Between Soil and Computer – Digital Registration on a Danish Excavation Project.

Henrik Skousen
Moesgaard Museum, DK-8270 Hojbjerg, Denmark[1]

The starting point for my paper is a major excavation project in progress under the administration of Moesgaard Museum, previous to the construction of a highway on the east coast of Jutland in Denmark. On this project we have tried to introduce systems for electronic registration of field data throughout all levels of archaeological investigation.

First a few words about the project and the project area illustrated by the use of digital maps. In connexion to the project there has been established a formalised co-operation with the local authorities in charge of the construction plans - the county of Aarhus. In this co-operation we exchange digital maps and other data, which facilitates our communication and in a wider perspective the communication with landowners and other persons who might be affected by our excavations and who may wish the possibility to gain an insight into the project.

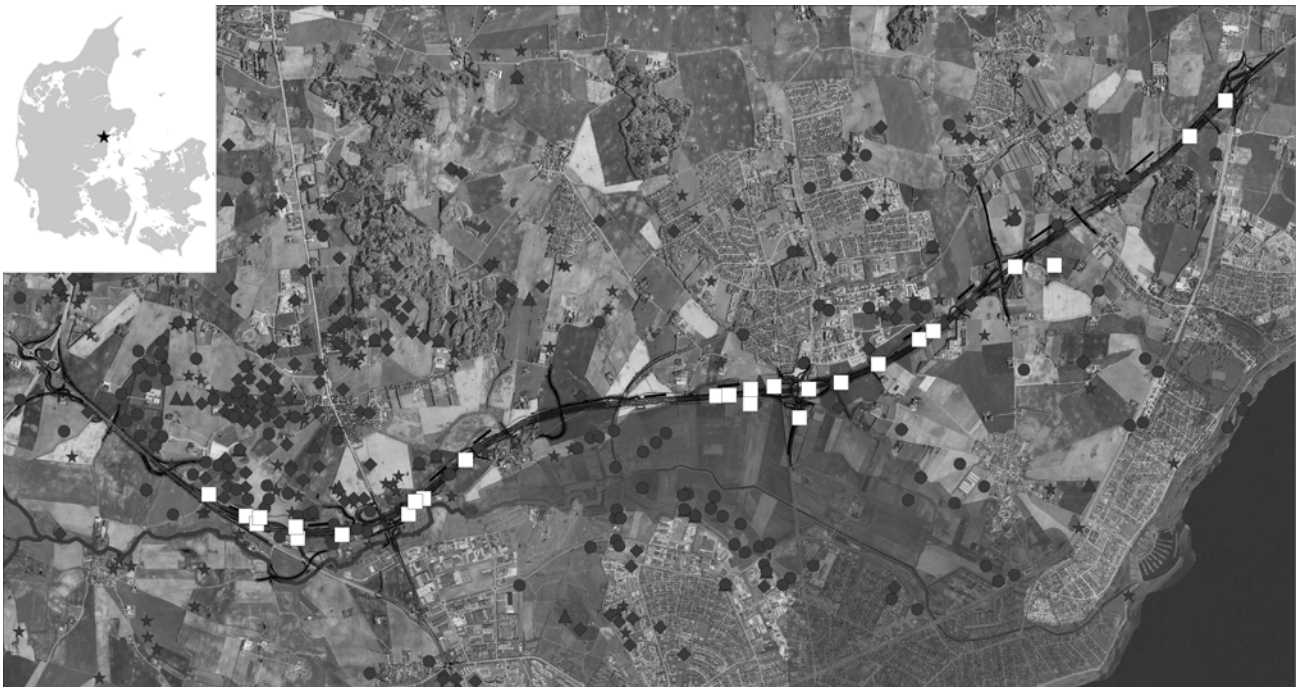

Figure 1. Administration of archaeological data. Map showing the project area with the construction plans of the highway inserted and linked with information from The Danish National Record of Sites and Monuments. White rectangles represents known registrations on the 13,6 km highway tracé combined with newfound sites from field reconnaissance in the area.

In this way the GIS maps have become an integrated part of the project from the very beginning and through all subsequent levels of archaeological investigation.
At the map - figure 1 - we see the highway inserted on the basis of the GIS material we have received from the local authorities constructing the highway.
Our first task was to give an account of the archaeological interests and to this purpose we had a splendid basis in The Danish National Record of Sites and Monuments which is an electronic database containing information on all registered finds and monuments nationwide. At present, The National Record contains data on almost 150,000 finds.
Our digital maps could easily be combined with information from this database. At the map we see a plot from the Danish national record containing registrations in vicinity of the projected highway. Each dot contains information about the archaeological object, state of investigation and status. On this basis we were able to give an impression of the archaeological interests in the area. After this operation status was that 20 sites must be excavated within two years by 5 excavation teams employing all in all 40-45 archaeologists and students. To carry out this task and to avoid a situation by which we would end up with an overwhelming mass of finds and paper recorded data and no energy left to take hand on the final reporting, we formulated a set of wishes and preconditions for a system that could ease and rationalize the task of data recording and reporting.

At the end of an excavation all field data should be electronic. What we needed was…

- A system for electronic data registration
- A system for digitising ground plans
- A registration scheme following a uniform procedure

This leads to the second part of my paper, which will be dedicated to what I call the digital excavation, the use of electronic field registration and the systems we have introduced in our daily work. Illustrated by the…

- Recording of field data on handheld computers
- Data collection in the ArchaeoInfo database
- From field pantographs to digital area plans in MapInfo
- And the linking of collected field data

In our procedure for recording field data we have tried to combine existing equipment with new technology.

