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*Progress reports*

# Cartography: mapping theory

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## I The great divide . . .

It is widely accepted that 'maps and cartography comprise a primary part of the geographer's technology, methodology and language' (Bradshaw and Williams, 1999: 250). Yet 'marxists . . . humanists . . . [s]ocial theorists and some feminists seem to find maps peripheral and irrelevant, and postmodern geographers often find maps, with their categories and symbols, downright inimical to their core agendas' (Wheeler, 1998: 2). It has been argued that quantitative geography and cartography have been devalued within human geography following the cultural turn (Dorling, 1998) and that large numbers of geographers have become 'mapphobic' (Wheeler, 1998), leaving map-related research to the burgeoning field of Geographic Information Science and visualization.

Meanwhile it has become increasingly fashionable for researchers informed by concerns with critical social theory to use the 'm' word, but to have little appreciation of how maps work as tools. Thus the history of cartography has become an active field for literary and historical investigation, with researchers discovering another map to deconstruct, or exploring written texts for embodied spatial concerns (see Helgerson and Woolway-Grenfell, 1998, and Cosgrove, 1998, for many examples of these approaches). Maps 'are once again in the thick of it' (Helgerson, 1998: 3) for critical social theorists, artists, literary critics and cultural geographers, but also in a very different way for planners, GIS researchers and scientists. Art and science offer different cartographic explanations (Krygier, 1995).

There are profound differences between those who research mapping as a practical form of applied knowledge, and those who seek to critique the map and the mapping process. On the one hand, scientific research addressing new agendas of visualization and representation (e.g., Fairbairn *et al.*, 2001; Slocum *et al.*, 2001) uses empirical investigation to develop better understanding of the cognitive processes underpinning representation of spatial information. On the other hand, critical social theory seeks to problematize mapping and visualization as social practice (e.g., Harley, 2001), to dissect the relationships between mapping and the exercise of power, and increasingly to explore the complex and contingent performative potential of mapping (e.g., Cosgrove,

1998). Addressing *how* maps work (MacEachren, 1995) involves asking different questions to those that relate to the *power* of the medium (Wood, 1992).

This second of my progress reports on cartography and visualization develops arguments around these theoretical battlegrounds and draws attention to differences highlighted by this split. It uses examples published in the main in the last five years and argues that a reconciliation between approaches is unlikely to take place. Instead, drawing on work by Turnbull (2000), this report argues that it makes more sense to understand contrasting approaches as representing different knowledge communities, telling very different stories.

## II Mapping contexts and 'transition tales'

Historians of cartography implicitly recognize that mapping practices and products reflect different contexts, cultures, times and places. The organization of the multi-volume, definitive *History of cartography* project illustrates this concern, with volumes arranged according to chronology and place (Harley and Woodward, 1987–). More detailed histories published recently include Edson (1997) and Cosgrove (2001).

Plans for the final twentieth-century volume in the *History* illustrate the continuing power of genre in shaping contextual research (Monmonier, 2000). The tradition of empirically grounded research – telling the practical story of different mapping practices – continues to be told in Mark Monmonier's work on cartocontrovery (1995), hazard mapping (1997), weather maps (1999) and electronic mapping of elections (2001). Detailed overviews of national practice include Perkins and Parry (1996).

The latest series of technological transitions through which mapping has passed have also exerted a powerful influence on theory. 'Transition tales' emphasize different aspects of these changes. For some, the organizational context is important and policy science is used to explain change (e.g., De Man, 2000; Taylor, 1998; Parry and Perkins, 2001), while for others the changing product mix that has emerged from the transition is more significant (e.g., Parry and Perkins, 2000). Others stress the profound changes in consumption brought about by the introduction of 'New Media' (e.g., Cartwright, 2001). Implicit in many of these tales have been notions of scientific realism.

Three contrasting papers originally presented at the ICA Conference in Ottawa in 1999 nicely illustrate different readings of these shifts. On the one hand, Goodchild (2000) argues for the emancipatory potential of the transition in a discussion of the Digital Earth project: here the emphasis is very much upon the technology. In an industry-focused response, David Rhind, then Director General of the Ordnance Survey, argues that governments and economics need to be considered, rather than purely focusing upon technologies (Rhind, 2000). A much more explicitly social reading of the transition is charted by John Pickles (2000), who critiques moves to interactivity. The surveillant potential of new mapping technologies profoundly alters their social role, and this transition tale theorizes the implications of the transition, rather than extolling its virtues.

