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The Southampton–York Archaeological Simulation System

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34.1 Introduction

The Southampton–York Archaeological Simulation System, henceforth called SYASS, is a joint project between the Departments of Archaeology at the Universities of Southampton and York. It is funded by the UGC/Computer Board *Computers in Teaching Initiative* and is one of many projects at present underway in universities throughout the UK (see also papers by Martlew, Rahtz and Ruggles in this volume).

Excavation technique and excavation strategy have long been an integral part of almost every university degree course. Because excavation technique and strategy have traditionally been taught in the classroom, followed by field experience, a method of simulating the process of excavation should provide a more realistic teaching aid. SYASS is being developed with this aim to the forefront of its objectives. The system concentrates on excavation strategy and will allow multiple methods to manipulate a data set or sets.

34.2 Computers and education

Because it is generally felt that there is a qualitative difference between Computer Aided Learning and Computer Aided Instruction there were some initial choices to be made in the overall strategy concerning the development of SYASS. It was generally felt by the Steering Committee,[1] after much discussion, that a broad resource based simulation (Rahtz 1987) would be more appropriate to modern under-graduates and modern teaching methods. Thus it became clear that we wished to develop a resource which could be used in teaching rather than a 'game' which the students played and got a score at the end for the right answer. In this respect SYASS is to be viewed as a resource based system designed to give students of archaeology (and others) an insight into the strategy decisions involved in the undertaking of archaeological excavations.

SYASS, as envisaged at present, is to be a query-based system with a database forming the core and a user friendly front end bolted on. It will be a resource in the sense that

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[1]My thanks to the steering committee: Martin Carver, Tim Champion, Sebastian Rahtz, Julian Richards, Steve Shennan, Robin Torrence and Todd Whitelaw.

it will be user driven rather than program determined and query based in that data is available for 'browsing' which may be accessed by the user and manipulated as she/he wishes. In this respect the proposed system has all the characteristics of a knowledge-based system, that is, a system whose central part is a dynamic database and which is usually manipulated by an expert system shell.

The major concerns of SYASS have been that the system, when complete, should provide:

1. Integrity in the sense that it works and is bug-free.
2. Portability in that it can be used on a wide number of IBM compatible machines.
3. Compatibility with other data storage methods in that data stored in machine readable form can easily be added to the system as a new data set.

In general the rule based data set which I have described goes a long way to meeting the above criteria (particularly in relation to point 3). All of the above points are desirable as the system is hoped to receive quite wide usage not only in the UK but also world wide. Thus portability and upgrading become very important considerations.

34.3 Data storage

There are numerous methods of storing and accessing data held either on disk on micro-computers or on disk on mainframes. There are several database packages available which work both on the PC and on the mainframe, such as Ingres (on a wide range of PCs, minis and mainframes) and dBaseIII+ (PCs and mini computers such as the IBM System/36). Given the fact that the SYASS software, when developed, may be used widely throughout the UK (and elsewhere) a standard data format is required which is applicable world-wide and software independent.The simplest solution and the one which has the widest *de facto* use in archaeology is dBaseIII+ .DBF files. These files can easily be read by the SYASS program if the file is structured properly, and plain ASCII files may also be used in conjunction with dBaseIII+ files and may prove the most acceptable and widespread method of ensuring that the fundamental aims of SYASS are kept intact.

The advantage of dBaseIII+ primarily lies in its data manipulation. dBaseIII+ is fairly standard in archaeology and much recording of archaeological data, including excavation data, is in dBaseIII+ files. The dBaseIII+ command language is designed to handle the manipulation of data in database files and comes with facilities to design screens for data input and more importantly in this case data display. The programming language can also call modules written in other programming languages such as Pascal, Prolog and C. Thus the more complex mathematical programming aspects (such as graphics etc) can be called and executed from within dBaseIII+. Selected information can be accessed by other programs to provide basic statistical routines or graphic displays.

