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"Say What You See": Preliminary Observations on the Role of Spatial Cognitive Mapping in Retail Locational Planning

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Biography

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Abstract

It has become apparent in recent years that the planning and management of location has become increasingly important to outlet-based retail and service organisations. Clearly, the subjective, 'lived' experiences of locational decision-makers impinge greatly on the locational decision and cannot be wholly supplanted by a computer. This paper seeks to explore how locational decision-makers visualise potential retail locations through a preliminary discussion of the role of spatial cognition and cognitive mapping. Spatial cognition, an established sub-field of both environmental psychology and behavioural geography, refers to how individuals internally reflect and (re)construct space and shape such information in the form of the cognitive map. The researcher can subsequently glean the nature of the cognitive map through the medium of the self-drawn sketch map. In a spatially-dependent field such as locational decision-making, it can be assumed that differences in locational planners' spatial cognitive abilities may have a significant impact on the subsequent choice of where to locate. Here, literature pertaining to spatial cognition and cognitive mapping is discussed, prior to discussion of appropriate methods for capturing the internal representations of locational actors in this particular research context.

1. Introduction: the Research Context

Multiple store-based retailing in the UK has in recent years been subject to a whole host of competitive pressures. The effects of a keen recession almost a decade earlier are still felt, and a number of other factors, including the advent of electronic commerce (Hart *et al*., 2000; Pavitt, 1997; Rowley, 1996; 1998), the entry of foreign competitors into the British market (Bennison and Gardner, 1995; Duke, 1993; Godley and Fletcher, 2000, 2001; Moore, 1999; Moore *et al*., 2000), a reduction in consumer confidence and High Street spending, and increased government regulation (Marsden and Wrigley, 1995), especially in the grocery sector (Flynn *et al*., 1999; Wrigley, 1993; 1998), are clearly manifest. On-going stresses in retailing such as these can only add weight to the argument that the strategic importance of outlet locations, where significant amounts of retail capital are 'sunk' (Guy, 1994; 1999), cannot be negated.

The current programme of research seeks to assess the role of Geographic Information (GI) in retail locational planning. GI has been defined as 'any information which can be related to specific locations on the Earth' (Department of the Environment, 1987, page 7) and is 'sometimes referred to as geographic data, geospatial information or spatial data' (Department of the Environment, Transport and the Regions, 2000, page 2). Although extremely prevalent in society, with some commentators suggesting that 90 per cent of all commercial data are geographic in nature (Moloney *et al*., 1993), the benefits of GI use have not been recognised either in business in general or in retail marketing in particular. This is despite the fact that awareness of the geographic dimension to data, and the subsequent mapping of such data, can aid a number of crucial retail marketing decisions pertaining to store location, including the position of customers, catchment delimitation and differential merchandising practices across locations.

As early as 1984, it was apparent that locating a new store in the United Kingdom was becoming ever more difficult, as the amount of sites available for retail development seemingly 'dried up' (Bowlby *et al*., 1984a; 1984b). Government planning policy, especially in the various guises of Planning Policy Guidance (PPG) Note 6, has since then sought to discourage retail development away from town and

city centres (Department of the Environment, 1996). PPG 6 emanates from central government and advises local planning authorities, who commonly decide on applications, to grant permissions for retail development first and foremost at locations close to the centre of towns, thereby directly impacting on the out-of-town opening programmes previously common to many multiple retailers. Despite the impact of PPG 6, it has also become clear that, in the grocery sector at least, some retailers have managed to maintain their market shares through the development of outlets at alternative sites (Pal, 1999) and through individual and trade association submissions to central government during policy making processes (Pal *et al*., in press).

A key feature of contemporary locational planning is the need to manage holistically the store portfolio, thereby focusing on more than just the opening of new outlets (Bennison *et al*., 1995). More so now than ever, management of a multiple retailer's estate routinely involves the types of decisions referred to as the '6 Rs of the location mix' (Hernández *et al*., 1998) which are listed here as follows: roll-out - increasing floorspace in an existing store or opening a new store; relocation - moving to a new site due to the close proximity of two stores or the availability of a new retail pitch; rationalisation - the closure of individual stores or the selling of divisions; refascia - altering the image of outlets by changing their name or appearance; refurbishment - updating fittings; and remerchandising - altering the product range of a retail location and tailoring the offer to the local consumer.

