Experimental Archaeology Dissertations

Guide to Best Practice

For UK Undergraduate & Postgraduate students

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Introduction

These notes are designed to guide undergraduate and postgraduate (masters and doctoral research) Archaeology students who are considering incorporating archaeological experiments into either dissertations (undergraduate or masters) or doctoral theses (PhD). The notes highlight the many benefits of experimental approaches and key issues in the design and implementation of archaeological experiments. These include the formulating of scientific research questions, designing and implementing appropriate experimental procedures for testing these questions, identifying the necessary resources (including personnel, facilities, equipment, consumables, and funding), risk assessment and health & safety issues, techniques for the effective analysis of experimental data-sets, and potential pitfalls.

Why consider including experiments in your research topic?

One of the main challenges in selecting a research topic is finding a subject where you can generate some original data of your own which enables you to say something new about a topic. A good dissertation should begin with clearly defined research questions and a method for addressing those questions, whether it involves library work, fieldwork, experimental work, or laboratory analysis. One good approach is to come up with methods which generate tables of data relevant to your research questions: you can then prepare graphs such as histograms and pie charts comparing the data from different archaeological contexts. Statistical tests will enable you to establish whether the observed differences between your samples are significant. The graphical and statistical patterns in these data will then underpin your interpretations and conclusions. That general model of research question > method of analysis > tables of data > graphical and statistical summaries of data > interpretation and discussion is suitable for any dissertation on a science topic (e.g. experimental approaches or environmental archaeological analysis of molluscs, pollen, seeds, or sediments). It would also be a suitable approach for many other types of project, especially those dealing with artefact assemblages (e.g. lithics and pottery).

Experimental topics are a good way to generate original data for your dissertation and to make sure that your dissertation work is focused on definable research questions. Experimental work is also a good way of getting involved in scientific approaches to archaeological questions: this can be a valuable experience for BA Archaeology students if you wish to undertake scientific work at postgraduate level (through Reading's *MSc Geoarchaeology* for example). Practical scientific experiences can also be a helpful

foundation if you are seeking to work professionally in archaeology after graduation (e.g. working for a company such as Oxford Archaeology). Experimental archaeology experience could also be an advantage if you are seeking a career in heritage interpretation, management, and/or education. The key point is to discuss your future plans with your dissertation supervisor and to design a dissertation which builds on your strengths and, if you wish to work in archaeology or related areas, creates foundations for a future career.

Types of experiment

Types of archaeological experiment vary widely and a wide range of examples can be found in the textbooks by John Coles (1973, 1979). More recent examples have been published in a variety of journals, including the *Journal of Archaeological Science* and *Lithics: The Journal of the Lithic Studies Society*. Experiments with artefacts can include questions about how artefacts were made or used, or what traces of wear are left on artefacts as a result of particular activities. Although understanding how artefacts (e.g. flint or bone tools) were made can be tricky because of differing levels of skill, sometimes even the most unskilled experimental attempts can be helpful in developing our understanding of the artefacts and their manufacture. Rather more amenable to research are the wear traces left on artefacts as a result of the activities they are used in. Archaeologists have made many assumptions over the years about artefact use in the past, and experimental methods provide us with a way of testing those assumptions.

Experimental approaches are also important in increasing our understanding of how the archaeological record forms, for example looking at changes to soils following burial and the traces left by hearths and a range of activities on hut floors. Many of these types of studies make use of existing experimental sites (e.g. experimental earthworks and Butser Ancient Farm) and use techniques of scientific analysis to investigate soil changes or traces of activities (e.g. sediment micromorphology and mineral or element analysis of soils and sediments).