Figure 2. “Hardware” for fieldwork. Working with a field pantograph, handheld computer and GPS survey equipment.

As basic elements in the fieldwork we have introduced: *Handheld computers*, *field pantographs* and *GPS survey equipment* combined with software from *Microsoft Access* and *MapInfo*.

As handheld computers we have tried working with Psion 5mx PDA’s, which are functional, require low battery supply, have a handy keyboard as well as a touch screen at a price of about 200 Euro a piece.

The field pantograph is a drawing machine which works by simple mechanics and quick and easy to use.

The GPS survey equipment is an advantage when working in GIS-systems.

It is important to notice that all elements are safe and stabile for outdoors working.

Field data is registered during excavation on handheld computers. All observations regarding contexts, constructs, finds, drawings, photos etc. are registered and classified in a predefined, uniform data structure. In the mens wagon these data are regularly transferred to the main excavation database on portable PC’s. In this way data are secured and checked simultaneous to fieldwork.

The handheld computers have shown to be surprisingly stabile, functional and useable under any weather condition. In case you have a malfunction on the hand-held PDA data are secured on a memory card.

Never the less experiences during our first excavation season shows that they do have clear limitations. Many people have great difficulties give up the paper. The greatest difficulty is probably the mental adaptation as the mental process is different from paper recording. The record does no longer have any immediate physic dimension. The immediate clarity is different. And some persons simply feel insecure with computers.

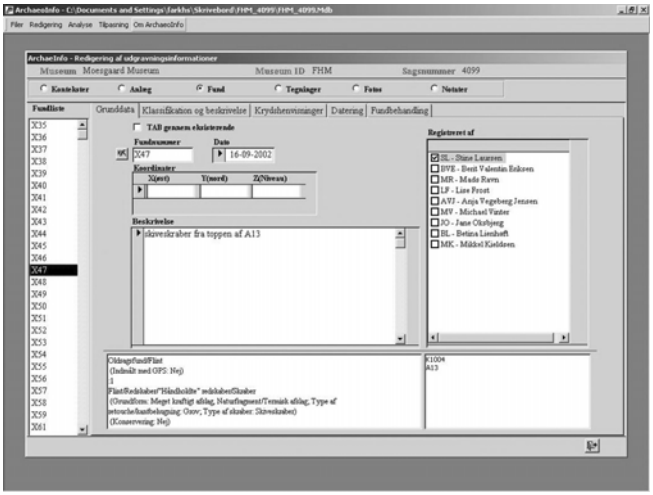

Figure 3. ArchaeoInfo – an object oriented information system for archaeological excavations.

For the recording of excavation data, we use *ArchaeoInfo*. ArchaeoInfo is an object oriented and flexible Access based database created by Torsten Madsen lecturer at the Institute of Prehistoric Archaeology in Aarhus.[2] Data are recorded on a structured form, which you can define on your own.

Collected field data are transferred from the handheld computers to ArchaeoInfo by an automatic converting to Access. In the process of transference, data are checked for errors such as double entries etc.

By Access we get the opportunity to link and exchange data between the various recording systems used at the excavations. In this way we obtain the requested and improved analytic and reporting possibilities.

The linking of several independent databases hasn't been without problems. Working on more databases, which are subsequently combined, demands that you are very conscious about the potential and limitations of the systems. Although functional, one of the problems is the integrity to the overall system of the very simple database on the handheld computers, which isn't optimal. After a phase of introduction these problems have been eliminated.

Recording of area plans and other digital map material is done in *MapInfo*. From ArchaeoInfo you can link to MapInfo.

Ground plans are drawn by the use of field pantographs and fixed by GPS measured UTM reference points. By these the drawings can be geographically orientated and digitised in MapInfo. In this way it is possible to carry out excavations without any local coordinate system. Digitising is done as part of the fieldwork, which means that area plans are quickly secured for further fieldwork, printed on waterproof, transparent paper.

MapInfo is a GIS like program with geographic objects linked to information in tabular data. It has been introduced to Danish archaeology by the national archaeological authorities as a standard to be used in the digital recording of archaeological area plans.

In MapInfo objects are fixed and registered in different layers within the global UTM coordinate system. You define the structure of layers as appropriate. This gives us the opportunity to collect

all relevant map material in a structure of layers containing administrative as well as archaeological maps. Behind the digital maps you have the tabular data linked to the objects in the layers. By these data you get the opportunity to carry out advanced search and analysis.

Figure 4. Digital area plan. Example of an excavation plan digitised in MapInfo superimposing an ortophoto

All finds are recorded during fieldwork with a pre-printed label containing barcode information. These pre-printed labels prevent double entries and the barcode facilitates further work and registration of the objects.

Figure 5. Registration of finds using pre-printed labels.

Further registration is carried out at the headquarter where all finds are washed, numbered and finally classified. Besides all characteristic finds are photo registered in an arrangement with a camera connected to a computer.

Photo registration is carried out in an independent photo database, but the photos can as well be linked to ArchaeoInfo containing all the recorded data relevant to a given photo.

[1] Visit our site on www.moesmus.dk and see more pictures from the excavation project.
[2] ArchaeoInfo was presented at the CAA-2003 by T. Madsen. See: ArchaeoInfo. An Object Oriented information system for archaeological excavations.