The paucity of more obvious sites for the location of retail outlets has in part led to more objective and scientific methods of locational decision-making becoming apparent. Whereas before, decisions were often taken on the basis of subjective and intuitive 'rules of thumb' alone (Hernández *et al*., 1998), characterised by Rogers (1987, page 74) as involving questions such as '[i]s Hartlepool as nice as Wilmslow?', more objective and scientific methods of locational planning are now commonplace, but by no means universal (Hernández and Bennison, 2000). Essentially there exists an 'art and science' of locational decision-making, and whilst recent research has established that only 13 per cent of retail organisations surveyed relied solely on experience to support locational decision-making (*ibid*.), it is also the case that 'the "retail nose" may remain the ultimate arbiter' (*ibid*., page 365).

Sophisticated methods of aiding locational decision-making include the use of techniques such as neural networks and Geographical Information Systems (GIS), the latter of which are powerful computer-based systems that allow the presentation and visualisation of geographic data. Decreases in the cost of such technologies have resulted in GIS becoming more widely implemented within the locational planning departments of multiple retailers. GIS have the potential to be utilised in all aspects of the locational decision-making process, not just the opening of new stores. In a retailing context, some research has assessed the role and potential of GIS as a decision support tool (Clarke and Clarke, 1995), especially in the 'spatially dependent' field of locational decision-making and planning (Benoit and Clarke, 1997; Clarke and Rowley, 1995; Hernández and Bennison, 1997).

Coupled with a rise in the availability of technology has been a marked increase in the type and amounts of data from both within and outwith retail organisations that are now at the disposal of decision-makers. Such data can be forthcoming from loyalty card transactions (Evans, 1999), EPoS scanners (Baron and Lock, 1995) and external agencies that provide geodemographics, product data and census information (Harris, 1998; Hernández *et al*., 1995). The challenge to decision-makers at present lies in effecting viable methods for turning this 'data mountain' into information, namely 'data with meaning'.

Within the academy, existing knowledge is such that the role of GIS and other more scientific techniques to support retail locational decision-making has, in the UK context and current timeframe at least, been established and conceptualised (Hernández and Bennison, 2000; Hernández *et al*., 1998), as has the role of organisational culture with respect to such techniques (Hernández, 1998). The prevalence and position of GI in the locational decision-making process, and the (often subjective) methods by which such information is viewed, encoded, and used has, however, not been adequately addressed to date. Although previous research has recognised the role of (often successful) decisions based on intuition and 'gut feel' (Guy, 1980; Rogers, 1987), it is only recently that researchers have systematically begun 'to try to capture, represent and examine the qualitative or intuitive judgement of executives' (Clarke *et al*., 2000, page 267). Utilising cognitive mapping techniques from the management sciences literature, Clarke *et al*.'s (2000) and

Clarke and Mackaness' (2001) research has sought to unearth the spatial knowledge of retail executives through requesting participants to recall the elements of a 'successful' retail site. Composite maps of all participants' schemata were then constructed. In spite of these efforts, a number of significant research questions concerned with GI, such as the cognising processes thereof, still remain. The role of spatial cognition, a crucial aspect of human existence which refers to 'the knowledge and . . . cognitive representation of the structure, entities and relations of space' (Hart and Moore, 1973, page 248), and *spatial* cognitive mapping has to date not been adequately evaluated in the context of retail locational decision-making.

Specific Aims of the Research

In the light of literature reviews undertaken, as outlined briefly above, the specific aims of the current programme of research are as follows:

1 To ascertain the relationship between Geographic Information and retail organisations' locational decision-making activity.

2 To establish the nature and extent of GI collection by UK multiple retailers, and to evaluate its use within decision-making activity.

3 To determine the role of spatial cognition with respect to the use of GI within locational decision-making behaviour, and to represent this through a conceptual framework.

The purpose of this paper is to present some preliminary observations regarding spatial cognition and cognitive mapping (pertaining to Aim 3 of the research) which will be considered in forthcoming case study research. Key themes emerging from the exploratory and descriptive stages of the research, including the role of GI in the decision-making process, barriers to GI use and adoption, will be further explored in the latter stages of the research. It is envisaged that this will then enable the construction of a theoretical framework to explain the use of GI in locational decision-making.

