

# 13 Going over old ground: GIS, archaeological theory and the act of perception

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## 13.1 INTRODUCTION

This paper is an attempt to redirect and refocus the recent academic discussion about the application of GIS technology onto some broader theoretical issues. These issues, it is argued, have tended to be obscured within the detailed methodological discussions of the last few years, with the result that GIS applications in archaeology are now characterised by a largely hidden agenda. This is found to encourage a functionalist approach to archaeological explanation, with all the associated explanatory weaknesses that have caused many archaeologists to reject simple functionalism. The notion of GIS as a “theoretically neutral” tool is considered and found to be untenable when the influence of similarly important technological advances on archaeological theory is considered.

As a general solution to these problems, it is proposed that archaeologists using GIS may wish to focus attention more on the act of perception, and thus use GIS in a new, and potentially more productive manner. As an example of this type of approach, the specific problem of definition of study areas is considered, and two methods deriving from different contexts is proposed.

## 13.2 ARCHAEOLOGICAL THEORY AND GIS

### 13.2.1 The trouble with systems theory ...

Geographic Information Systems research, especially that using predictive modelling techniques (see e.g. Kvamme & Jochim 1989, Warren 1990), has to date adopted an ecological systems-theory paradigm within which to attempt archaeological explanation. Within this type of model, human beings are essentially considered only as one organism within a broader ecosystem: one compo-

nent of a natural system of interrelated components which is usually assumed to be in balanced equilibrium.

This is a valuable approach. Human ecology clearly has a significant role to play in the explanation of the archaeological record. Unfortunately, however, it also leaves the GIS approaches to archaeology open to those criticisms of systems approaches which have been raised since their wholesale adoption in archaeology during the 1960s and 1970s, and their subsequent rejection by the majority of archaeological theorists. Although it is outside the scope of this paper to discuss this shift in archaeological theory in any detail (see perhaps Earle & Preucel 1987 for an overview, Shanks & Tilley 1989 for a more specific position), the most relevant of these criticisms are:

- 1) That system approaches, as used in archaeology, cannot deal adequately with the presence of conflict and change within societies. This is because the assumptions about equilibrium and social order within such models are based on a conservative ideology (although systems theory itself is not inherently tied to the notions of static equilibrium and conservatism);
- 2) That it is difficult to reconcile the notion of human beings as components of systems obeying systemic semantics, with social theories of action, which emphasise the centrality of purposeful choice by social actors: systems theory is thus almost inevitably deterministic in nature.

Systems theory — at least as used in archaeology — can therefore be seen to be an extremely restrictive approach to archaeological explanation. Most of the more interesting aspects of human cultures are precisely those aspects that deviate from the rules of the system: belief, taboo and the

ritual modification of the landscape for example are all difficult (although perhaps not impossible) to explain in terms of simple functional adaptation of social systems. Those features of human activity that have no adaptive value whatsoever, are impossible to explain within this type of theoretical framework, and are as a result consistently ignored by this type of theorist.

As a result of these limitations of systems approaches, GIS applications have consistently avoided study areas where ritual or subjectivity are a significant aspect of the archaeological record, and they have tended to concentrate on areas where there are no “nasty” ritual complications to upset the theories. Instead, GIS approaches to archaeology have concentrated on areas and periods for which the majority of the evidence is economic; consequently studies of the Mesolithic (E.g. Kvamme & Jochim 1989) are common targets for the archaeologist armed with a GIS. This constant reference only to these aspects of human cultural remains introduces a false duality into archaeological interpretation. The concentration solely on the economic activities of Mesolithic people, for example, reinforces the notion that:

«successful farmers have social relations with one another while hunter-gatherers have ecological relations with hazelnuts» (Bradley 1984).

Encouragingly, exceptions to this are beginning to emerge (Gaffney *et al.* forthcoming, Ruggles this volume), and studies of ritual landscapes are beginning to make an appearance. It is not, therefore, the intention of this paper to decry GIS applications to archaeology in any way but to make explicit the theoretical orientation within GIS studies, while arguing for an alternative interpretative framework which is not constrained by this limiting and deterministic philosophy.

### 13.2.2 GIS and theoretical neutrality

Far more worrying, however, than the theoretical position outlined above, is the recently typical idea that GIS does not actually require theorising at all, because it is “theoretically neutral”. Clearly this notion cannot be defended — whatever interpretation is placed on the word neutral — because all influential methodologies affect the trajectory of a discipline to a greater or lesser extent. In archaeology there has been a history of technological and methodological advance which has altered the theoretical perspectives of those within the subject. One example, as Richards (1986) observed, is the introduction of C-14 dating to archaeology, an innovation which fundamentally altered archaeology in two ways.