### III Visualization and representation

The technological transition has encouraged an increasing focus on the development of scientific theory about how mapping and visualizations work (Kraak, 1998; Antle and Klinkenberg, 1999). It has been argued that the new flexibility offered by these approaches offers exciting potential for a renewed interest in spatial representation (Fairbairn *et al.*, 2001).

On the one hand, there continues to be scientific investigation of the cognitive principles underpinning representation. Cognitive research has increasingly sought a scientific alternative to cartographic communication and many researchers have used MacEachren's 'Cartography cubed' concept (MacEachren and Taylor, 1994) to develop theory in these areas, with an increasing investigation of the kinds of interface that are appropriate when visualizing, analysing, presenting or exploring with graphical spatial displays (e.g., Cartwright *et al.*, 2001).

Many of these initiatives are concerned with how to theorize the kinds of uses that may be made of new cartographies. Slocum *et al.* (2001), for example, argue that novel methods for visualizing geospatial data need to be developed within a theoretical cognitive framework and tested using usability engineering principles. Others have explored the role of visualization in knowledge discovery (e.g., MacEachren *et al.*, 1999; Gahegan *et al.*, 2001); discussed the creative potential of geobrowsing (Peuquet and Kraak, 2002); contrasted how different media may be used to visualize spatial data (Dransch, 2000); and explored the potential of collaborative approaches to decision making and explanatory visualization (MacEachren, 2000; 2001b). Two theme journal volumes published in 1997 and 2001 have sought to establish research priorities in this newly emerging world (MacEachren and Kraak, 1997; 2001).

Semiotic approaches, on the other hand, continue to build on Bertin's classic work to establish the syntax and semantics of signs in visualizations (Daru, 2001). For example, Koch (2001) has sought to develop and apply semiotic approaches to multimedia displays, while MacEachren (2001a) discusses how cognitive-semiotic approaches developed in *How maps work* have evolved.

These cognitive and semiotic approaches are increasingly applied to 'new' visualizations (Cartwright, 2001) described in three recent edited overview volumes. Cartwright *et al.* (1999) bring together a mix of theoretical and empirical papers concerned with the design and use of multimedia systems in cartography. Maps on the web (MacEachren, 1998) continue to be hugely significant and the contributors to Kraak and Brown (2000) discuss many aspects of this growing application area. Representations of virtual geographies are discussed and illustrated in Dodge and Kitchin (2001; 2002).

### IV Socially acceptable technology

In the mid-1990s, critical texts began to challenge the truth claims of the increasingly powerful and popular applications of GIS (Pickles, 1995; Schuurman, 1999). This theoretical critique also encouraged a consideration of the ethical responsibilities of the GIS researcher (Crampton, 1999) and by the millennium 'alternative' empirical mapping studies were much more established than in the early years of GIS research. The emancipatory potential of new mapping technologies has been reflected in work in

a number of different areas (King, 2002). One strand of this research explores the potential of counter-mapping as a technique for engaging in bottom-up village-led development initiatives in the third world (Peluso, 1995). Mapping has been central in the land reform process (Harris and Wiener, 1998; Anderson, 2000). Community-led GIS initiatives that integrate many different voices into mapped worlds have been explored (e.g., Ghose and Huxhold, 2001), and participatory multi-agency community-based information sharing in GIS is becoming increasingly common (e.g. Schroeder *et al.*, 2001). The democratizing potential of cartographic visualization has been discussed (Rød *et al.*, 2001).

On the other hand, the weaknesses and dilemma of counter-mapping have been charted (Walker and Peters, 2001; Hodgson and Schroeder, 2002), and western remote-sensing led approaches to land-cover mapping contrasted with the value of local knowledge claims (Robbins, 2001). The social context of technology-led GIS initiatives has been critiqued by Hoeschele (2000) and the potential of mapping tools to reify and reinforce existing discourse charted (Towers, 1997).