2. Spatial Cognition: An Introduction

> "Spatial cognition has become an increasingly important area of study since it represents a major type of human knowledge with considerable theoretical and practical significance."
>
> (Golledge, 1990, page 156)

Spatial cognition plays a vital role in the lives of almost every organism on the planet. The way in which space is both perceived and navigated permeates all aspects of life. Consider the widespread use of spatial metaphors and narratives such as 'over there', 'behind you', in everyday speech. The preponderance of such terms is just one example of the importance of spatial processes, however latent they may be, to life itself. The importance of the phenomena has resulted in the growth of a sub-field of geography known as behavioural geography, which has often focused on such wide-ranging fields as spatial abilities, spatial decision-making, and locomotion, wayfinding and navigation (Gärling and Golledge, 1993).

In this paper, I introduce spatial cognition and its subset cognitive mapping, by necessity drawing on literature from psychology and geography. A number of examples of applications of work in this field are then touched upon. Different types of geographic and spatial knowledge are then discussed, as is spatial ability and the different variants, such as age and gender, that can affect this. The paper then continues by considering how the role of spatial cognition could be incorporated into the current research project by discussing work on spatial cognition in a retail setting, and concludes with a brief discussion of the feasibility of measuring spatial cognition as part of this research project. The multiplicity of terms surrounding the topic, including spatial knowledge, spatial ability, spatial memory, spatial perception, and spatial orientation (Gentry and Wakefield, 1991) reflects the wealth of literature and the breadth of the field. Although detailed, the discussion presented here is by no means exhaustive.

3. 'Maps in minds': Spatial cognition and cognitive mapping

A commonly accepted, although somewhat longwinded definition of spatial cognition has been given as follows:

> "[spatial cognition is] the knowledge and internal or cognitive representation of the structure, entities and relationships of space; in

> other words the internalized reflection and reconstruction of space and thought"
>
> (Hart and Moore, 1973, page 248)

Spatial cognition is considered to be part of environmental cognition, a 'way of seeing' that also incorporates other non-spatial elements such as emotions and perception. Cognitive mapping, in turn, is a subset of spatial cognition and has been defined by Downs and Stea (1973, page 9) as:

> "a process composed of a series of psychological transformations by which an individual acquires, stores, recalls, and decodes information about the relative locations and attributes of the phenomena in his [*sic*] everyday spatial environment"

Although both spatial cognition and cognitive mapping have understandably been of considerable interest to psychologists in the past, research in these areas has also diffused into the realm of other academic disciplines including geography Kitchin *et al*., 1997). Geographers' interest in spatial cognition and cognitive mapping is understandable given the inherent desire and need to study all things spatial. Current work in this area of geography grew from a (partial) rejection of the pure spatial science of the Quantitative Revolution[1] (Rushton, 1993) and was also stimulated by Lynch's (1960) seminal work *The Image of the City*. This book argued that built environments could be decomposed into sets of two-dimensional components such as landmarks, nodes, paths, boundaries, and so forth. These could then be reconstructed from memory, such as in the form of sketches of what respondents knew of places. These sketches are invariably in the form of points, lines and areas as typified in cartographic maps.

The impact of this work was significant and contributed to the spawning of a large field of work that concentrated on spatial cognition, spatial decision-making, behavioural geography and environmental psychology in some form or another. Golledge and Timmermans' (1990) and Timmermans and Golledge's (1990) two-part review of work in the field produced an overview that drew on some 700 cited sources. The fact that these works concentrated only on applied work from the last

[1] Although behavioural geography does appear to have been characterised by a positivist nomothetic ethos and outlook on many occasions.

decade and, by the authors own admission (Golledge and Timmermans, 1990), neglected discussion of work on a number of other major areas including emotional response to environments, perceived threat from pollution and attitudes towards nuclear threat; signifies the huge amount of literature that can be classed as residing under the heading of 'behavioural geography'.

