Applied Geography 71 (2016) 24–31

Contents lists available at ScienceDirect

Applied Geography

journal homepage: www.elsevier.com/locate/apgeog

Does base map size and imagery matter in sketch mapping?

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ARTICLE INFO

Article history:
Received 19 September 2015
Received in revised form
2 April 2016
Accepted 7 April 2016
Available online 28 April 2016

Keywords:
Sketch map
Cognitive map
GIS
Base map
Fear of crime
Behavioural geography

ABSTRACT

Sketch mapping has been an important data collection technique for geographers since the 1960s. Structured sketch mapping requires participants to draw spatial data onto a base map containing cartographic information, in order to assist with spatial referencing. A concern that base map characteristics may influence sketch map content has been raised repeatedly in the research literature. However little scholarly attention has been paid to systematically testing the effect of base maps.

This paper aims to test the effects of base map size and imagery on structured sketch maps of avoidance behaviour in university students. Using an experimental design, 272 sketch maps were compared for differences in: sketch map style; the location of collective avoidance hotspots; the extent of the reported area avoided; the number of reported areas avoided; the intensity of avoidance; and the tortuosity of sketch map features.

No significant differences were found between base maps in sketch map style or the size, intensity or number of areas avoided. Provision of larger base maps caused respondents to draw more detailed sketch maps. Collective avoidance hotspots shifted location slightly between base maps, probably due to difficulties interpreting aerial photographs.

Sketch map content appears to be remarkably robust to changes in base map. Base maps appear to assist respondents with spatial referencing rather than cueing respondents to report specific features.

1. Introduction

Sketch mapping is a widely used data collection method whereby respondents are invited to record spatial data in map form. Sketch mapping studies originated with investigations of how people come to understand their urban environments (Downs & Stea, 1977; Golledge & Stimson, 1997; Lynch, 1960), but more recently have come to include a diverse range of applied concerns. Sometimes described as a process of externalising a person's cognitive map or internally-held spatial representation of knowledge (Pearsall, Hawthorne, Block, Walker, & Masucci, 2015; Tolman, 1948), sketch mapping usually utilises one of two methods. So-called 'free recall' (Evans, 1980) or 'normal' (Kitchin, 1996) sketch mapping is conducted with plain unmarked paper, onto which respondents are invited to draw a map. The second method, 'structured sketch mapping' (Boschmann & Cubbon, 2014; Pocock, 1976), invites respondents to draw on a consistent base map, expediting integration with Geographic Information Systems (GIS) due to their use of a consistent spatial referencing scheme.

Many authors have voiced a concern that base map size may bias the sketch maps drawn by respondents (e.g. Day, 1976; Downs & Stea, 1977; Evans, 1980; Gieseking, 2013; Gillespie, 2010; Kitchin, 2000; Pocock, 1976; Robinson, 1981; Saarinen, 1988; Tu Huynh & Doherty, 2007). This paper addresses this concern in the context of structured sketch mapping, as it has frequently been suggested that the base maps used in structured sketch maps will impact on the sketch maps that respondents draw (e.g. Brennan-Horley & Gibson, 2009; Curtis et al., 2014; O'Neill, Brennan, Brereton, & Shahumyan, 2014). This paper explores the influence of base maps on the style and content of structured sketch maps, using a case study of fear of crime on an Australian university campus.

1.1. Background

Sketch mapping has been an important tool for eliciting geographic information regarding spatial behaviour and spatial cognition since the publication of Lynch's seminal 1960 book *The*

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http://dx.doi.org/10.1016/j.apgeog.2016.04.001
0143-6228/

Image of the City. Whilst a diversity of terms such as 'sketch mapping', 'cognitive mapping' and 'mental mapping' (Kitchin & Blades, 2002) have been used to describe sketch mapping exercises, each shares the common goal of attempting to capture spatial representations of environmental information (Golledge & Stimson, 1997). In general, during sketch mapping exercises respondents are asked to draw or annotate a map or other spatial representation of their environment (Walmsley & Lewis, 1993). Pioneering cognitive mapping studies were primarily concerned with exploring the structure of 'maps in the minds' of respondents and the processes by which they orient themselves. As Kitchin and Freundschuh summarised (2000, p. 1), 'cognitive mapping research seeks to comprehend how … people learn, process and use spatial information that relates to the environment that surrounds them.'

Despite the abandonment of the behavioural geographic ambition to understand how people come to know their environment during human geography's 'cultural turn' (Argent & Walmsley, 2009), sketch mapping itself as a method has experienced something of a renaissance in recent years. Sketch mapping has been adopted by a wide research community as an applied method for eliciting spatial information, including by post-positivist researchers who might reasonably be expected to object to the behaviouralist assumptions ascribed to by the pioneers of the method (e.g. Gieseking, 2013). In consequence, much recent research applied sketch mapping to investigate a wide variety of geographical phenomena, shifting the research focus toward application rather than the exploration of internal representations. Scholarly approaches to the use of sketch mapping have taken diverse turns, incorporating ethnographic (e.g. Boschmann & Cubbon, 2014; Gieseking, 2013; Jung, 2013), participatory (e.g. Brown, Raymond, & Corcoran, 2015; Dickin, Schuster-Wallace, & Elliott, 2014; Elwood & Leitner, 1998) and sophisticated statistical elements (e.g. Golledge & Stimson, 1997; Kitchin & Blades, 2002).