34.3.1 Programming languages

At present the SYASS software is being implemented in the dBaseIII+ command language. However dBaseIV has been announced, and this new release will have support

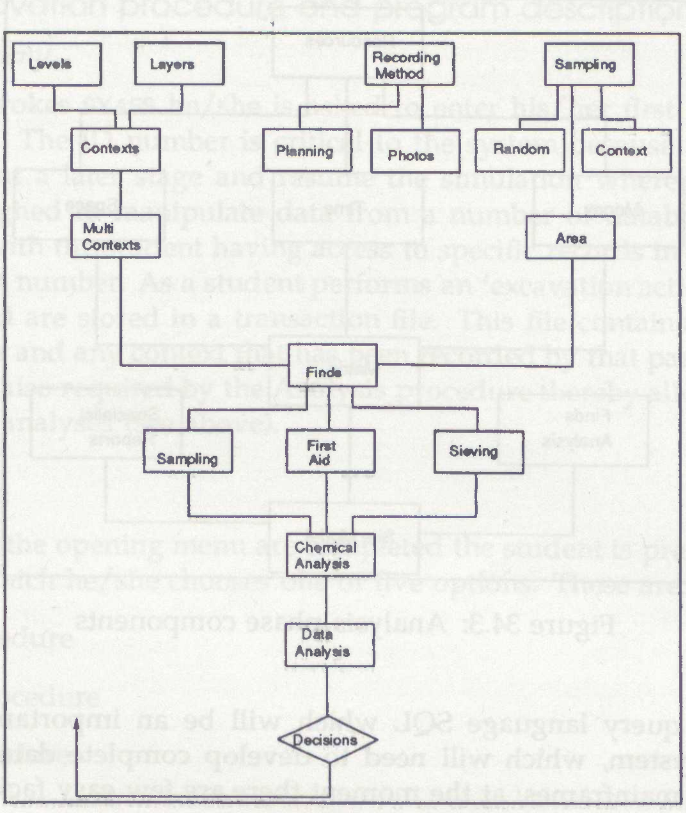

Figure 34.1: Excavation phase components

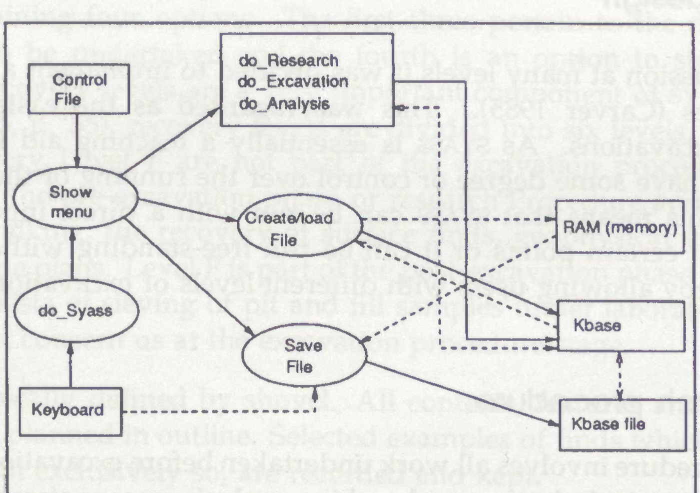

Figure 34.2: Data flow diagram

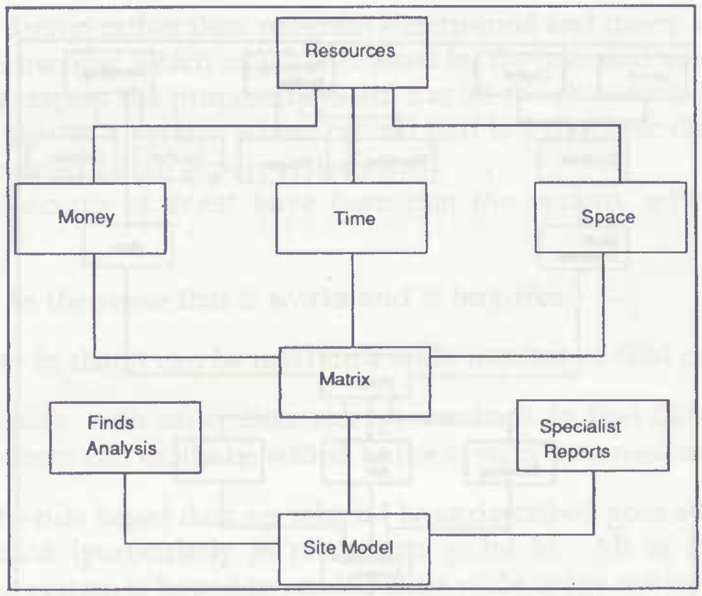

Figure 34.3: Analysis phase components

for the standard query language SQL which will be an important element of the projected SYASS system, which will need to develop complete database connectivity between PCs and mainframes; at the moment there are few easy facilities for transferring applications between PCs and mainframe database systems.

34.4 System design

After much discussion at many levels it was decided to implement a three tier system of set procedures (Carver 1985). This was regarded as the easiest way to teach archaeological excavations. As SYASS is essentially a teaching aid it is desirable for the instructor to have some degree of control over the running of the program at any or all stages. This means that SYASS can be run with a direct input from a course tutor to highlight certain points or it can be run free-standing without any direction whatsoever thereby allowing users with different levels of excavation skill to benefit.

34.4.1 Research procedure

The research procedure involves all work undertaken before excavation actually begins. Research procedures include map and archive analysis, reconnaissance methods such as field walking and aerial photography, costing of the project, obtaining funding etc. Once this reconnaissance has been undertaken the student is in a suitable position to formulate a suitable research design for the project and to decide on realistic (or otherwise) goals for the excavation. At present the SYASS project is concentrating on the excavation and analysis procedures and the full implementation of the research procedure will begin in the autumn of 1988.

34.4.2 The excavation procedure and program description

34.4.2.1 Opening menu

