# 18

## Who will make the drawings?

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### 18.1. Introduction

The problem with new developments in the use of computers in archaeology is that either they work or do not work. But as soon as things work, especially if they are dealing with computers, they sound so basic, boring and old-fashioned. This is one of the reasons why we normally hesitate to write about databases, graphics and field computers, but in the end that is precisely what this article is all about. So why write it? The answer is simple. We promised the people who gave us the money to buy our equipment that we would "spread the word".

### 18.2. Total Stations

The Institute of Prehistory of Leiden University (The Netherlands) is using an Electronic Distance Measuring instrument (EDM), a so called electronic "Total Station" to register data on excavations, not only to measure the precise location of points but also to draw sections and plans. In 1990 our Institute received a grant from the Netherlands Organisation for Scientific Research (N.W.O.) to investigate how far an archaeological excavation can be automated. We were planning to buy, among other things, a Total Station, a computer, a digitiser and a plotter. We use the Total Station, a SET4B, in combination with an electronic field book for recording data, a so-called SDR (Survey Data Recorder). The Total Station measures vertical and horizontal angles and distance by means of an infrared light beam and a reflecting prism. For the processing of the data we use a portable computer with our program SDRmap.

On large-scale excavations the Total Station is very useful for setting out the site grid system. It works fast and accurately. We also use the instrument for placing measurement tapes in the trenches and we measure the three-dimensional co-ordinates of features and finds. The electronic field book gives us the opportunity to add information to these measurements, such as find number and find category. On large-scale excavations we use the following procedure: first we take at least one measurement of every feature and then add the find number of that feature to the electronic field book. After completion of the trench, we transfer the data from the SDR to a portable computer. On the computer we process the data with the program SDRmap. In SDRmap one can make selections and drawings, like a contour map (or digital terrain model). Normally we transfer such selections as find numbers and X, Y and Z co-ordinates to a dBASE file. This file can be used later to add more information.

We will use two of our excavations to illustrate the work with Total Stations. First a small excavation in a wetland situation in the centre of the Netherlands, and then a large scale project in the extreme south of the country.

### 18.3. Sections

Sometimes the use of sophisticated instruments is unavoidable. Such was the case in the excavation of Brandwijk (Van Gijn & Verbruggen, in prep.), Het Kerkhof (which, by the way, means "the graveyard" — it was where farmers cremated their cows infected with splenic fever). "Het Kerkhof" is the top of a sand hill in the middle of the peat district (see Fig. 18.1). It is situated approximately 3km north of the Hazendonk (see A. R. T. Jonkers' article in this volume). These sand hills were formed in dried out river beds of the Rhine and Meuse during the Late Glacial, about 10,000 years ago. Due to the post-glacial sea level rise the dunes became surrounded and partly covered by thick layers of clay and peat. During the Atlantic period, *donken* were the only dry places in an extensive swamp forest with numerous lakes. Over one hundred of these dry river dunes have been found in the peat district.

In 1990 one of us (MV) proved the presence of Neolithic remains in the peat surrounding the donk "Het Kerkhof". One hundred and ten gouge-auger borings unravelled the stratigraphy around this donk. Five refuse layers were discovered, up to 7m below the surface. A test excavation of the site followed in 1991. Only one pit measuring 3m x 15m with a depth of 5m, the bottom being 6.5m below sea level, was dug on the donk slope in the peat.

As we pointed out earlier, we were forced to use advanced instruments, that is, a Total Station instead of a simple levelling instrument. The pit was simply too small, too soft and unstable to set up our levelling instrument. We had several additional motives to use a Total Station and SDR:

- To separate the find layers we decided to excavate from the top of the uppermost refuse layer downwards. As a result we had to take an incline of 15 degrees for granted. The only way to make the drawings was to measure 3D-coordinates.
- On the basis of the geological information we expected to find huge quantities of pottery, flint and bones, concentrated in four layers. To avoid a classical Hazendonk trauma (see Chapter 17), we thought it advisable not only to measure 3D-coordinates, but also to register layer number and find number.