This paper now turns to consider briefly work that has been carried out into the role of spatial cognition in the use of Spatial Information Systems (SIS) and in cognitive mapping. Work by Medyckyj-Scott and Blades (1992) and Medyckyj-Scott and Hearnshaw (1993) has recognised the importance and relevance of spatial cognition to the design of Spatial Information Systems (SIS) and GIS, highlighting the importance of human cognitive processes to the functionality of such technologies. The human-computer interface, and the necessary spatial processes that govern this field, are a relatively new area for research into spatial cognition, however. Mental mapping and cognitive mapping have instead long been a focus of research in behavioural geography (Downs and Stea, 1977). Some of this work has focused on the fact that encoding information in a cognitive map relies on similar processes to the encoding of information that takes place when information is encoded in a cartographic map (Lloyd, 1993). More recently, Kitchin (1996) has suggested a reworking of the cognitive mapping schemata in order to give greater credence to research into the field. To that end, he provides a new conceptual schema that suggests the integration of psychological and geographical theory, if the discipline is to advance. A more practical and applied aspect to cognitive mapping also appears to be emerging (Jackson and Kitchin, 1998). As cognitive mapping 'involves the description of the way in which individuals store and process geographic information' (Kitchin and Fotheringham, 1998) it is this facet to spatial cognition that is most relevant to the current research into the use of Geographic Information by locational decision-makers.

4. Geographic knowledge and variants in spatial ability

Golledge (1990) and Mark (1993) have summarised the different types of geographic and spatial knowledge into a three-fold classification. The lowest order type of geographic knowledge is that which is known as declarative geographic knowledge. This is knowledge concerned with geographic facts or any knowledge of geographic space. This could consist of statements such as 'Manchester is in England' or 'Quito is the capital of Ecuador'. Such knowledge is regarded as context free, and does not necessarily have to be acquired by actual knowledge of the place in question. A subject may know that Manchester is in England, thereby possessing declarative geographic knowledge, but s/he would not necessarily be able to locate the city on an atlas.

The second type of geographic knowledge is known as procedural geographic knowledge. This is evidenced by the ability of someone to find her or his way from one place to another. It is procedural in the sense that it refers to the ability of a person to perform a task, such as navigation. The next type of knowledge referred to in the literature is configurational knowledge. This is knowledge which is 'map-like and often has a Euclidean geometry' (Mark, 1993), although it does not have to be perfect. At a basic level, configurational geographic knowledge can involve knowledge of the connections between objects, as in topology. At a more advanced level, this knowledge can manifest itself in the ability of a subject to estimate distances and directions as on a map. Kitchin (1997; 1998) has investigated configurational knowledge of geography students in Swansea, noting the importance of using a number of tests to examine this, as results can vary widely if methodological rigour is not introduced into analysis of cognitive maps.

A debate appears to be ongoing in the literature at present surrounding the acquisition of these different types of geographic knowledge (Freundschuh, 1991; Golledge, 1992) and clearly, different cognitive processes govern the acquisition of the different types of knowledge. Some commentators contend that configurational (or map) knowledge cannot be acquired from procedural (or route) knowledge (Lloyd, 1989) whilst others argue that map knowledge *can* be gained from route

knowledge (Thorndyke and Hayes-Roth, 1982). Golledge *et al*. (1995) have provided evidence to show that route knowledge is more accurate with the aid of a map, whilst Tkacz (1998) has stressed the advantages in gaining configurational knowledge from a map prior to performing a wayfinding task.

Differences in the acquisition of geographic knowledge may be a function of the scale at which these experiments have been carried. The Lloyd (1989) study was carried out at the level of the city whereas the Thorndyke and Hayes-Roth (1982) work was carried out within an office block. If it is assumed that map knowledge *can* be gained from route knowledge, this could have significant implications for the study of retail locational decision-making activities. The retail organisation that relies 'merely' on experience and 'gut-feel' whilst shunning new technology such as GIS has been long decried in the literature (see, *inter alia*, Rogers, 1987). Perhaps routine site visits to prospective locations are sufficient in order to acquire geographic knowledge. The executive that drives home along the same route each day to and from work may in fact be gaining detailed 'birds-eye' configurational knowledge and information of an area, which in turn may reduce the need to invest heavily in supposedly 'miracle' technical solutions.