## V Evaluating maps: designs or texts?

Evaluation of the performance of maps and visualizations is an ongoing theme for researchers. Some studies have continued to adopt implicitly scientific approaches concerned with improving the efficiency of the way the map communicates (e.g., Stehman, 1999; Simley, 2001), whereas others have focused upon comparing different designs of the same map (e.g., McKendry, 2000). Comparative analyses of map designs in different genres have been carried out by Zeigler (2002), Collins-Kreiner (1997), Vujakovic (1999b) and Byer-Smith and Kent (1999). Others have focused upon differing user perceptions of mapping products (e.g., Rieger, 1999; Lohrenz *et al.*, 2000). A useful overview of qualitative approaches to mapping research was carried out by Suchan and Brewer (2000).

These empirical studies almost all implicitly take an atheoretical view of the map as a 'mirror of the world', or as part of a system of cartographic communication, largely isolated from social or historical contexts. Yet Brian Harley and Denis Wood had profoundly challenged the implicit assumptions underpinning these approaches well over a decade ago (e.g., Harley, 1988; 1989; 1990; Wood and Fels, 1986; Wood, 1992). Harley's work offered an alternative that appealed in particular to historians of cartography and inspired a series of theoretical revisionings (Smith, 1996; Edney, 1996; Jacob, 1996). Harley's key papers were recently published together in book form with a new critical introduction (Harley, 2001) and they continue to have a major influence on views of the map as a social construction (Wood, 2002). Attempts have been made to build upon Harley's critique and integrate his views with newer theorizing about representation and visualization (Crampton, 2001).

## VI Maps as power

Harleyan notions of maps as élite discourse continue to receive attention. The central role of mapping in imperial projects has been a continuing focus of attention

(Godlewska, 1995; Craib, 2000; Edney, 1997; Dodds, 2000; Given, 2002). There also continue to be Andersonian takes on the role mapping occupies in the construction of imagined communities of nationhood (e.g., Winichakul, 1994; Short, 2001; Crampton, 1996; Kosonen, 1999; Biggs, 1999; Peckham, 2000; Sparke, 1998) and on the role played by cartography in commercial élites (Brotton, 1998). Military power and its mapping has also received attention (Craib and Burnett, 1998; Vujakovic, 2002). The property relationship also continues to be mapped out in different contexts (e.g., Kain, 2002; Walker and Peters, 2001). Media power and the role maps play in reinforcing narrative have been the focus of work by Kosonen (1999) and Vujakovic (1999a). There have also been attempts to use methodologies established in critical geopolitics and to apply these to mapping (e.g., Foucher, 2000).

Meanwhile others have investigated the power-relationship in mapping for different social groups such as the plethora of work on tactile maps (see Perkins, 2002, for a review of the research in this area); physical disability (e.g., Vujakovic and Matthews, 1994); gender (e.g., Ritzlin, 2000); and ethnicity (e.g., Withers, 2000).

## VII Maps as performance

Increasing attention is being paid on how mapping might be theorized as performance (Gough, 2001). Attention focuses upon the process of mapping, rather than upon the mapped outcome and what it might represent. A map becomes part of a story, to be created and enacted, rather than simply serving as a discourse for the powerful. It becomes a subjective imagining, instead of an objective tool.

Arguments were advanced in the early 1990s for a process-based approach to mapping (Rundstrom, 1991) and have often been applied to mapping from non-western traditions (Harley and Woodward, 1987–; Lewis, 1998). Relationships to oral native traditions have been mapped out (e.g., Rundstrom, 1993; Mundy, 1996; Withers, 2000; Kelly, 1999; Toupal *et al.*, 2001).

Two significant strands of work from other disciplines have developed notions of the map as performance.

Artists who problematize relationships to the world by using mapping in their work reflect this concern with subjectivity and ambiguity and have been the focus of a number of recent studies. Schultz (2001) brings together many of the exhibitions that have focused on this area in the last decade and relates the work to the spatial turn in cultural studies, and in particular to Foucault, Deleuze and Guatarri and Broodthaers, while Curnow (1998) focuses upon conceptual, performative and installation artists using maps as devices in their work. Casey (2002) considers the complex association between landscape art and mapping. Others have emphasized individual artistic projects involving mapping such as Common Ground's Parish Map Project (Crouch and Matless, 1996) or the Chinese landscape tradition (Hu, 2000). The role that maps play in creative design has been explored by Corner (1998).