Things either work or they do not. In "Het Kerkhof" the Total Station and SDR worked in a first class manner. In

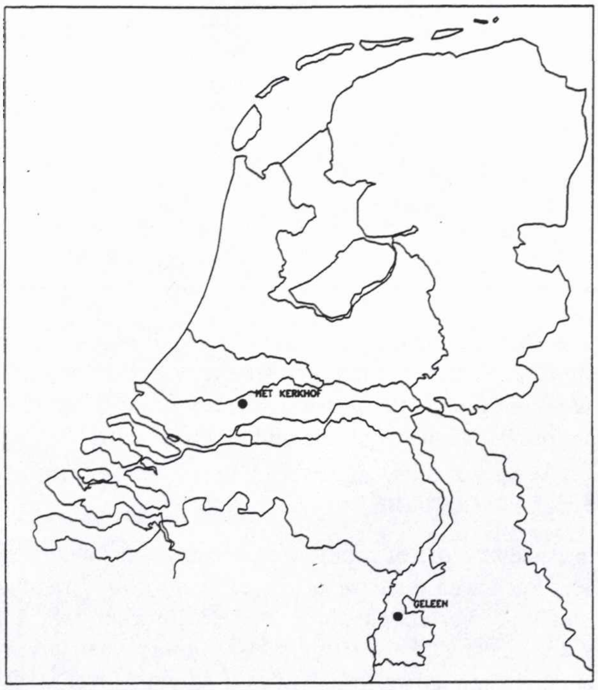


*Figure 18.1: The Netherlands with the location of "Het Kerkhof" near Brandwijk and Geleen.*

twenty days we recorded 4100 artefacts. In the electronic field book we registered X, Y and Z-co-ordinates (Fig. 18.2), find numbers, artefact categories and layer numbers. It was quite easy for one person to measure 500 artefacts a day. At the end of the working day we transferred the data from the SDR to dBASE, enabling us to add information for the description of the artefacts. The sort and plot options of our small program JAN11, a link between dBASE and AutoCAD, offer a thousand and one possibilities. This means that anything described in dBASE can be plotted.

## 18.4. Plans

During the summers of 1990 and 1991 the Institute of Prehistory of Leiden University excavated the site of an early Neolithic settlement in Geleen (Louwe Kooijmans 1991, Kamermans *et al.* 1992), province of Limburg, in the south-eastern part of the Netherlands (see Fig. 18.1). The settlement is a beautiful example of an almost complete village of the Bandkeramic, or Linear Pottery culture (5,300 BC).

The settlement was, if not the first village of the Netherlands, at least one of a series of very early villages. The archaeological map is dominated by plans of long houses (Fig. 18.3). There are four long houses with a wall trench, at least ten ordinary long houses without a wall trench, and about 36 other houses or house locations, ranging from possible long house fragments and full small house plans to disputable post clusters. Most of the houses have the characteristic Y-configuration of central posts. Some very important features are the shallow traces of narrow trenches, surrounding the larger part of the settlement. They are the remnants of a multi-phased surrounding structure, probably a palisade.

During this excavation we began to experiment with site planning with the Total Station.

As the 1991 excavation was a salvage excavation, we only had from April to September to excavate 3 hectares before building activities for a town extension were started, so we were in a hurry. Time was crucial. Could we make the site plan faster with the Total Station than by hand?

Our work procedure was as follows: we followed the contour of the trenches and the features, and made the site plan without tape, rod, paper and pencil.

It sounds relatively easy, but I assure you it is not. In order to get an accurate drawing lots of measurements need to be taken, and in order to get a good map lots of codes must be input to tell SDRmap, the computer program, how to draw the lines. There are codes to start a curve, end a curve, close a loop, *etc.*

## 18.5. Example

We will give one detailed example. You have to keep in mind that SDR connects points with the same code, to be precise it connects a point with the previous point with the same code, unless you tell the program specifically not to do so.