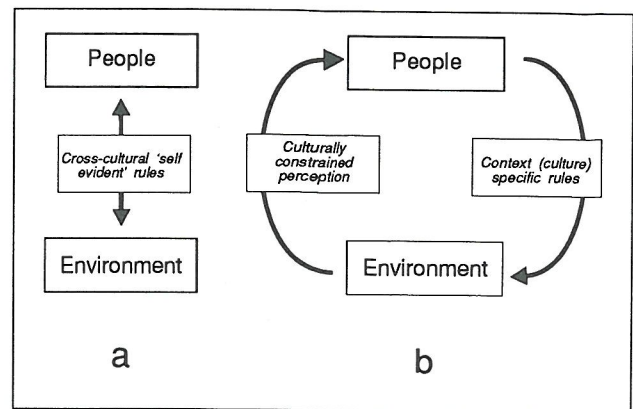


Figure 13.1: Two alternative notions of the interaction of humans with their environment.

Firstly, the current interpretation of some aspects of the archaeological record was directly modified because C-14 dating finally tipped the balance away from the migration theories of the earlier 20th Century and towards the idea of diffusion (it did this by demonstrating that a number of major prehistoric sites in western Europe were considerably earlier than their supposed originals in Mycenaean and the Mediterranean). This has become the dominant explanation of change for much of European prehistory ever since.

Secondly, and perhaps more pervasively, C-14 dating presaged and accompanied the wholesale adoption of scientific methodologies by archaeology, a process which more recently has even led to the question of whether archaeology itself should be regarded as a science. This supposed benefit has only recently been seriously questioned (Thomas & Edmunds 1990), and some aspects of “scientistic” behaviour within the discipline have been found seriously lacking. There is, of course, no suggestion that the adoption of C-14 dating, or of scientific methodologies generally has been a bad thing, but that a fuller debate and consideration of the theoretical implications of these technologies at an early stage may have prevented some of the divisive and destructive arguments which have characterised recent years.

That GIS studies presently adopt a functionalist perspective within which to generate archaeological explanation has been argued above. This in itself is a defensible position, although this paper has argued against it. However, the notion that GIS is theoretically neutral is not defensible: it allows the perpetuation of the current theoretical orientation without any cause for its debate, and in this way conceals the theoretical agenda. It seems therefore, that a greater recognition of the

implications of the widespread adoption of GIS is desirable, if not essential, if it is to fully develop and mature. I note with some satisfaction that other archaeologists have recently expressed similar views:

«the use of GIS modules may lead to the unwitting exposition of an environmentally deterministic viewpoint of a type which has largely been rejected by most archaeologists.» (Gaffney *et al.* forthcoming).

### 13.3 GIS IN A POST-FUNCTIONALIST FRAMEWORK

#### 13.3.1 The importance of perception

Introducing the notion of subjectivity to a CAA conference may seem to be the academic equivalent of serving pork at a Jewish wedding, but it is nevertheless the contention of this paper that the subjective perception of the landscape is vitally important if GIS is to escape from a processual, functionalist framework for explanation. To incorporate this fact in GIS studies, we need to accept two theoretical propositions about the ways in which people interact with their surroundings.

- 1) That people do not interact directly with their environment, and they do not respond like automata to external environmental stimuli (see Figure 13.1a). This does not imply that factors such as proximity to water, degree of shelter or the availability of natural resources do not impinge on human consciousness, merely that to use this as the basis for explanation does not tell us much more than we already knew. With the associated costs of GIS, this can be a very expensive way of stating the obvious.
- 2) That people do first perceive their surroundings and place on it a cultural interpretation; this interpretation is constrained by cultural preconceptions. Only then do people react to this perceived environment, and then they react to it in a similarly culture- and context-specific manner (see Figure 13.1b).

This perception of environment is also not necessarily consistent through time. My colleague Antony Firth has explained this notion using maps of the Isle of Wight (an island of about thirty square kilometres situated on the south coast of England). During the period when cultural perception of the island was governed by ships and transportation by the sea, the different currents surrounding the island caused the people to adopt a particular perception of its shape. This perception manifests itself in the form of

contemporary maps, which always show the island rather longer and thinner than it actually is. It can be seen from this example, that the ways in which people interacted with the island must have been constrained by this perception of it and that any explanation of, for example, the location of the coastal villages and towns would be flawed if it were based solely on a modern transverse-mercator projection, and far more profound if it could take into account this culturally determined perception of the form of the island.

