sketch of common ground. This diagram is not intended to be definitive!

Space does not permit us to expand on all of these congruences (see also Duckham and Sharp 2005). Instead we note that while spatial representations in GIS/ci remain absolute, human geography increasingly takes relational space as the norm (Harvey 2006; Jones 2009). While human geographers often position their critiques of absolute space and its quantitative representation outside of GIS/ci debates and histories, it is unclear why GIS/ci should neglect relative conceptions of space, when they are so relevant to the systems we wish to engage. Computational challenges are not what they were, and much remains to be done, theoretically and in terms of applications, to demonstrate the feasibility and practical utility of such

approaches for mainstream GIS/ci (O'Sullivan et al. forthcoming). We suggest that this is where we might find rewards to renewed consideration of theoretical concepts and empirical examples from geography, even if much relevant research has not yet been formalized as it would need to be in order to become mainstream GISci. At GIScience 2016, we hope to provoke new thinking and new conversations along these lines.

References

Clarke KC, and Cloud JG, 2000, On the origins of analytical cartography. *Cartography and Geographic Information Science* 27(3): 195-204.

Couclelis H, 1992, People manipulate objects (but cultivate fields): beyond the raster-vector debate in GIS. In: AU Frank, I Campari and U Formentini (eds), *Theories and Methods of Spatio-Temporal Reasoning in Geographic Space,* Springer: 65–77.

Cova TJ and MF Goodchild, 2002, Extending geographical representation to include fields of spatial objects. *International Journal of Geographical Information Science*, 16(6): 509–532.

Drucker J, 2009, *SpecLab: Digital Aesthetics and Projects in Speculative Computing*, U Chicago Press.

Duckham M and Sharp J, 2005, Uncertainty and geographic information: Computational and critical convergence. In: Fisher PF, Unwin D (eds) *Re-presenting GIS*. Wiley, Chichester. England: 113-24.

Frank AU and Goodchild MF, 1990, Two perspectives on geographical data modelling. *NCGIA Technical Reports* (90-11), available at http://escholarship.org/uc/item/7zn585sw (accessed August 2016).

Frank AU, I Campari and U Formentini (eds), 1992. *Theories and methods of spatio-temporal reasoning in geographic space*. Berlin ; New York: Springer-Verlag.

Galton A, and Mizoguchi R, 2009, The water falls but the waterfall does not fall: New perspectives on objects, processes and events. *Applied Ontology*, 4(2): 71-107.

Golledge RG, Couclelis H and Gould P (eds), 1988, *A Ground for Common Search*. Santa Barbara Geographical Press, Goleta, CA.

Goodchild MF, 1992, Geographical information science. *International Journal of Geographical Information Systems,* 6(1): 31-45.

Goodchild MF, 2006, Geographical information science: fifteen years later. In: Fisher PF (ed), *Classics from IJGIS: Twenty years of the International Journal of Geographical Information Science and Systems,* CRC Press, Boca Raton: 199-204.

Goodchild MF, Yuan M and Cova TJ, 2007, Towards a general theory of geographic representation in GIS. *International Journal of Geographical Information Science*, 21(3): 239–260.

Gould P and Olsson G (eds), 1982, *A Search for Common Ground*. Pion, London.

Harvey D, 2006, *Spaces of Global Capitalism: A Theory of Uneven Geographical Development*, Verso, London.

Jones M, 2009, Phase space: geography, relational thinking, and beyond. *Progress in Human Geography* 33(4): 487–506.

Mark DM, 2000, Geographic Information Science: Critical Issues in an Emerging Cross-Disciplinary Research Domain. *URISA Journal,* 12(1): 45-54.

Mark DM 2003, Geographic Information Science: Defining the Field. In: Duckham M, Goodchild, MF, Worboys M (eds), *Foundations of Geographic Information Science*. Taylor & Francis, London: 3–18.

Mark DM and Frank AU, 1996,Experiential and formal models of geographic space. *Environment and Planning B: Planning and Design*, 23(1): 3-24

Miller HJ and Wentz EA, 2003, Representation and spatial analysis in geographic information systems. *Annals of the Association of American Geographers* 93(3): 574–594

O'Sullivan D, Bergman LR and Thatcher JE, forthcoming, Spatiality, maps, and mathematics in critical human geography:Toward a repetition with difference. *The Professional Geographer*

Pickles J (ed), 1995, *Ground Truth*. Guilford Press, New York, NY.

Raper JF, and Livingstone D, 1995, Development of a geomorphological data model using object-oriented design. *International Journal of Geographical Information Systems*, 9: 359-83.

Schuurman N, 2000, Trouble in the heartland: GIS and its critics in the 1990s. *Progress in Human Geography*, 24(4): 569-590.

Ullman E, 1997, *Close to the Machine*, City Lights Books, San Francisco, CA.

van Eck NJ and Waltman L, 2014, CitNetExplorer: A new software tool for analyzing and visualizing citation networks. *Journal of Informetrics*, 8(4): 802-823.

Wright D, Goodchild MF, and Proctor D, 1997, Still hoping to turn that theoretical corner. *Annals of the Association of American Gerographers*, 87(2): 373.