Opportunities also exist to make use of what are sometimes called ‘natural experiments’. These are situations where known human activities at a known date in a known environmental setting have created a particular context, the investigation of which can enhance our understanding of the archaeological record. Examples would include situations where a bank, road or railway embankment of known construction date has buried a soil of known type which formed under known environmental conditions. Researchers could then investigate those soils to understand changes to buried soils in the years, decades or centuries after burial. This illustrates that there are very widespread contexts which may be used to answer some (but not all) of our questions about buried archaeological soils. Such studies can complement other work focused on the formally-established experimental earthworks at sites like Butser Ancient Farm and Overton.

Formulating Scientific Research Questions

At the core of all archaeological experiments should be the overall research question which you wish to answer: this may be identified through lectures, field projects and other practical work, further reading, and/or the completion of assignments. Having identified the research question you should then consider whether an experimental approach is appropriate for answering the question, either wholly or just in part. If you believe that it is, then you should consider the likely specific outputs of any experimental work, and how they will contribute to the answering of the overall question. These contributions are usually made through the answering of a series of specific sub-questions, which combine together to clarify the main question.

For example, a recent Reading University undergraduate student’s dissertation was concerned with an overall research question investigating patterning (in the occurrence and changes through time of different artefact types) in Later Prehistoric stone arrowheads. The student chose to use experimental archaeology to address the sub-issue of the functional effectiveness of the different types of arrowheads (which could of course be one explanation for the overall patterning), principally because of the very limited available data regarding

arrowhead effectiveness. The sub-questions addressed very specific aspects of arrowhead use (e.g. did the effectiveness of the different arrowhead types, measured by hit rate accuracy and depth of penetration into a pig carcass, vary depending upon the poundage or draw weight of the bow used): these were excellently formed, as they could be directly answered on the basis of the data-sets to be generated by the student's archery experiments.

Designing and Implementing Experimental Procedures

There are no set rules for designing and implementing your experiments, as the range of topics and activities is potentially so extensive. However there are some basic points to be aware of:

- **What will your experiments consist of?** This may seem like an obvious point, but it is absolutely fundamental to the process of archaeological experiments: what activities will be conducted? Are they single or multi-staged? What are the timescales of your experiments? How many variables are there and how many different values will each variable have? Will you run the experiments once or upon multiple occasions? Where possible it is very desirable to do repeatable experiments because the concept of *experimental reproducibility* is central to experimental science. In essence what this means is that you have to record the methods, materials and conditions of your experiment precisely, so that in future you or another researcher can test your results by repeating the experiment. All of the answers to these questions should of course also be connected to the research questions and sub-questions discussed above.

- **Anticipate your outcomes**: what types of data will your experiments generate (NB we are talking about the broad types of data here, *not* specific results)? While all experiments have the potential to generate the odd unexpected piece of data, there should not be too many of these (it makes recording that bit harder!) if your experiments have been well designed and pre-planned. For example, a recent Reading University postgraduate student's experimental deer butchery with handaxes was expected to generate (and did!) a video archive (with timings) of the butchering of each deer leg, a series of questionnaires regarding the 'ease of use' of each handaxe (completed by the butchers), and a verbatim record of the butchers' spoken comments during the experiments.

- **Data recording**: It is very important that you create an archive documenting the results of your experiments. This archive should take the form of detailed notes and numbered and dated photographs, and the archive should grow and change as your experiments proceed. One of the most important parts of your archive should be the clear recording of which contexts or materials you have sampled or analysed in your experiments. It can also be helpful to devise a pre-printed recording form, as these can help you to ensure that you record all of the relevant data at each stage simply by ticking boxes and entering data under predetermined headings (in short: it makes it easier to remember everything you have to do!). Such forms can also help you to consider at which points in your experiments you will need to gather data. Finally, standardised recording forms also make it easier to turn your experimental work into data tables and graphs. If you are working on an already existing experimental site you need to make sure that your naming, numbering and recording system is consistent with that used on the site and in any previous publications. This is particularly important because your research will become part of the archive of the wider project on that site.

