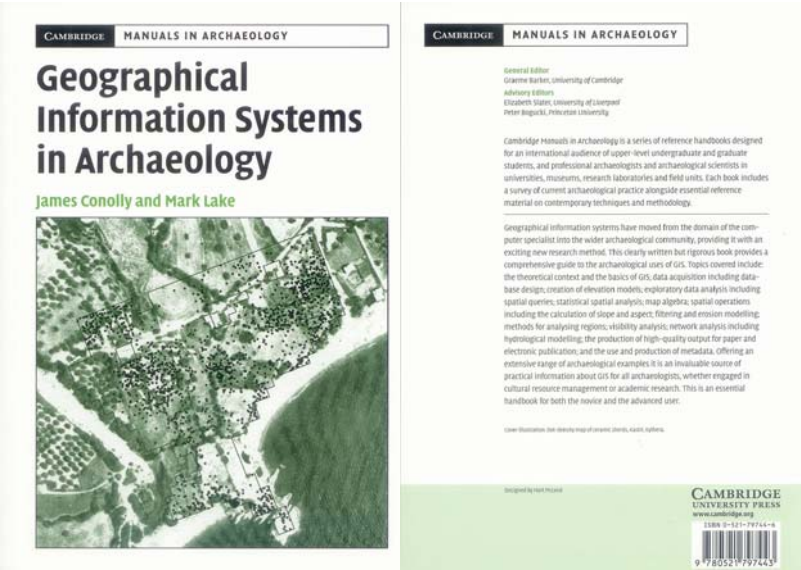
Connoly, J. & M. Lake. 2006. Geographical Information Systems in Archaeology. – Cambridge Manuals in Archaeology. Cambridge University Press, United Kingdom.

Book review by T. Vereenooghe[1]



Geographical Information Systems (GIS) have been described as "the most powerful technological tool to be applied in archaeology since the invention of radiocarbon dating" (Westcott & Brandon, 2000: 135), but also as "a technology without intellectual vigour, overly dependent on simple presuppositions about the importance of spatial patterns in a dehumanized artificial space" (*cf.* Pickles, 1999: 50–52). James Connoly (Trent University, Canada) and Mark Lake (University College London) both have several years' experience of working with GIS and teaching GIS to archaeology students. In their new book 'Geographical Information Systems in Archaeology' (in the 'Cambridge Manuals in Archaeology' series), they adopted an approach that is both practical and rigorous. The manual focuses on the kinds of problems that are routinely faced by archaeological users of GIS.

Although the authors do not envisage many readers methodically working their way through the manual from start to finish, they have tried to maintain a logical progression such that topics are introduced in roughly the order that they might be encountered in the course of developing and using an archaeological GIS. The authors first introduce some theoretical issues and provide an overview of the 'first principles' of GIS: the software and hardware requirements, geodetic and cartographic principles and GIS data models. As the archaeological user is – in general – not an expert in cartography or computer graphics, this first chapter is extremely useful. How do the geographical coordinates we daily use in our archaeological work relate to the position on the Earth's surface? This is explained in an in–depth description of map projections systems, coordinate transformations and grid systems. The chapter concludes with a good overview of raster and vector data structures and their inherent (dis)advantages.

Throughout the manual real–world examples of GIS applications are provided. These examples are often related to Connoly's own work in the Kythera Island Project[2] (*cf.* Bevan & Connoly 2004) or to projects in the United Kingdom. Chapter 3 reviews four typical applications of GIS in archaeology: the management of archaeological resources (Greater London Sites and Monuments Record), excavation (West Heslerton Project), landscape archaeology (Kythera) and the spatial modelling of past human behaviour (Mesolithic site location and foraging behaviour in Scotland). These examples provide a good picture of the wide array of archaeological questions to which GIS can contribute.

The next chapters of the manual look more closely at how one builds a GIS. In chapter 4 the authors intend to provide the necessary information about data models and data design to enable archaeologists unfamiliar with computer databases to make appropriate decisions about how best to construct a system that will work well and efficiently. Further, they examine the different ways in which spatial datasets are acquired and structured to take advantage of the visualisation and analytical abilities of GIS.

[1] Second version, updated 4 October 2006.
[2] http://www.ucl.ac.uk/kip/

As archaeologists have more and more access to several types of data, the acquisition procedures for both primary and secondary geospatial data are becoming an important issue in the archaeological process and this is not as straightforward as it often seems. This manual provides a good introduction to these issues, including an assessment of surveying technologies (total station, GPS...) and an extensive description of remote sensing applications. Though this primary acquisition of (digital) data is becoming a standard activity in archaeological research, the transfer of data from an existing storage medium (*e.g.* from proper maps) remains a common route of spatial data acquisition. The manual gives the necessary attention to this aspect as well, and explains how the data can be captured and digitised. Finally, the common problem of map rectification and geo–referencing is tackled.

From chapter 6 onwards, more technical details are provided about certain aspects of GIS, which seem to be written for semi–professional GIS users. Readers without a technological or statistical background will probably decide to skip several sections of the book, although the texts are, in general, clearly written and accessible for the non–specialised public as well. One learns, for example, how to derive a surface model from a set of discrete observations by using different interpolation techniques, and how to build a digital elevation model (DEM) from contour data.

After the GIS has been built, the process of data exploration, pattern recognition and interpretation of the spatial data can effectively start. The authors devote a large section of their book to the exploratory data analysis and spatial analysis. Subjects covered in these chapters range from basic SQL queries over non–parametric tests of significance to nearest neighbour analysis. People who are not interested in the statistical formulas can browse through the examples and the numerous illustrations. The chapter about spatial analysis concludes with a short section about predictive modelling.

Research–oriented readers will find a lot of inspiration in the chapters about map algebra and the analysis of regions. Although the calculation of slope is almost route in research–oriented archaeological GIS, the authors make clear that there are various potential pitfalls to be avoided. Other applications, which are often met in the scientific literature are more related to regions; these include the analysis of catchment areas, cost–surfaces and visibility analysis through the use of view sheds. The authors go on to discuss the various network analysis tools that can be used to study relationships between point locations, including methods to predict the likely path of an unknown route between locations and the flow of water and watersheds. Once more, the necessary theoretical introductions are amply illustrated with real–world examples. These clearly show that well–known techniques as the generation of least–cost paths are by no means unproblematic.

The authors of this manual realise that dynamic digital maps will become the primary vehicle with which users interact and explore archaeological data. One of the most interesting chapters in the book, devoted to maps and digital cartography, not only discusses how maps can become effective communication devices, but also the growing importance of the Internet and interactive mapping for the publication of spatial data. Unfortunately, some of the very recent developments in digital maps, such as the emergence of Google Earth, are not mentioned in this chapter, although they have recently attracted a lot of attention in the archaeological community (*cf.* Ullman & Gorokhovich, 2006).

This volume concludes with a short chapter providing advice for the maintenance of spatial data. Although the authors themselves suspect "that some readers will be tempted to skip this last chapter" (pp. 2), they convincingly demonstrate the vital importance of adequate metadata in order to guarantee the interoperability and sustainability of the GIS data.

Although quite a lot of scientific literature is available in the field of GIS and archaeology, this book certainly deserves its place on the desk of every archaeologist dealing with spatial data. It provides an extensive overview of the archaeological uses of GIS, and thanks to the inclusion of many examples and ample illustrations, it will appeal to both the novice and the advanced user.

Connoly, J. & M. Lake. 2006. Geographical Information Systems in Archaeology. – Cambridge Manuals in Archaeology. Cambridge University Press, United Kingdom. 358 pp. ISBN 0521793300. Price £55.00 (paperback).

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