IT-based Documentation of Large Scale Excavations - Drengsted: A Case Study

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CAA 97

Abstract

Managing the amount of data from large scale excavations with conventional methods is often a cumbersome job and leads frequently to backlog problems - an increasing number of Danish excavations are left unpublished. A new IT-based approach on the data from the Drengsted site, excavated during the 1960s and 1970s has been shown to be an appropriate method for handling data from a large scale excavation. The methods and applications used are discussed, and the paper also focuses on how future backlog problems can be avoided.

1 Introduction

The project presented here: *A settlement analysis of sites with iron production from 200 AD to 600 AD in Denmark* is a part of the research programme: *Settlement and Cultural Landscape*, funded by the Danish Research Council of Humanities. The main goals of the project are to analyse the distribution of iron production within a number of sites and across the landscape. The research area is present day Denmark.

Several sites dating to the Late Roman and Early Germanic Iron Age form the basis of the analysis. So far five sites with excavated areas ranging from 50.000 sq. m. to a few thousand sq. m. have been IT-documented and thereby made ready for a more carefull analysis at site-level. IT-based documentation was considered to be less time consuming than traditional methods, and the opportunity to present the results rapidly was a major reason for the choice. The use of IT-based documentation of large excavations has little precedence in Danish archaeology, consequently much experience was gained during the procedure.

Analysis and visualiation was carried out within the userfriendly MapInfo. This was chosen initially because of its accessibility along with its capability to manage both graphical data and databases saimultaneously. The main aim of this article is to describe the software and methods used in the process. The recording of the Drengsted-site situated in the south-western part of Jutland is an appropriate example to demonstrate this.

Drengsted is a well known and important site in Danish archaeology. An Iron Age hamlet; the site has structures dating from the Early Pre-Roman Iron Age (c. 4th to c. 3rd century BC) as well as occupation in the second half of the Late Roman and Early Germanic Iron Age (late 4th century to late 6th century AD) (Nørbach 1997). The site is only partially published. The latter period is of primary interest to this project. Approximately 50.000 sq. m. were excavated in a series of campaighns between 1957 and 1973 initially under the supervision of Dr. Olfert Voss, operating from the University of Aarhus and later from the National Museum of Denmark. More recent excavations were carried out by the author in 1996 and were intended to find the limits of the hamlet.

2 Data entry

The data sources related to the Drengsted-site are generally representative of a Danish large scale excavation and are as follows:

1. Excavation plans and related finds databases.
2. Graphical documentation of selected finds e.g. pottery important for dating.
3. Archaeomagnetic survey.
4. The central SMR records held by the National Museum of Denmark
5. Soil maps made by the Geological Survey of Denmark (GEUS).
6. Historic cadastral maps.

It is difficult to think of an IT-project without considering the labour and problems associated with data entry, and the Dregsted project is no exception to this. The excavation plans represented a number of levels of documentation therefore different methods for IT-documentation were used. The aim was, of course, always to produce vector plans in order to make use of MapInfo's capability of combining objects like postholes within, for example, a house-structure and attach information to the structures. Some excavation plans were manually digitised and others (most of the plans from the Drengsted) could be scanned first, and then vectorised in a application like R2V (Raster to Vector) from Able Software and imported into MapInfo as DXF-files.

R2V can produce closed objects in DXF which are interpreted as regions when imported into MapInfo. Unfortunately, one cannot take full advantage of this because of the frequency of closely lying objects on site. Groups of adjacent features, e.g. postholes, are often percived as a single object by the scannersoftware and they are then given common lines. This is a problem if the aim is to get distinct objects. This problem can only be solved by time consuming manual editing.

The finds database (with a flat hierachy) was Microsoft Access; chosen because the National Museum of Denmark is using also Microsoft Access as a common interface to the

Danish Central SMR (Hansen 1992; 1994). Using identical tools always helps to integrate data from different archives.

