STRATA - THE MICROCOMPUTER VERSION

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Introduction

The need for computer assistance in the ordering of archaeological contexts from a large urban site was first pointed out in April 1974 by York Archaeological Trust. It was stated that 'drawing the phase diagrams involves weeks and months of work for one man, usually the site supervisor. It is probably the greatest bottleneck in the work of the Trust. This is obviously a job well suited to machine methods'. To cater for this need the STRATA program (Wilcock 1975; Bishop & Wilcock 1976) was written in ALGOL 60 for main frame use. It was successfully used to produce phase diagrams for the Bishophill Site, York. Now that microcomputers are actually being used on site, a microcomputer version of STRATA has become necessary. Using this system, context relationships can be checked and any ambiguities investigated while the excavation is in progress. The microcomputer version has been written in BASIC, a language available on all microcomputers, and a PASCAL version is also planned. The chief limitation seems to be the long run time.

Details of the STRATA algorithm

The STRATA algorithm has the following processing phases:

1 Data input

Site title

Expected maximum number of vertical positions. This is used to control formatting of the output and also to detect context loops (see 12 below).

Pairs of contexts separated by delimiters of three types: upper/lower relationships; same date relationships (distinct contexts thought to be of the same date); identities (contexts separately numbered but now known to be identical).

2 Removal of any duplicate identity specifications.

3 Deletion of identites.

4 Removal of any duplicate same date specifications.

5 Output of valid same date specifications.

6 Rationalisation of same date context relatioships, e.g. if a/b and (a = c or c = a) then include c/b; if in addition (b = d or d = b) include a/d and c/d. This rationalisation is necessary to obtain a complete automatic phase diagram.

7 Sorting of context relationships by upper context, and by lower context within each group of relationships for a given upper context.

8 Removal of any duplicate upper/lower context relationships.

9 Detection and notification of relationships of the form a/b together with b/a. While not necessarily illogical from the archaeological point of view, this situation must be investigated. From the computer point of view the situation is illogical and is henceforth deleted to prevent looping in the program.

10 Output of sorted list of context relationships.

11 Counting of number of links up and down from all contexts.

12 Detection of 'chain heads', i.e. contexts which have no contexts above them. Use of a stack to assemble chains and to allocate vertical and horizontal positions in the phase diagram to all contexts. If the maximum vertical position input in 1 above is exceded, this usually means that a loop of contexts of the form a/b/c...../a has been detected. While not necessarily illogical from an archaeological point of view, this situation must be investigated. The loop is notified, and the bottom link deleted to prevent the program looping.
13 Listing of chain heads. Sorting of links by lower context and by upper context within each group of relationahips for a given lower context.
14 Output of sorted lists of all lower contexts with allocated vertical and horizontal positions, number of links to upper contexts and an individual sorted list of the relevant upper contexts. Output of vertical positions, each with a sorted list of the contexts allocated to the position. Output of automatic phase diagram.

Experimental results

The program STRATA V1.0 written in BASIC occupies 14K bytes on the RML 380Z microcomputer (4MHz Z80A microprocessor). An empirical run time relationship, using a BASIC interpreter, of:

$$n^{1.65} - 95 \text{ seconds}$$

for n context links was found. This gives estimated run times of 103 minutes for 200 links and 472 minutes (nearly 8 hours!) for 500 links. Run times of this order are of course not acceptable. The situation may be improved by:

(i) splitting the data into several overlapping blocks, e.g. if the 500 links were split into 5 overlapping blocks of say 110 links, run time would drop to about 3 hours.

(ii) using a compiler, and probably a more efficient language, run time may undoubtedly be reduced to an acceptable figure on a microcomputer. This is the aim for future work.

An example of the program run

ROMAN HOUSE: description of contexts

```
 1 topsoil/humus, modern
 2 final destruction layer, inside
   house, end of period II
 3 rough floor, inside house,
   period II
 4 levelling inside house,
   period II
 5 destruction layer, inside house
   end of period I
 6 occupation deposit on top of
   floor 1B
 7 occupation deposit on top of
   floor 1A
 8 levelling outside house, period I
 9 alluvial deposit, pre-Roman,
   after timber building destruction
10 topsoil/humus layer, period of
   timber building
11 not allocated
12 floor 1B
13 floor 1A
14 posthole of timber building,
      pre-Roman
15 wall 2
16 wall 1
17 foundation of wall 1
18 foundation trench
19 destruction layer, outside
   house
20 erosion surface (cuts all
   road surfaces)
21 garden soil, outside house
22 road 3
23 soil
24 road 2
25 soil
26 road 1
27 levelling (soil), outside
   house
28 alluvial deposit, pre-Roman
29 natural clay
```

Preliminary matrix

	1	2	3	4	5	6	7	8	9	10	20
1						1					
2	2					19					
3	3				20						
4	4				21						
5		15			22						
6		5			23						
7		6			24						
8		12			25						
9		7			26						
10		13									
11		8		27							
12		16									
13		17									
14		18									
15		9	28								
16		14									
17		10									
18		29									

Conclusion

It has been shown that the analysis of stratigraphic relationships on site using a microcomputer is a feasible proposition. This facility will enable context relationships to be checked for consistency while the excavation is still in progress, with the resolving of ambiguities before the evidence is destroyed. Run times are lengthy at present, but suggestions have been made about how to bring processing times within acceptable limits.

BISHOP, S. & WILCOCK, J.D. 1976 Archaeological context sorting by computer: the STRATA program. Science & Arch. 17, 3-12.
WILCOCK, J.D. 1975 Archaeological context sorting by computer. Comp. Appl. Arch. 3, 93-97.