When a student invokes SYASS he/she is asked to enter his/her first name, surname and an ID number. The ID number is critical to the system because it allows a user to return to SYASS at a later stage and resume the simulation where he/she left off. The system is designed to manipulate data from a number of databases linked in a relational manner with the student having access to specific records in various files *via* the key field context number. As a student performs an 'excavation action' the contexts which are excavated are stored in a transaction file. This file contains two fields, the students ID number and any context that has been recorded by that particular student. This information is also required by the Analysis procedure thereby allowing a student to perform various analyses (see above).

34.4.2.2 Main menu

When the details of the opening menu are completed the student is presented with the main menu from which he/she chooses one of five options. These are:

1. Research Procedure
2. Excavation Procedure
3. Analysis Procedure
4. Help
5. Exit SYASS

Having chosen the excavation procedure module the student is presented with a further menu containing four options. The first three pertain to the detail at which the excavation is to be undertaken and the fourth is an option to stop excavation. The Information Recovery levels are a very important component of SYASS. Following Carver (Carver 1985, p. 55), recovery levels are divided into six levels, A–F. Recovery Level A and recovery Level F are not part of the excavation procedure. Level A recording is part of the pre-excavation phase or research Procedure and includes such activities as field-walking, the recovery of surface finds, geophysical exploration and the creation of outline plans. Level F is part of the post-excavation phase (although now always so) and consists of sieving of pit and fill samples under laboratory conditions. Levels B–E are what concern us at the excavation procedure stage.

Level B This is typically defined by shovel. All contexts, features and structures are described and planned in outline. Selected examples of finds which typically will be large but not exclusively so, are recorded and kept.

Level C This level is defined by coarse trowel. Contexts are described and some selected details are described by colour using the Munsell soil colour chart. Features are fully described and planned in detail. Spot heights are also taken at this level. Structures are defined recorded and photographed. Plans are drawn at the 1:100 level. Selected attributes of structures are photographed. All finds are recorded, examples kept and are plotted by metre square.