More generally, it can be argued that GIS must consider this culturally constrained level of perception quite explicitly, and in some circumstances should begin by developing relevant transformations of the physical landscape with which to model and understand this perception. One way in which this might be achieved is suggested by the current use of transformed distance surfaces, such as the results of cost-surface analysis. These surfaces are transformations of distance maps, weighted to account for the fact that travelling is more difficult across steeply sloping or rough terrain (see Gaffney & Stančič 1991). Figure 13.2 is an example of this type of result, and shows the cost-surface generated by using the Neolithic Causewayed Enclosure site at Windmill Hill (Wiltshire, England) as the starting point, and using the variance of the topography (a measure of ground roughness) as a friction surface. The result is a map that indicates those parts of the landscape which are most easily accessible from the enclosure, and those which are most difficult. It can be claimed, therefore, that this is a representation of how the region appears to an individual for whom the centre is the enclosure site, and for whom we cannot assume a linear view of space. This type of methodology can also be extended to account for less general perceptions of the environment: for example those areas around the long barrows of the region clearly possessed some ritual importance, and we can investigate the hypothesis that these areas were consequently avoided. If the analysis is weighted for this by including an appropriate weighting factor to the variance map before the cost-surface projection, then the landscape transformation is different, and the representation of the perception of the region is also changed. Of course this is a simple example, and it could also be argued that the barrows may actually have been maintained as areas of short grassland during the period in question, and consequently would have represented easier passage. The example, though, suggests one way in which this type of problem might be approached using GIS technology.

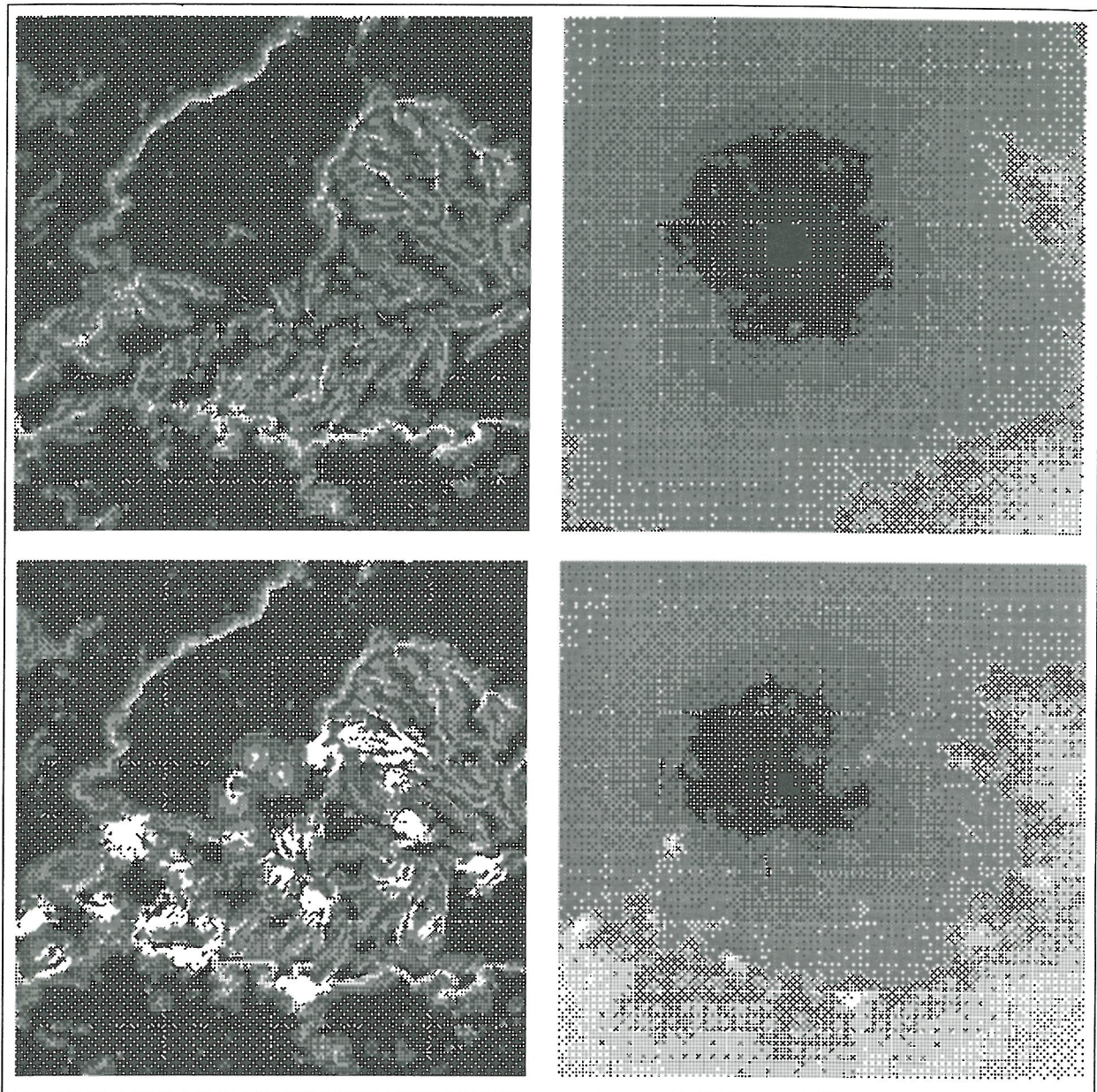


Figure 13.2: Top left: Variance map of Windmill Hill region. Top right: cost surface derived from variance. Bottom left: variance map with weights from long barrow proximity map. Bottom right: "corrected" cost surface. All maps are 20 by 20 km.

