Archaeological prediction and risk management

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Archaeological Prediction and Risk Management

Alternatives to Current Practice

Edited by

Hans Kamermans
Martijn van Leusen
Philip Verhagen

Contents

1. Archaeological prediction and risk management

Hans Kamermans[2], Martijn van Leusen[3] and Philip Verhagen[4]

1.1 Introduction

Since the adoption of the European Convention on the Protection of the Archaeological Heritage on Malta in 1992 (also known as 'the Malta Convention', 'the Convention of Valletta' or 'the Valletta treaty'; Council of Europe 1992), archaeology in the Netherlands has not been the same. From then on, as a direct result of the Convention's aim 'to protect the archaeological heritage as a source of the European collective memory and as an instrument for historical and scientific study', archaeology has played an important role in spatial planning. All over Europe, archaeology is under threat from development plans, and the Convention was drafted to remedy this. Article 5 reads: 'Each Party undertakes: to seek to reconcile and combine the respective requirements of archaeology and development plans by ensuring that archaeologists participate in planning policies designed to ensure well-balanced strategies for the protection, conservation and enhancement of sites of archaeological interest'. Whereas before, archaeology was about the past, it is now about the future.

And all of a sudden there was money for archaeological research. The Convention specifies that financing should be done by 'taking suitable measures to ensure that provision is made in major public or private development schemes for covering, from public sector or private sector resources, as appropriate, the total costs of any necessary related archaeological operations'. Archaeology became 'developer funded'. These changes in the position and funding of archaeologists brought about a profound shift in the archaeological profession. Archaeology was, and is, no longer the playground of a relatively small group of people who want to know about the past: it has become socially relevant, part of a world that is concerned about its future.

1.2 The Dutch situation

Across Europe, countries implemented the Malta Convention in their own specific manner (Willems 2007). Whilst all embrace the 'developer funded' principle, this is about the only thing they have in common. Spatial planning in the Netherlands has a long tradition, starting with the building of the first dikes circa 1000 AD. Being densely populated and under continual threat of flooding from the sea and the rivers, cooperative planning was needed to remain safe and avoid conflicts about the right to use the limited space available. Various governmental bodies were therefore formed very early on to produce spatial plans and to control their implementation. The management of our archaeological heritage has now become an integral part of this system.

Before 'Malta' the Dutch provinces together with the National Service for Archaeology, Cultural Landscape and Built Heritage (RACM) were responsible for the archaeology in the Dutch soil. Finds had to be reported and only government related agencies were allowed to do archaeological research. These agencies were the RACM, the National Museum of Antiquities, the Universities and some municipalities.

After 'Malta' for some years an interim situation existed. During this period developers who were about to disturb the soil were confronted with their responsibilities, archaeological companies were given access to an archaeological market, and the role of the provinces and the RACM became even more important. A whole set of techniques, rules and regulations were developed during this period.

Since the revised Monuments and Historic Building Act was passed (2007) 'Malta' is fully implemented in the Dutch system. Developers have to pay for the archaeological research and the main responsibility for archaeology is now in the hands of municipalities.

Since the 1990s archaeological predictive modelling has been used as a tool in an early stage of the archaeological heritage management cycle in the Netherlands. Predictive Modelling is a technique to predict,

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at a minimum, the location of archaeological sites or materials in a region, based either on the observed pattern in a sample or on assumptions about human behaviour (Kohler and Parker 1986: 400). There are two reasons to apply predictive modelling in archaeology:

- to gain insight into former human behaviour in the landscape; an academic research application;
- to predict archaeological site location to guide future developments in the modern landscape; an archaeological heritage management application.

Predictive modelling plays an important role in desk-based archaeological assessment studies, indicating where as yet unknown archaeological remains in the soil might affect spatial planning. In the Dutch 'post-Malta' archaeological heritage management practice three parties or 'stakeholders' interact in a free market: the developer, the archaeological contractor, and the authorities. The developer needs archaeology to be dealt with; the archaeological contractor wants to do the archaeological research as efficiently as possible, and the authorities determine the desired quality of research, and perform quality control.

Predictive maps, indicating where there is archaeology in the soil or where it can be expected, now play a major role in spatial planning. By avoiding areas with a high 'risk' of archaeology, developers can reduce the costs involved for archaeological research. This is because predictive maps will always carry policy advice. In some areas, developers will not be obliged to do archaeological research. In others, they might avoid this by taking mitigating measures, like not disturbing the soil during building. And in other cases, archaeological research will be inevitable, in some cases leading to very expensive excavations. So one could say that archaeological predictive modelling is a condition without which archaeology could not be part of the spatial planning process. In the Netherlands, predictive maps are produced on two scales: national and regional. The National Service for Archaeology, Cultural Landscape and Built Heritage (RACM) has produced several versions of the Indicative Map of Archaeological Values of the Netherlands (IKAW). Commercial companies produce predictive maps on a regional or local scale – the latter typically covering a single large municipality or several smaller ones.