Level D This level is defined by fine trowelling. Contexts and feature are fully described and planned at 1:20. Additionally features are photographed and contoured. Structures are excavated and photographed by phase. Sample sieving is also undertaken on-site with the spoil then being discarded. All visible finds are plotted, recorded in three dimensions and kept.

Level E This level is defined minutely. This could involve definition at the 'probe and brush' level and similar small tools. finds are treated in the same manner as Level D. Contexts, features and structures are all defined minutely, fully described and planned at 1:5 or 1:10, and photographed.

The student chooses a recovery level based on the above criteria. After any action on the part of the student the recovery level can be re-chosen enabling the student to make optimum use of resources based on carefully chosen strategies.

34.4.2.3 Defining an area for excavation

Once the recovery level is defined the student is then asked to specify where to excavate and to what depth. This is achieved by using a standard X Y Z grid co-ordinate system. Using this system the student can excavate an area of any chosen size based on the square, up to and including the whole site (open area excavation). Similarly small *sondage* trenches can be put in at any point to enable the participant to get a feel for the site and its complexity before commencing larger scale operations across the site. It will be noticed that the shapes of the cuttings are based on rectangles and squares. It would be interesting to allow students to excavate in non-standard shapes such as circles or trapezoids but it was felt that the amount of programming needed to define these non-standard shapes outweighed the usefulness (if any) of this facility and was not worth the effort in relation to the life of the project.

34.4.2.4 Data access or excavation

Once all the parameters have been set the program then proceeds to 'excavate' the area specified. Excavate in this context means that the databases are queried and selected information is extracted from them. At this level it is only necessary to extract and context number(s) with which the student has come into contact. This data is then stored in the student's log file and tagged as having been excavated and recorded. When this is done the student is told, by means of a simple counter how many contexts have been encountered during that particular excavation activity, how much money has been spent and the money remaining in the budget. Control is then passed to the main menu and the participant is free to choose one of the main menu options outlined above.

34.4.3 Analysis procedure

The analysis procedure forms the core of SYASS. It is here that the student can interpret any or all data that has been accumulated during the course of the excavation and research procedures. This ranges from a simple examination of the contexts and finds descriptions to graphical and statistical analyses of the data. Graphics modules are being developed at the University of York. which will enable point pattern distribution of finds and contexts to be displayed by type and context. Further modules planned include the ability to draw sections across the site and to produce site plans at given intervals. The statistical routines are already in existence and have been ported from a Unix environment to run on IBM PS/2s.

34.5 Management skills

The management of the resources at the disposal of the director of any archaeological excavation is a very important part of conducting a filed project. SYASS recognises this and will incorporate some management skills into the program. Perhaps the most obvious is the control of the financial resources of the project. Throughout the SYASS program the user will be faced with decisions concerning the allocation of the budget at his/her disposal. For example a user might choose to strip a large area of the site by mechanical means at a considerable saving in money terms but a possible loss in terms of information retrieved given that machine stripping will not enable the archaeologist to uncover all the contextual data and some small finds (if present) will end up on the spoil-heap. The same considerations could be applied all procedures of the program. At any stage the user shall be able to access a sub-routine which will allow costings to be done on line enabling him/her to expend the available budget in the most advantageous manner and make strategy decisions based on budgetry considerations.

Carver (Carver 1986, p. 79) has given a detailed breakdown of excavation costs in so far as they apply to the Sutton Hoo research project. Assuming that these costs are standard they can be used to model the cost of any given excavation operation, the minimum number of staff required to oversee the activity, the recovery rates in metres square per hour and per day and the cost per metre square of each activity. Costings are also given for the staff employed and this may also be taken into account in the general overall costings.

34.6 The immediate future

The SYASS system will continue to be developed and it is planned to have an integrated version developed by October 1988 for testing by students at the departments in York and Southampton. Based on the results from these tests further refinements will be added and it is planned to release a version for wider beta-testing in the Summer of 1989.

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