  The following comment comes with the benefit of bitter experience(!): it is all too easy to let an experiment progress to its conclusion and only then realise that half of your data has been lost as it has fundamentally changed in character over the second half of the experiment. In short: sketch out the stages of your experiments *before you begin* (perhaps as a basic flow-chart) and think about what data will be generated, how it will change, and when you should be recording it. You should also remember that data recording can be done in many different ways: e.g. artefact or feature measurements, activity timings, video or audio recordings, and questionnaires or interviews with the experimental participants.

- **Logistics**: you need to think about the resources that your experiments will require (these are discussed in more detail below), and ensure that you can arrange these.

- **Be flexible**: you may well find during the course of running your experiments that your intended scheme of work needs slightly modifying (e.g. as a result of unfavourable weather conditions or certain activities taking a longer or shorter time than you anticipated). This is not necessarily a problem (although major changes should be avoided if possible, as you've usually not had the chance to consider their implications fully), but do remember to fully record any changes in your experimental procedures as you go along. For example, due to poor weather on the day of a Reading University undergraduate student's experimental archery shoot (and its impact upon arrow hit rates), the number of target ranges was reduced from three to a single distance (20 yards). In making this decision the student correctly recognised that it was more important to generate one data-set of sufficient size (for analysis), than three of insufficient size.

- **Disposal**: almost all experimental archaeology will generate quantities of either material debris or archaeological features (e.g. pits or earthworks). You need to consider whether the material debris (e.g. the débitage and tools from stone knapping experiments) is going to be stored (and if so, where, and will this storage generate any costs?) or discarded: if the latter then you need to think very carefully about how you will avoid potentially contaminating the archaeological record (i.e. adding non-genuine materials to it). However some experiments may generate samples which should be saved as part of an archive, while others may generate material which would be a useful addition to your Department's teaching collections. You can discuss these possibilities with your supervisor.

Resources

Archaeological experiments can require some or even all of a wide range of resources, including:

- **Facilities**: will your experiments require either laboratory space or an open-air setting? If the former you should first discuss any laboratory needs with your prospective dissertation supervisor. If the latter you should consider with your supervisor whether you will need to conduct your experiments on an established experimental archaeological site (Butser Ancient Farm for example) or whether you will simply need access to a dedicated space. To give an example, a recent Reading University graduate undertook an investigation of the properties of shallow pits: the experimental pit features were dug (with prior agreement) at the University's farm site.

- **Staff/Personnel**: will your experiments require any specialist expertise (e.g. for the production or use of particular ancient tools)? If so, who can provide this expertise and what will be the cost of their services? For example, a recent Reading University graduate's experimental archery work involved two members of the University Archery Club to generate the data-sets (firing replica Later Prehistoric stone-tipped arrows at a pig carcass target). If you include the views of other participants in your dissertation then you may also need to organise ethical clearance from your University (such requirements will vary between institutions, and you should find out whether they are an issue for you through early discussions with your prospective dissertation supervisor).

  If your University does have ethical requirements, it is likely that they will apply to any dissertation using questionnaires to gauge the general publics' (or fellow students') opinions: for example, one designed to evaluate visitors' experiences or perceptions of an experimental site. If a questionnaire is involved in your work (and this applies to all dissertations, not just those using experimental approaches) you also need to prepare it carefully and discuss it fully with your supervisor (most good questionnaires go through several drafts and lots of fine-tuning). It is also a good habit to do dummy runs with the questionnaire to make sure it works well in practise and that you are asking the right questions in a clear manner. You should also consider how you are going to quantify, graph, and evaluate the significance of the results of your questionnaire.

- **Consumables and/or equipment**: what consumables will your experiments require? This could include the raw materials required for either tool production (e.g. flint for replica stone tool knapping) or functional/use experiments (e.g. deer and pig carcasses for butchery and archery, or timber for woodworking). You may also require consumables (e.g. permatrace for the drawing of experimental pits or earthworks) and/or equipment (e.g. the hiring of digital cameras). You should also consider any potential travel and accommodation/subsistence costs (e.g. will you need to visit an off-campus experimental site on one or more occasion? Will it involve any overnight stays?).