With reference to the imaginary plot shown in Fig. 18.4, we start measuring the south-west corner of the trench and entering the codes P ST N1 which means P for "Put trench", ST = Start, N1 = number 1 (trench number 1). The next point is the start of a feature so the code is SP for feature, SNC = Start New Curve and P for Put trench. Next we measure two points for the feature and add to one of them the feature number. Back to the trench for measure number 5 with the code ENC = End New Curve. We do exactly the same for the other feature and more or less the same for the feature in the north-east corner of the trench. Here we do not start a curve, but we end the line with an ES = end sequence code. We close our trench with a CL code in the north-west corner. Other instructions include SL = Start Loop if it is a closed curve, and EL = End Loop to close the loop.

The most important person during this kind of work is the person who holds the prism. Only he or she can see the start of a new feature or the intersections between different features, and he or she gives, by means of a radiotelephone, the codes to the person behind the Total Station. When a trench was completed, we transferred the data to the field computer, created a map and transported the map to AutoCAD. The entire process, from positioning the Total Station to a completed AutoCAD map, for a trench with relatively few features, took less time than the conventional method. The conventional method included laying out measuring tapes, making a drawing with pencils and rods, and digitising the field map in order to get an AutoCAD drawing. However, for trenches with lots of features, the coding became so complicated that it was easier to make a plan by hand.

We tested this procedure on several excavations. For instance on a large scale Bronze Age to Iron Age excavation in Oss (Fokkens 1992), province of Noord-Brabant, and on a small scale excavation in Limburg (Verhart & Wansleeben 1991). The results were the same: with rela-