The next part of this section considers the variants that can determine spatial ability and geographic knowledge acquisition of an individual and will highlight the various variables that need to be accounted for in the current programme of research. Gender appears to play an important part in terms of brain processes in general, and more specifically in terms of spatial cognition (Hausmann *et al*., 2000; Kimura, 1992). In terms of pre-eminence however, the literature is not conclusive and as summarised by Golledge and Stimson (1997, page 546),

> '[f]or every spatial aptitude task on which men perform at a superior level, other spatial aptitude tasks on which women's performance is superior can be cited'

Women appear to do better at tasks involving landmarks, which is probably a consequence of the traditional gender roles prevalent during hunter-gatherer evolutionary stages. Men used fewer landmarks when hunting as compared to women who stayed by the dwelling and had to have knowledge of a smaller home environment including sites for water collection, foraging and the location of

relatives. In addition to the effects of landmarks, men also tend to have a more detailed knowledge of world geographic facts.

Empirical research carried out in recent years has highlighted some of the differences that exist in spatial abilities between men and women. Dabbs *et al*. (1998) found that men were 'more abstract and Euclidean' (*ibid*., page 89) in the giving of directions, using cardinal terms and miles more than women, who tended to rely on left-right terms and landmarks. Men and women exhibited similar object location skills, when a 'Kim's Game' type experiment was carried out. Brown *et al* (1998) used 'map-present' direction giving-paradigm in which subjects had to give directions to a stranger whilst looking at a map. No significant differences between the sexes were reported in this experiment, but differences in age did emerge. Middle age subjects used more direction-giving strategies than younger subjects in this study.

A further factor that may affect spatial ability is the amount of geographic training that a subject has received, although as recently as eight years ago Golledge (1993, page 41) postulated that

> 'there is little research that has tested thoroughly whether those exposed to geographic training have greater success in sustaining spatial knowledge than those who have not been so exposed'

An exception to this comes from Stern (1983) who provided evidence that geography students perform better than non-geography students at tasks including the estimation of distances, locations, and some connections.

5. Spatial Cognition in a Retail Setting

The field of retailing appears to have been an important focus of work on the phenomenon of spatial cognition and associated concepts. The vast majority of work surrounding spatial decision-making, spatial abilities and spatial perception in a retail setting seems to be mainly from the point of view of the consumer (Golledge and Rushton, 1976; Hackett *et al.*, 1993; Mackay and Olshovsky, 1974; Timmermans, 1993; Wrigley, 1980). Timmermans (1993), for instance, provided a review of spatial shopping behaviour under headings such as 'consumer perception and cognition of retail environments' and 'consumer attitudes and preference structures for retail environments'. Much of this work appears to rely mainly on statistical modelling

(see, for example, Timmermans, 1980), and therefore largely generalises mathematically about behaviour, an approach that is not deemed desirable for the present programme of research.

There appears to be a paucity of research that has focused on the spatial cognition or spatial ability of the retailer as a decision-maker. Golledge and Stimson's (1997) detailed overview of work in behavioural geography, '[a] substantial book' in the words of one reviewer (Johnston, 1998, page 582), could only muster some two pages and two cited works from within its 619 pages that dealt with the issue of '[r]etailer's cognition of store and shopping centre environments'. Some work has been carried out by Halperin *et al*. (1983), however, who probed the 'entrepreneurial cognitions' of retail environments in four shopping centres in Victoria, Australia. This research considered how owners of small and medium sized outlets cognised the shopping centres where they operated, using statistical techniques such as Multi-Dimensional Scaling (MDS)[2]. Little work appears to have been carried out on the cognitions of those operating a number of stores, or from the point of view of the whole store portfolio. Despite being made 18 years ago, the following assertion by Halperin *et al*. (1983) would still appear to hold true today:

> '[t]here is . . . a critical need to examine entrepreneurial, as well as consumer, cognitions of the retail environment. Unquestionably, more extensive work remains to be undertaken if we hope to provide meaningful explanations of issues related to entrepreneurial spatial behavior'
>
> (*ibid*., page 5)

The next section of the paper therefore considers how spatial cognition could be explored in subsequent case study research.

