Introduction

GIS, with its capacity to rapidly process and display masses of data, and its ability to combine many environmental and archaeological variables to create new information, should hold great appeal to the landscape archaeologist. As Gillings and Mattingly note in their introduction, ground breaking publications such as those from Allen, Green and Zubrow (1990), Gaffney and Stancic (1991), stimulated quite a flurry of interest in the use of GIS in the early 1990s. But since then it does perhaps seem that archaeologists' excitement in this "new" technique seems to have gone a bit stale. Whilst becoming more widespread in its adoption in commercial archaeology, its uptake (certainly in British) research is seemingly quite limited. GIS is, for example, only routinely taught in relatively few archaeology departments in the UK, and then often only at post-graduate level - low priority as compared to learning to tell your bulbs of percussion from your pressure flakes.

So why have archaeologists entered this "honeymoon over" period with GIS applications? Perhaps it is because we have yet to be convinced of their use or desirability by hard published evidence - much of that which was published in the early 1990s is criticised, anecdotally at least, for consisting of little more than dry technical descriptions of systems design and what they might do, rather than helping to provide interpretative insight. Because environmental variables such as slope, elevation or soil type are easy to quantify digitally, but concepts of social space are not, post-processual archaeology in particular has criticised GIS for encouraging environmentally determinist accounts of the past. Where GIS has been used in ways that could engender post-processual interpretation of the landscape, e.g. viewshed analysis, there
still is a sense that authors are failing to realise the theoretical capital held in the work that they produce.

Things are now however starting to change - for example, see Llobera (1996), or Gillings and Wheatley (2000) for theoretical developments in viewshed studies. This volume, commissioned as part of the wider "POPULUS" project, aims to be part of this change, in presenting a range of papers that help to bridge the gap between archaeological theory and GIS practice, representing a continuum from the "explicitly theoretical to inherently practical".

The Papers

The first paper in the volume, by Peter Fisher, presents a well articulated introductory discussion about what GIS actually is, what it does, and how archaeologists have been using over the last 10 or so years, ranging from its use as a data management tool, through spatial and other analytical techniques through to publication. Equally valuable in this paper is the author's critical evaluation of the problems found in using GIS: Some of these are generic problems in GIS, such as lack of interoperability between different system and data formats, and sheer complexity of use. Other problems covered are more specific to archaeological applications of GIS, such as that of environmental determinism, as touched on above. This paper provides a very useful overview of the use of GIS in archaeology, and spares the potential reader from having to trawl through much disparate and complex literature often not written with the archaeological community in mind.

The theoretical implications for the use of GIS in archaeology outlined in part by Fisher are explored extensively in the second paper, by Robert Witcher. Witcher presents us with a fairly alarming fact that whilst GIS was developed by geographers, planners, and the military to quantify aspects of geographical space, most post-processual archaeologists represent a move towards more qualitative accounts of the past e.g. Edmonds 1999. As such then, the use of GIS would appear to be at odds with this more humanised approach. Given these two apparently opposing trajectories one might think that they will either go flying past each other so that they are unaware of each others presence, or crash so horrendously for neither to survive. But research in GIS is attempting to address more qualitative issues, as Witcher goes on to critique. These are those forms of analysis that attempt to map some aspects of human cognition, such as viewshed analysis, and the use of cost surfaces. Whilst there is a growing body of literature describing the case studies and applications of these particular techniques, arguably very few of
these adequately explore the theoretical implications of this work, and this paper provides a very timely discussion of these issues.

The paper by Peter Attema is again one of a theoretical rather than technical bias. In this study, he describes how the Renaissance cartographers provided an idealised view of the classical landscape, and that this view is not born out by contemporary archaeological research, which reveals far more complex patterns of land use and settlement. Whilst not focussing on the use of GIS per se, it does remind us that the cartographic paradigm so fundamental to that of GIS is far from the objective reality we often assume, and serves as a cautionary tale for those whose research depends on the use of historical maps.

The next 6 papers all present various case studies of recent and ongoing applications of GIS in real research contexts, addressing in particular how GIS can be integrated with field survey data.

The paper presented by Mark Gillings and Kostas Sbonias paper is effectively divided into two halves. The first half provides a good introduction to the integration of GIS within field survey data, and discusses the problems of "retrofitting" GIS applications to exiting survey data - data whose strategy for collection was not formulated with GIS in mind. They describe in particular the problems of extrapolating data from irregularly and arbitrarily spaced transects, and the need to adhere to an externally imposed grid, rather than which is dictated by land use or topography. The second half of the paper demonstrates how analysis of artefact densities from the entire survey area allow for potential "site definition", as well as distributions across the area by period. This is of particular relevance to research students who may be engaged in producing regional syntheses, who will invariably be working with a variety of material from diverse collections, procured from a wide range of sampling regimes.