The fact that predictive maps play a role in this process and the fact that one of the consequences of this process is selection (some areas will be studied, others will not), the quality of the maps is very important since they are involved in what should be called a form of risk management.

1.3 The project

However, academic experts both in Europe and in North America have contested the use of predictive modelling in archaeological heritage management because of its theoretical and methodological shortcomings (cf. Ebert 2000; Wheatley 2003; Woodman and Woodward 2002; an overview can be found in Van Leusen and Kamermans 2005). Throughout the 1990s, the situation was characterised by separate 'academic' and 'management' discourses. In 2001, the newly established national NWO-funded research programme 'Protecting and Developing the Dutch Archaeological-Historical Landscape' (BBO, Bloemers 2001) sponsored a group of Dutch researchers to begin a thorough study of archaeological prediction, and to establish a meaningful link between scientific knowledge, archaeological-historical heritage management and applied planning policy in the Netherlands The official name for the project was 'Strategic research into, and development of best practice for, predictive modelling on behalf of Dutch cultural resource management' (Kamermans *et al.* 2005). This project ran from 2002 to 2006 at the archaeological departments of the universities of Leiden and Groningen. Martijn van Leusen from the University of Groningen was appointed as a post-doc to be the main researcher. Philip Verhagen has a background in commercial archaeology and was paid by the project for several months to finish a chapter for his PhD thesis. Initially three researchers from the RACM, Jos Deeben, Daan Hallewas and Paul Zoetbrood were also involved. Hans Kamermans from Leiden University directed the project.

The first product of the project was the *Baseline Report on Predictive Modelling for Archaeological Heritage Management in the Netherlands* (Van Leusen *et al.* 2002), which summarizes and analyses current

national and international approaches to predictive modelling on the basis of a review of the available literature.
Six areas of concern were identified:

- quality and quantity of archaeological input data;
- relevance of the environmental input data;
- need to incorporate social and cultural input data;
- lack of temporal and/or spatial resolution;
- use of spatial statistics; and
- testing of predictive models.

Extensive comments were provided on the Baseline Report by a range of international experts invited to a meeting held at the offices of the RACM on 22 and 23 May 2003. The full scientific papers submitted by these experts were subsequently published together with the Baseline Report in an edited volume titled *Predictive Modelling for Archaeological Heritage Management: A research agenda* (Van Leusen and Kamermans 2005).

The subsequent research of the group focused mainly on aspects of the first and the two last topics. Martijn van Leusen investigated the role of expert judgement on the quality of archaeological input data (this volume chapter 9), Philip Verhagen examined the use of statistics and testing in predictive modelling (Verhagen 2007, this volume chapter 8). For the third topic, the incorporation of social and cultural data into predictive models, the project tried in vain to find additional funding (Verhagen *et al.* in press). The research of Hans Peeters, although not part of the project, tackled the two remaining topics (Peeters 2007).

A complete list of publications by the research team can be found in the appendix of this chapter.

1.4 This volume

This book however starts with the experiences of the users. On the 1st and 2nd March 2006 a symposium on '*Archaeological Prediction and Risk Management*' was held in the Kamerlingh Onnes Building of Leiden University. Five experts, all professional users of predictive maps, were invited to present their views on the role of predictive models in Dutch archaeological heritage management. This meeting was intended as a form of 'action research', where problems are being solved in a collaborative context with researchers and other stakeholders. The written contributions of the participants, brief outlines of which are given below, form the first part of this volume.

Marten Verbruggen, director of RAAP, writes about the role of predictive models in prospective research in Dutch archaeological heritage management. After a first success of the small-scale and broad inductive predictive maps, the demand is increasing sharply for large-scale, detailed deductive maps. Nowadays municipalities are the main commissioners of these maps, as they have been given far-reaching powers in the field of the heritage management by the recent amendment to the Monuments and Historic Buildings Act. In the course of the more then 15 years that these maps have been around, it has however become clear that the aim with which these maps were made and the role they subsequently played in the decision-making process in the archaeological heritage management have changed radically.