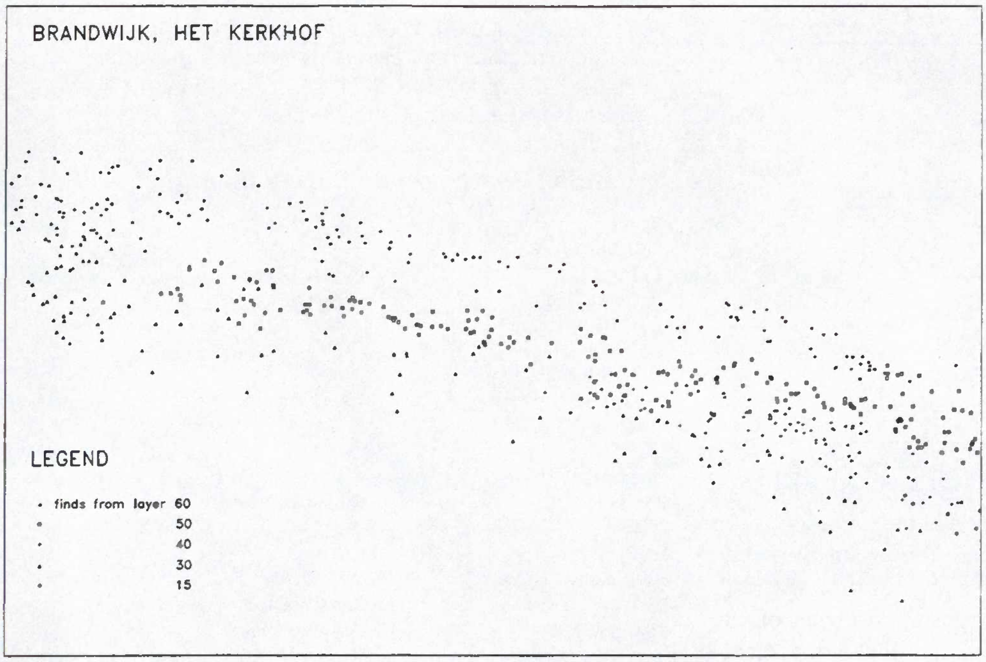


*Figure 18.2: A section from "Het Kerkhof" near Brandwijk.*

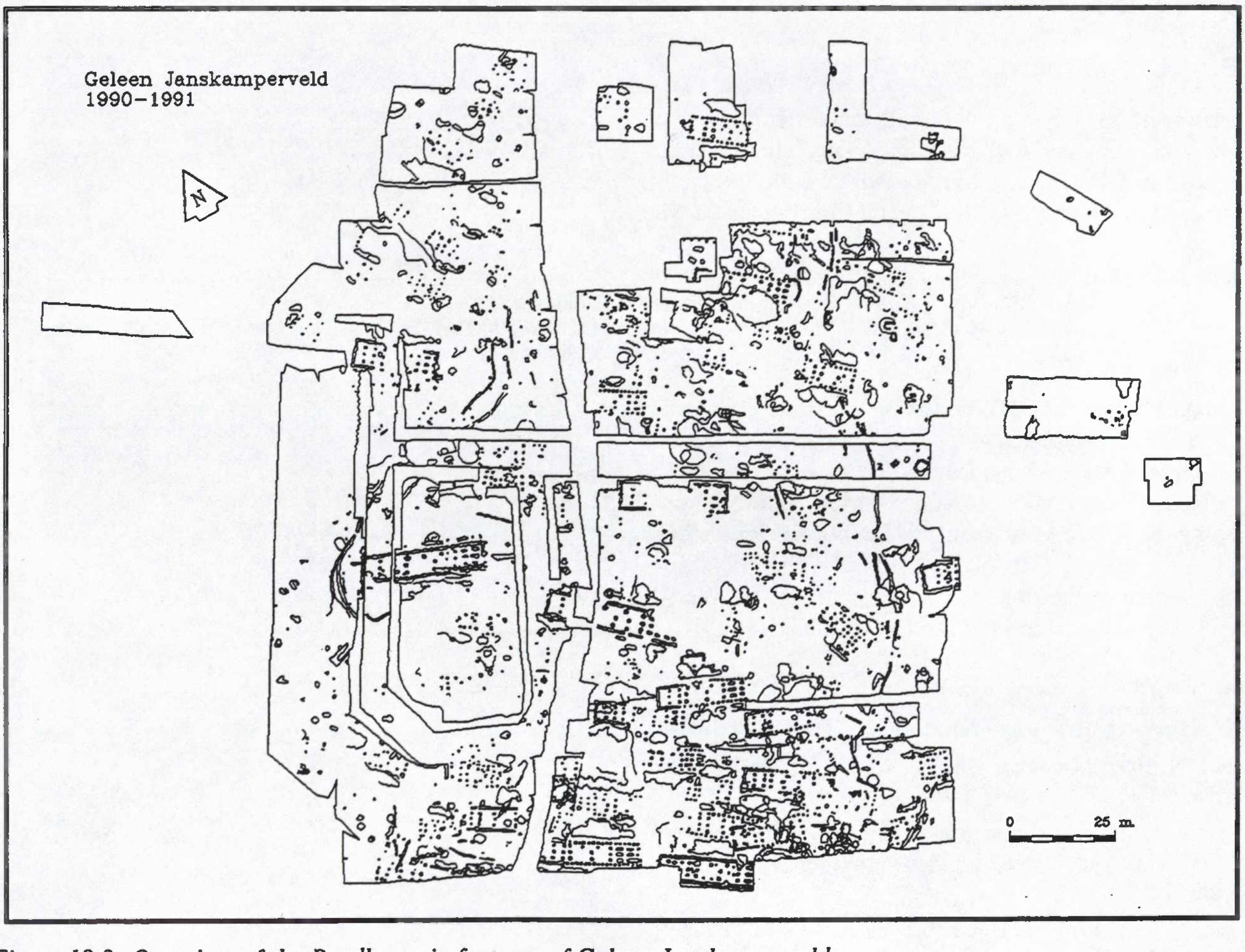


*Figure 18.3: Overview of the Bandkeramic features of Geleen-Janskamperveld.*

tively few features it was easier and faster to use the Total Station, otherwise it was preferable to make drawings by hand.