- **Time**: One of the demands of archaeological experiments is scheduling the work: you need to find enough time to both prepare and run the experiments, and then analyse and interpret the resulting data. These issues are greatest for masters degree students (as the dissertation research period is usually only one summer), but all undergraduate dissertation students should aim to have completed the experiments (if not necessarily the data analysis) by the end of the summer vacation between their second and third years.

- **Finances**: as also indicated in the bullet points above, the costs of experimental archaeology can be wide-ranging, including fees for facilities and/or project personnel (see above), the costs of consumables and/or recording equipment, and disposal charges. For example, a recent Reading University postgraduate student's initial experimental butchery research costs included laboratory hire, the butcher's professional fees, two fallow deer, digital video tapes, and the disposal of the biological waste.

In planning any experimental archaeological work you need to consider **at an early stage** what resources you need and how they will be funded (if these resources incur any costs). Your dissertation supervisor should be able to offer guidance on this issue.

Risk Assessments and Health & Safety

Almost all experiments (like fieldwork) will generate health and safety issues and will require you to complete (in collaboration with your supervisor) a risk assessment. These documents will inevitably vary in content depending upon the experiment and the requirements of your host institution, but it is likely that you will need to prepare and submit these documents well in advance of the first proposed work. Again, your dissertation supervisor should be able to offer guidance regarding your University's health and safety policies.

Recording & Analysing Experimental Data

Like other dissertation topics, archaeological experiments will you require you to develop (if you don't already have them) skills in two key areas:

- **Data recording**: whether your experiments are generating new artefacts, biological evidence, structures, or features, or modifying such materials through use or the passage of time, you will need to develop a recording system for this material and be able to confidently record the data. This may build upon experience on practical modules, fieldwork projects, wider reading, and/or discussions with your prospective supervisor. You will need to make sure that you label all of your samples clearly and logically (e.g. with the site or project name, the sample number, and the date). It is also good practice to keep an incremental list of sample numbers in a notebook to avoid the risk of duplicating numbers. If you are working in the laboratory you should keep all of your samples together in a box, clearly and neatly labelled with the project name, your name and degree programme (e.g. BA Archaeology), and the date.
- **Data analysis**: many experimental projects generate data which is amenable to quantitative analysis. There are widely available resources to help you get to grips with basic numerical, visual, and statistical data analysis, including Stephen Shennan's (1997) *Quantifying Archaeology*, and statistics software packages such as Microsoft Excel, SPSS, SAS or Minitab (it is likely that your University's computer clusters will offer at least

one of these). Your IT Department may offer training courses, and further expertise may also be available from Archaeology staff members in your Department.

Potential Pitfalls

There are many potential traps when conducting archaeological experiments, but three of the major ones are:

1. Designing an experiment whose outputs don't relate to your overall research question(s).
2. Generating experimental results which are unclear (this is often caused because there are too many variables in your experiment, making it difficult or impossible to understand any patterning in your results).
3. Generating too much or too little data, respectively resulting in either you being unable to effectively analyse all the data (the dissertation can then appear unfinished) or your results appearing trivial or random due to vary small sample sizes.

There is no quick fix to these problems: all experiments need careful planning before you begin. In particular think about the data that is going to be generated: is this the data that you need to answer your overall research question(s) or your sub-questions? How many variables will the data-sets contain? Are you interested in all of them? Could some of these variables be controlled for (i.e. removed as variables)? Will the sample sizes be the correct size? You should consider and discuss all of these issues with your potential dissertation supervisor.

Perhaps the most important lesson to be aware of prior to starting your experiments is:

Just like fieldwork, individual experiments are unrepeatable: so record everything that you think you may need to know while you can!

And the most important message is:

Archaeological experiments can be hugely rewarding and can make a great contribution to your dissertation or thesis research, so please consider using experimental approaches in your work.

Bibliography

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