In *The high price or the first prize for the archaeological predictive model* Martin Meffert, archaeologist for the province of Noord-Brabant, stresses the point that archaeological predictive models form the basis of practically all archaeological research in the Netherlands. He considers the production of predictive maps by archaeological companies undesirable because they could potentially profit from defining large areas with a high indicative value. The manufacturing of predictive maps should lie in the hands of a government institution that is able to operate independently of the market. And since most large university archaeological institutes have their own archaeological company that is dependent on commissions from the market, the universities have thus become structurally dependent on this non-government funding. That is the reason why, in Mefferts view, Dutch

universities can no longer take on this independent role either, and the only suitable candidate left would be the RACM. We would qualify Meffert's conclusion on both counts: firstly, methodological research at universities certainly is not market-dependent, and secondly, the RACM as an institution is not really independent from the archaeological market either - it too profits from a broad definition of 'areas of high indicative value'.

In *Archaeology as a risk in spatial planning: manoeuvring between objectivity and subjectivity*, René Isarin, Philip Verhagen and Boudewijn Goudswaard, all working for archaeological companies, highlight some of the risks in present-day Dutch archaeological heritage management. They consider the risk from the viewpoint of the civil contractor or initiator of a specific spatial development, and not as the risk for the archaeological remains in that specific area. Focusing on the risks related to the first phase of archaeological research (assessment studies), they discuss whether solutions for risk management may be found in the use of predictive modelling and in the development of reliable core sampling survey strategies. In the end the goal must be to reduce risk and uncertainty for the initiator to an acceptable level.

Whatever the shortcomings of current predictive models, they have become an accepted instrument in the planning process. Since no formal publications exist on the subject, the best way to assess the stakeholders' (managers and authorities) views is to look at contested situations, where an attempt by one party to limit the rights of another to do damage to archaeological remains is contested in court. This usually revolves around planning permissions; a case brought before the Dutch Council of State by the municipality of Coevorden is used to illustrate the central role played by differences in interpretation of the IKAW.

The second part of this volume presents work by the project team on the two themes selected for in-depth study after the midterm review. The first two chapters discuss the testing of predictive models. The short *rough guide* (chapter 7) was written especially for the non-technical reader while a full discussion of the theme of testing predictive models can be found in chapter 8. The second set of chapters presents new approaches to predictive modelling, in which the relation between expert knowledge and archaeological input data is redefined.

In chapter 7 and 8, Philip Verhagen explains that archaeological predictive modelling is an essential instrument for archaeological heritage management in the Netherlands. It is used to decide where to conduct archaeological survey in the case of development plans. However, very little attention is paid to testing the predictions made. Model quality is established by means of peer review, rather than by quantitative criteria. In Verhagen's first chapter, *Testing archaeological predictive models: a rough guide*, the main issues involved with predictive model testing are discussed. The potential of resampling methods for improving predictive model quality is investigated, and the problems associated with obtaining representative test data sets are highlighted. The commissioned chapter *Predictive models put to the test*, published previously as a part of Verhagen's (2007) PhD thesis, investigates in more detail how one could test predictive models in a quantitative manner, using either old or new archaeological data. Both chapters give some serious warnings concerning the current use of predictive models in the Netherlands: without quantitative quality norms, the models will remain uncontrollable.

The project team considered *reasoning with uncertainty* a major research theme for the second phase of the project. A pilot study on this theme was organised from 17th to 21st January 2005 in Amsterdam, in the offices of RAAP Archeologisch Adviesbureau. Two experts in spatial statistics from Germany (Benjamin Ducke) and the UK (Andrew Millard) together with experts in Dutch archaeology (Bert Groenewoudt, Roy van Beek and Huub Scholte Lubberink), tried to improve the predictive models for a study area in the eastern part of the Netherlands with the application of Bayesian inference statistics and Dempster-Shafer belief and plausibility models. Martijn van Leusen, Benjamin Ducke and Andrew R. Millard publish the results of this study in chapter 9: *Dealing with uncertainty in archaeological prediction*. They created a worked example based on a widely published Dutch case study (Rijssen-Wierden) (Ankum and Groenewoudt 1990; Brandt *et al.* 1992), in such a way that the benefits of these new approaches could be made clear to non-technical readers as well as to those working in heritage management positions. The chapter aims to demonstrate that these approaches can result in useful models for CRM decision support (hopefully more useful than the existing traditional models), and

that concepts of expertise and uncertainty can be given a place in formal models without compromising on robustness and replicability, and hence can provide the link to concepts of (financial) *risk* employed by the people who use these models in the real world.

All these contributions show the application of predictive modelling in archaeology is a fascinating one but not without its problems. It is clear that there is a future for the use of this technique in archaeological heritage management.

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