What might be termed the 'applied turn' in sketch mapping research coincided with the popularisation of Geographic Information Systems (GIS) in the 1990s. Consequently, sketch mapping during this period began to be integrated with GIS, with several researchers emphasising the ontological compatibility of these techniques. For example, Golledge and Stimson (1997) asserted that cognitive maps represent an 'internal GIS', whilst Kitchin (1996) noted that the typical graphical elements of sketch maps, namely points, lines and areas, have a strong similarity to the building blocks of the vector data structure used in GIS. In line with Goodchild's (2004) argument that there is enormous potential for the use of GIS in social research, sketch mapping has formed an integral part of many GIS-based initiatives in areas as diverse as emergency management and hazard planning (e.g. Alexander, 2004; O'Neill et al., 2014), 'coolness' and creativity (e.g. Brennan-Horley & Gibson, 2009; Gibson et al., 2012), the sense of 'belonging' amongst minority groups (Jung, 2013; Pearsall et al., 2015), land use planning (Bauer, 2009; Golobic & Marusic, 2007) and community safety (Ceccato & Snickars, 2000; Dennis, 2006; Doran & Burgess, 2012; Kohm, 2009).

Given the recent proliferation of applied sketch mapping research, it is somewhat surprising that relatively little scholarly attention has been paid to the sketching mapping *methods* in applied contexts (Curtis, 2012). Perhaps due to a lack of contemporary methodological guidance, some authors encounter avoidable problems. To give one example among many, Bauer (2009) identified a range of difficulties associated with using a GIS to integrate sketch maps constructed without the use of a common base map. Bauer suggested that while it was possible to retrospectively triangulate features from freeform sketch maps during the digitizing process, some uncertainty about precise locations is inevitable, as is some interpretive bias from the computer analyst entering the data. Difficulties such as these could easily have been avoided if methodological guidelines for the design of sketch mapping studies were available, but as Gieseking (2013) points out, few scholarly resources of this kind exist.

The lack of guidelines may be in part due to an insufficiency of evidence on which to base recommendations. In particular, the use of base maps in sketch mapping research raises concerns about potential map-induced bias that have rarely been systematically addressed. Highlighting shortcomings in the methodological literature, Curtis at al. (2014, p.268) specifically call for basic research to address and refine practices to enable the continued development of methods for the integration of sketch mapping and GIS. They note that the potential for both the imagery and scale of base maps to influence the content of sketch maps has long been recognised but has rarely been tested. Evans (1980), for example, while reviewing free recall sketch mapping studies, voiced a concern that the size of the drawing surface would influence the relative size of features, based on the order in which the respondent drew the objects. However, neither Evans (1980) nor the more contemporary geographers who have raised similar concerns (e.g. Curtis et al. 2014) have systematically tested the effect of base map size on sketch map style or content.

In the case of base map imagery, Kitchin (1996) tested the effect of providing different amounts of spatial cueing on the accuracy of respondents sketch maps. Kitchin found that more detailed base maps assisted respondents to produce more 'accurate' sketch maps by providing spatial cues to anchor points and familiar locations. However, because Kitchin's base maps were intended for testing behavioural hypotheses about spatial cognition, they contained minimal spatial information and bore little resemblance to the type of base maps that applied geographers might use in structured sketch mapping. As such, despite Kitchin's (1996) research, it remains unclear if the choice of cartographic imagery in base maps bias respondents. Rather than unduly biasing respondents' sketch maps through spatial cueing, an alternative hypothesis suggests that base map imagery may merely assist respondents to apply a consistent spatial reference when drawing their mental maps. Fig. 1 sets out this question schematically. If base maps exert a prejudicial effect on the content of the sketch map that respondents draw, then we would expect that base map to trigger specific recollections which bias the resulting sketch map (panel A). Specifically, the cartographic features of base maps may remind the respondent of particular spatio-cognitive anchor points, prompting the recollection of specific locations and thus their over representation in the resulting sketch maps. If, however, base maps simply serve to assist with the spatial referencing of cognitive maps, we would not expect to see a bias according to base map imagery (panel B). From an applied perspective, model A would result in different types of sketch maps resulting from different base maps and, potentially, different hotspots emerging, whereas model B would generate consistent responses and individual sketch maps would not vary in type according to different base maps. Such concerns prompted Curtis et al. (2014) to call for research to test the effect of base map variations of sketch maps.

In this paper we respond to Curtis' call for research and set out to test the effect of different types of base maps on information elicited during sketch mapping exercises. We assess whether collective outputs generated within a GIS vary according to the type of base map provided to respondents. We explore these effects in the context of fear of crime, which has seen an emergence of GIS-based mapping studies in recent years (Boschmann & Cubbon, 2014; Ceccato & Snickars, 2000; Curtis et al., 2014; Dennis, 2006; Doran & Burgess, 2012; Doran & Lees, 2005; Kohm, 2009; Lopez & Lukinbeal, 2010; Matei, Ball-Rokeach & Qiu, 2001; Nasar, Fisher,