### 13.3.2 Defining study areas

It has been shown how an appreciation of the culture-context of perception might aid the development of more sophisticated GIS studies. Another methodological issue that may benefit from a greater focus onto the act of perception by human actors may be the definition of study areas themselves. This is a theme that should be of considerable importance in GIS research as the extents of these areas determine the "universe of discourse" for the study. In general little, if any, considera-

tion has been given to this issue in print — most GIS studies are currently presented without any justification of the definition of the extents of the area concerned or any description of the reasoning behind the selection. The absence of discussion concerning this point is actually highly misleading, it has already been suggested that considerable thought and effort is actually expended on the location of suitable study areas, and that this has generally lead to the selection of areas which suit a simple functionalist perspec-

tive — areas with good economic or settlement evidence — rather than those which introduce complex social problems. This, like the more general absence of discussion of archaeological theory outlined above, inevitably conceals part of the GIS agenda for archaeology: namely that of a functionalist approach based on economic and settlement studies.

In order to understand the mechanisms by which study areas can be defined, we must explicitly recognise that there are two essential means of defining the extents of a GIS (or any other) spatial area; broadly these can be characterised as a positivistic mode of definition and a normativistic mode of definition.

In a positivistic manner, an area is defined either by pragmatic choice or by some independent selection method such as statistical sampling theory. Examples of a pragmatic choice of area include the adoption of modern political boundaries because the available databases are organised in that way. The essential characteristic of a positivist approach to definition of areas is that there is no assumption or claim that the area was recognised in any form by the people who inhabited it at the time.

A normativist approach, on the other hand, is a claim that the area was recognised as an entity in the past. This is always a somewhat subjective assertion although in some cases — the Island of Hvar (Gaffney & Stančič 1991, 1992) for example — it seems reasonable to assume that the natural boundaries used to define the limits of the area were recognised by the people who are being studied.

This distinction is of key importance when the inferential power of studies based on each type of area is considered. In the positivist example it may obviously be possible to make statements about population density, or about crop yields but a study based on a normatively defined area is clearly more powerful, with the ability to make all the inferences which could be made from a positivistic study, but also additional statements about the social totality which it represents.

While this may seem to imply that normatively determined areas should be preferred in all circumstances, it is important to understand, however, that there are disadvantages to this approach. Firstly, and most obviously, it is possible to simply be wrong: to make a false claim that the area was real, when in fact it was not recognised. If this is proved to be the case, then the bulk of the study would then be undermined, although in practice it is never possible to categorically demonstrate either the truth or falsity of such defini-

tions. Consequently such studies will stand or fall by the quality of the claim for the “reality” of the area. Secondly, however, it has already been seen that changes through time may alter the perception of the world, and this may redefine how areas were constituted in the past. Social and political allegiances, although stable in the short term, inevitably change in the longer term and this must be recognised in normatively defined GIS case studies. This suggests that normative studies using GIS are less suited to long-term archaeological landscape studies than they are to short-term, context-specific studies of defined areas. This is unfortunate, but is an unavoidable consequence of a contextual approach.

### 13.4 CONCLUSIONS

It is accepted that this paper presents little concrete for those interested in the application of GIS, and little which is new — or even particularly topical — to those concerned with the role of theory in archaeology. Were it not for the remarkable lack of contact between these two groups of people, then the paper would have little merit. However, accepting that this lack of contact exists, the paper raises the important general problem of how to prevent our GIS studies falling into the enticing trap of a naive and outmoded functionalism; and in a rather more positive vein suggests this problem is not insurmountable.

The tentative direction that has been suggested here is that GIS studies might focus attention on the act of perception as a means of more properly explaining the ways in which people interact with their landscape, and that one way in which this might be achieved is through a more thorough consideration of the definition of study areas. Neither of these suggestions is intended to be a programmatic statement, but is offered only as one possible direction. If archaeologists using GIS accept the challenge to reconsider their own theoretical perspective, but reject the specific directions expounded here, then the paper will have achieved its aim. It is hoped, therefore, that it will prompt some of those who are currently using the vast potential of GIS technology to pause for thought, to consider in more detail the implications of the choices they make, and to provide a more considered justification of their currently inexplicit position.

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