Ever since we started to make plans with the Total Stations, there has been a debate in our Institute about this development. There are field archaeologists who are unwilling to give up the old pencil and paper. They believe that you have to walk through the trench with a pencil and an eraser to make a good section drawing or plan. Of course you must be able to make corrections and to indicate when you are not sure whether to draw a solid or broken line. We try to solve this problem by immediately making a print-

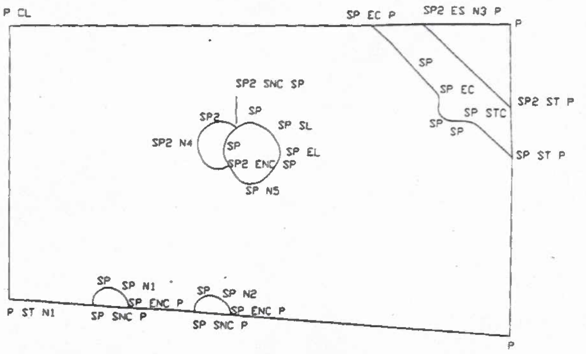


*Figure 18.4: SDR codes in an imaginary plot.*

out, preferably in colour, on translucent plastic film. We then go back into the field and pencil in the corrections. In order to prevent rain washing away the printer drawing, we mirror the image in AutoCAD and print it on the back of the transparent film. Then we put the drawing on the drawing board the other way round, and make the corrections on the other side of the film.

## 18.6. Conclusions

So, answering the question who will make the drawings: we, the archaeologists will make the plans. In principle there is no difference in making drawings with an elaborate piece of machinery or with a pencil. In conclusion we can say that the only reason why we should make drawings with the help of a Total Station is that, in some cases, it is faster and, most of the time, the results are comparable.


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## Appendix: Feature code library listing

| | | |
|---|---|---|
| CL | CC | |
| close lijn | | |
| 23 Join | First same code | |
| 25 Curve End | Unknown tangnt | |
| | | |
| EC | CC | |
| einde curve | | |
| 25 Curve End | Tan next same | |
| | | |
| EL | CC | |
| einde cirkel | | |
| 25 Curve End | Closed loop | |
| | | |
| ENC | CC | |
| einde nieuwe curve | | |
| 23 Join | End sequence | |
| 25 Curve End | Tan prev same | |
| | | |
| ES | CC | |
| eind sequentie | | |
| 23 Join | End sequence | |
| N | CCP | |
| vondstnummer | | |
| 26 DB Desc | | |
| | | |
| P | PC | |
| putgrens | | |
| 3 Point Sym | Dot | |
| 4 Sym Size | 1 mm | Paper |
| 5 Sym Pen | 1 | |
| 12 Line type | 1 | |
| 14 Line Width | 0.3 mm | Paper |
| 15 Line Pen | 1 | |
| 23 Join | Prev same code | |
| 27 DB Code | P | |
| | | |
| SL | CC | |
| start cirkel | | |
| 23 Join | Start sequence | |
| 24 Curve Strt | Closed loop | |
| 28 Skip Feat | Join | |
| | | |
| SNC | CC | |
| start nieuwe curve | | |
| 24 Curve Strt | Tan next same | |
| 28 Skip Feat | Join | |
| | | |
| SP | PC | |
| spoor | | |
| 3 Point Sym | Dot | |
| 4 Sym Size | 2 mm | Paper |
| 5 Sym Pen | 5 | |
| 6 Pt Annot | Desc text | |
| 8 Pt An Size | 3 mm | |
| 10 Pt An Pen | 3 | |
| 12 Line type | 1 | |
| 15 Line Pen | 5 | |
| 23 Join | Prev same code | |
| 27 DB Code | SP | |
| | | |
| SP2 | PC | |
| spoor 2 | | |
| 3 Point Sym | Dot | |
| 4 Sym Size | 2 mm | Paper |
| 5 Sym Pen | 5 | |
| 6 Pt Annot | Desc text | |
| 8 Pt An Size | 3 mm | |
| 10 Pt An Pen | 3 | |

| | | |
|---|---|---|
| 12 Line type | 1 | |
| 15 Line Pen | 5 | |
| 23 Join | Prev same code | |
| 27 DB Code | SP2 | |
| ST | CC | |
| start lijn | | |
| 23 Join | | Start sequence |
| 28 Skip feature | Join | |
| STC | CC | |
| start curve | | |
| 24 Curve Strt | Tan prev same | |

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