6. Discussion and Conclusion: Ways of Measuring Spatial Cognition and Consequences for the Present Research Project

In-depth case study research is envisaged within 3-4 UK retail organisations in order to evaluate further the role of GI within locational decision-making and to investigate the role of spatial cognition with respect to the use of GI. The case study approach is appropriate here as it gives an holistic view of phenomena and 'is a useful strategy

[2] See Harman and Betak (1976) for a detailed description of MDS.in this context.

for studying processes in companies and . . . for explanatory purposes' (Gummesson, 2000, p 85). In terms of conceptualisation, Eisenhardt (1989, p 548) notes that building theory from case studies 'is particularly well-suited to new research areas or research areas for which existing theory seems inadequate', a statement that would seem particularly appropriate to this area of study.

From the literature it becomes apparent that a number of different methods of measuring spatial skills have been utilised in the recent past. Many of these are quantitative in nature and rely on the direct measurement of spatial ability. Eliot and Macfarlane Smith's (1983) *International Directory of Spatial Tests*, for example, presents a detailed discussion of almost 400 different tests. Such tests have been used in a number of studies (Thorndyke and Hayes-Roth, 1982; Lloyd, 1989; Gentry and Wakefield, 1991). It would appear from the literature that more qualitative approaches to the measurement of spatial cognition have to date been lacking and are worthy of future research, as are applied applications as opposed to theoretical ones (Kitchin, 1994; 1997). A favoured early method of probing subjects' spatial cognitions involved determination of mental and cognitive maps via the use of sketch mapping. Tobler (1976, page 80) notes that 'one can elicit information concerning locational configurations from people and that these . . . [are] sufficiently like conventional maps that they can be compared'. Pocock's (1975) comparative study of the mental maps of residents, visitors and summer tourists of Durham City used such an approach. Respondents were asked to draw a map of the city for a stranger, without recourse to a map or guide. Not surprisingly, residents' and frequent visitors' sketch maps were more detailed than day-trippers' sketch maps.

A further sketch mapping technique was utilised by Lee and Schmidt (1988) in their study of the evolution of urban spatial cognition in Guangzhou, China. Changes in the features of sketch maps were analysed and it was noted that 'urban cognition evolved slowly' (*ibid.*, page 350). Although sketch mapping appears to often be utilised at the level of the city, as opposed to a higher order level such as the region or nation state, some sketch mapping has been carried out which has looked at students' geographical knowledge of the whole world (Pinheiro, 1998; Saarinen, 1973). Pinheiro (1998) conducted tests using sketch-mapping techniques to assess Brazilian students' knowledge of the Earth. Subjects were asked to picture

cognitively the world and to then draw the image that presented itself. Subsequent analysis evaluated which countries were included. Sketch mapping can be a valuable technique for assessing geographic knowledge and ability, provided it is not used in isolation (Blades, 1990). The respondents in the present study do not all come from the same parts of the country, so comparisons of sketch maps of one particular town are not possible. Asking respondents to sketch a map of their location of their stores could be feasible, were it not for the fact that literally hundreds of outlets would have to be incorporated in some instances. Asking respondents to draw their visions of the world would be a possibility, although the value of such responses is questionable as only routine declarative geographic knowledge would be displayed.

Cognitive mapping perhaps provides the most relevant area of spatial cognition to the current project, as it relates to how geographic information (the focus of this research) is encoded and visualised in the minds of individuals. The need for the present programme of research to focus on the macro level as opposed to the micro level (i.e. intra-store) also needs to be recognised. Store portfolios can be considered in terms of the individual outlet, that is at the monadic level (Hernández *et al*., 1998), in which case cognitive mapping could be a viable option involving some sort of testing of the retail decision-maker's cognition of one particular store and its surrounding environment. It is intended, therefore, to utilise a sketch mapping technique to ascertain how locational planners visualise the geographical situation of an 'ideal store'. Such a stated preference approach has been used by Clarke *et al*. (2000) and Clarke and Mackaness (2001) who have used *aspatial* cognitive mapping techniques to ascertain executives' intuitive judgement regarding store location. The approach suggested here furthers this earlier work through employing a *spatial* cognitive mapping technique. Essentially a phenomenological approach is being adopted: it is proposed that this exercise will form part of a semi-structured interview undertaken with all individuals responsible for the locational decision-making process in a given retail organisation (see also Kitchin, 1997, who has adopted this approach). In order to complement further the cognitive mapping technique (and answering Blades', 1990, concerns that sketch maps should not be used in isolation), it is hoped that data gleaned from the interviews will also aid understanding of how store locations are intuitively cognised by practitioners.

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