The uses made of mapping by artists emphasize the complex and nuanced ways in which the power relationship in mapping practices is exercised. In some contexts mapping practices may be used to subvert (Pinder, 1996), while in others it is the polyphonous potential of the map that is teased apart, with the same image representing many different views and used for many different purposes (Matless, 1998). A good

example of this interrelated, ambiguous and contested mapping can be seen in the interwoven world of identity and tourist spaces described by Del Casino and Hanna (2000). Intertextual approaches from cultural studies, reading, reciprocity and the body are also becoming popular in mapping studies (e.g., Bradshaw and Williams, 1999; Charlesworth, 1998).

The second field where a process-based critical take on cartography has been important is literary and historical studies. Starling (1998) highlights recent attention given to mapping in these discourses. The relationship between maps and ideas has increasingly been explored as the spatial turn in the humanities and social sciences has fostered new critical approaches to literature, culture, representation and identity. Only a sample of the many studies in this field will be illustrated here. Huggan (1994) was one of the first to explore the role of maps as metaphors, motifs and icons in recent post-colonial fiction. Other work has been more historical in emphasis and in particular interrogated imaginings of the early modern world, for example the papers in Helgerson and Woolway-Grenfell (1998) and Gordon and Klein (2001). In contrast, Cosgrove (1998) groups together a wide range of critical approaches to mapping from different times places and contexts, while Conley (1996) discusses the detailed relationships between maps and imaginings of sixteenth-century France.

Paradoxically, this process-based work has also increasingly come to focus upon the morphology of the map, and what it can reveal about lived experience. For example Moretti (1998) uses the positivist map display as a means of destabilizing plot devices in the modern European novel. Lilley (2000) has called for a renewed use of the map by cultural geographers, drawing attention to the creative power of mapping, and Soini (2001) makes similar claims for the potential of drawn maps in human research in landscape studies.

## VIII Knowledge spaces

John Pickles (2000: 9) recognized that 'it is fairly well established in critical studies (if not in practice) that the 'Cartographic anxiety' of modernist universalist cartography has been pretty much laid to rest. In its place is a much more nuanced and multiform understanding of cartographic practice and use and one in which the production of geographical images is understood as a thoroughly social product'. Nonetheless there remains a continuing and profound divide between critical studies and the hegemonic practice of scientific mapping worldwide.

Crampton (2001) argues for a rapprochement between Harleian notions of maps as constructions, and emerging theories of visualization. He seems to be calling for a 'politics of mapping' and suggests a number of possible research agendas, but does not really explain the political mechanisms that might bring these into being. Krygier (1999) argues that a theoretically informed practice is even more important in an age of multimedia visualizations, but also fails to explain how praxis reconciling social theory with day-to-day mapping will come about.

Why should we attempt to reconcile social constructionism with realist notions of science? There may well be ethical reasons for GIS to have a greater social concern than has sometimes been the case in the past (see Schuurman, 1999, for a summary of these arguments), but the concerns of research into visualization are essentially scientific and

applied, with research interests likely to focus upon essentially apolitical notions of *how* visualizations might work. In contrast, critical approaches will inevitably be more concerned with the power of the mapping process and will often reject notions of progressive scientific investigation. Recent calls (Sismondo and Chrisman, 2001) for a repositioning of the philosophical basis of mapping to take into account deflationary philosophy do not offer a framework that would reconcile modernist science and postmodern critique.

Instead David Turnbull's work on knowledge communities offers us a plausible explanation for the continuing divide in research into cartography and visualization (Turnbull, 2000). He argues that there are plural and local knowledges, complex and heterogeneous in their construction and composition. We should expect research to continue to be locally contingent and messy and only anticipate reconciliation if a sufficient critical mass of researchers with shared concerns emerges. Different research communities talk different languages, draw upon different assumptions and do not usually collaborate. The lack of cross-citation suggests reconciliation is unlikely in the near future.

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