Beside the textual information of the finds, approximately 150 finds from Drengsted are recorded in PhotoDraw, a software product combining photography and digital halftoning techniques. The advantages of this method are primarily a document of the object produced approximately 4 times quicker than with conventional methods. Secondly it produces faster files compared to conventional photos. Besides this it is relatively easy to display the object in the requested size (Holm 1997). By using this technique it is possible to reach a high level of documentation. The number of artefacts thus recorded are beyond the limits of conventional manual drawing methods (Fig. 1).

Figure 1: Pottery from Drengsted displayed in PhotoDraw. ACC cup with ornaments. Created by Jørgen Holm.

Historical cadastral maps contain important information about the historic and prehistoric landscape. They are an exellent source for demonstrating the exploitation of the landscape before the agricultural reforms in Denmark at the end of the 18th century AD, and before the introduction of modern farming. The maps are scanned and displayed as bitmaps, then registered together with the excavation plans of the same area. The historical maps can with advantages be used at the site level to demonstrate the very local settlement pattern. Unfortunately, MapInfo only displays one bitmap at a time. A composite picture containing several bitmaps must be composed in a picture processing application like Adope Illustrator before integration within MapInfo.

The central SMR is supplied with my own documentation at local museus to ensure that the data are up to date, and modern maps displaying the soil types provide the data source at the regional level. MapInfo provides good tools for simply displaying maps including site distribution across different soil types. Simple analystical operations such as buffer, cluster, classify etc. can also be carrried out using MaoInfo, but when it comes to more complex analytical operations such as analytical operations on elevation models you are left with no possibility other than to turn to an application like ArcView.

When considering the disadvantages of MapInfo the lack of an ability to work in 3-D is important. However the problems of working in 2-D can in some way be "solved" by working in different layers and attaching the levels to the finds database.

Getting a composite plan can be a cumbersome job when working with large scale excavations and MapInfo allows little flexibility when you want to display several different coordinate systems within one overall system. This problem can of course be solved by using another application with such a capability, this would, however, probably result in loss of data attached to the objects (e.g. information of finds in postholes). Despite this, there is a way of carrying out this operation within MapInfo - with a little help from Microsoft Excel. The displacement coordinates and rotation angle can be calculated in Excel and then entered in the MapBasic Programme: Rotator (note1).

3 Conclusion

MapInfo with its low learning curve and potential for integration with Microsoft Access provides a good platform for a usefull GIS which will fulfil the demands of most archaeologists. As the case study of Drengsted showed, the application can handle the most common data sources from a large scale excavation. Beside this, the IT-based documentation saved time during post-excavation analysis, and with this in mind it is clear that the IT-based documentation of excavations probably will help avoiding future back log problems in Danish archaeology.

The methods and applications used also clearly demonstrated that the basic demands of the IT-based documentation of data sources is a tight interrelationship between graphical objects and databases (Madsen 1997). It is therefore important that one does not stop with the ordinary CAD drawings, a common practise in Danish archaeology, in the mistaken believe this will pass for a GIS. This is, in my opinion, a waste of time and good money.

Notes

1 To calculate the angle V between two coordinate systems A and B the following equation can be used. The coordinate system A is an overall coordinate system where two coordinates are known (x_1; y_1), (x_2; y_2). The coordinate system B is a local coordinate system with two known coordinates (u_1; v_1), (u_2; v_2) equal to the two known coordinates from A. If $x_1 / x_2 = 0$ then transverse x_1 with y_1 and x_2 with y_2 and u_1 with u_2 and v_1 with v_2. The equation used in Excel is: $V = \tan^{-1} ((((v_2 - v_1) / (u_2 - u_1) - (y_2 - y_1) / (x_2 - x_1)) / (1 + (y_2 - y_1) \times (v_2 - v_1) / ((x_2 - x_1) \times (u_2 - u_1))))$ For help with the equation and Excel, I thank Mads Kæhler Holst.

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