The paper by Gary Lock, Tyler Bell and John Lloyd again discusses some of the general problems encountered in integrating field survey data with GIS, and draws particular attention to the important distinction between "site" and "off site" archaeology in survey. One important point here is that depending on the scale of your analysis, at some point, your GIS will need to treat a series of individual artefacts distributed across the Earth's surface as a single point, or vice versa, and that this choice may be more or less arbitrary. It is of course this ability to traverse scale in such orders of magnitude that is one of the great attractions of using GIS. The paper then goes on to detail the methodology employed by the Sangro Valley Project. This includes useful
and highly practical discussions including the choice of raster versus vector analysis, the relationship between field data collection units and resolution of the GIS derived data, and the use of data filtering to create "fuzzy boundaries".

The next paper, by Robinson and Zubrow, discusses some of the problems involved in "interpolation". Interpolation is the practice of estimating values from between known data points (as opposed to extrapolation, which make estimates that go beyond known data points). Performing interpolation is vital in archaeological applications of GIS - it is interpolation that produces seductive density plots from irregular field walking or test pit data, or digital elevation models from topographic survey. The science of interpolation is technically complex, involving some deeply sophisticated mathematics, and not surprisingly, there are several different algorithms ("ways") for doing it. This in part where problems can arise - the transparency of operation of many modern GIS packages can make the user blissfully unaware of what these differences might be, and how they might produce different results on different kinds of data sets. Where the results of interpolation are used as the basis for other analysis, error propagation can soon arise, as these subsequent analyses are often themselves similarly complex and equivocal.

Two of the three remaining "case study" papers concern the analysis of past population trends, as indeed such analysis is one of main objectives of the POPULUS project overall. Interestingly, neither papers (by Zoran Stancic and Vincent Gaffney, and Philip Perkins) are dominated by discussions about GIS, and the focus is placed rather more on the "actual archaeology". This can be seen to represent a move to the more "archaeologically integrated" use of GIS called for by Gillings and Mattingly in their introductory chapter. The third of these case studies, by Martin Belcher, Andrew Harrison and Simon Stoddart, again discusses some of the practical considerations with integrating existing survey data into GIS format, and some of the problems encountered in producing Digital Elevation Models from existing non digital information. Some preliminary results from viewshed and cost surface analysis are also presented.

The last three papers in the volume reside more in the technical and methodological end of Gillings' and Mattingly's "continuum". As such they may be of more interest to the GIS practitioner than to archaeologists in general. The first, by Jan van Dalen, looks at different means of probability modelling to predict site location. Whilst many attempts to do this in the past are the very studies which have been most accused of being mislead by environmental determinism, van Dalen points out that it is "modern
environmental factors are the ones that have the most influence on whether a site will be found or not”. This is a valid point, and becomes very significant when dealing with regional analysis whose scale may cover a variety of modern day land uses. In the Peak District for example, a much greater wealth of lithic evidence from areas under plough than those areas under the peat created a very skewed picture of Neolithic activities in his region (Barnatt, 1996).

The second of these papers, by Kristof Ostir, Zoran Stancic and Majda Trusnovec, describes how satellite imagery can be used as a data source in GIS analysis. This can be very important when studying areas for which there are no soil or land use maps available, or when working at scales that cross national governmental boundaries. As with the discussions of interpolation and probability modelling above, the processing of satellite imagery is quite complex but well described in this paper, and would be a valuable reference for anyone needing to use this format of data. The final paper in the volume, by Javier Baena Preysler, Concepcion Blasco, Javier Espiago and Alberto Rio, provides a critical evaluation of how GIS facilitates different kinds of visualisation for different purposes, using Late Bronze Age and Iron Age data from the region south of Madrid.

Conclusions

Whilst the case studies are exclusively Mediterranean, the papers in this volume are highly transferable to other regions and periods, both in their theoretical and methodological considerations. I would say that this volume is necessary reading for those engaged in using GIS at post-graduate or equivalent professional levels, but contains much of value to the wider archaeological community, particularly the more generic papers at the beginning of the volume from Fisher and Witcher. People from a geographical background, who ten years ago would have described themselves as "user's of GIS", are now more likely to describe themselves as "practitioners of Geographical Information Science". One refers to the use of simple tool, the other refers to an emergent discipline coming to terms with its own non theory-neutral paradigms. It must now be time for those using GIS as archaeologists to take the same steps. To do this we need an equally emergent body of archaeologically integrated and theoretically aware literature. This volume represents a contribution to this body, and whilst many of the questions it raises still require adequate answers, they are now being seriously addressed.
Bibliography


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