Introduction to experimental archaeology

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What is experimental archaeology?

If one takes a scientific and 'positivist' view (Popper 1959), then experimentation is part of a 'hypothetico-deductive' process. A hypothesis is formulated and then tested to see if it can be 'falsified'. If falsified then that hypothesis must be discarded and replaced with a new, hopefully better one, which will, itself, then be tested. If a hypothesis resists falsification, and is supported by experimentation, it can be regarded as valid. 'Valid', in this sense, does not mean 'true', but merely that the principles behind the hypothesis can continue to be used until falsified and replaced by a better set of principles. An experimental, positivist approach can escape the shackles of simple historicism and empiricism, because it allows one to move beyond the limited range of options made available by records of the currently known world. It allows investigation of the counter-intuitive and for the possibility of deductive leaps, rather than simply relying upon probabilistic and inductive extrapolations of existing knowledge.

Positivism is still the underlying philosophy of modern science. While Kuhn (1962) very clearly outlined his view of how science really works in the fallible and often prejudiced world of human scientists, his critique was not so much a direct challenge to Popper's ideals, but more of a reality check. Experimentation remains a method that clearly sits within the realms of science. The postmodernist attack on science and method (e.g. Feyerabend 1975) presented instead a philosophy of 'anything goes', and gave no special place to testing hypotheses though experimentation. This is not the place to debate, in depth, the nature of the postmodern or post-processual challenge to science, but the reader should note that this volume presents experimental archaeology as a scientific research method. As such, while it is accepted that other theoretical viewpoints will interpret the experiences of experimenters differently, this volume does not take an 'anything goes' approach to the topic, but it does investigate a range of styles and approaches to experimental archaeology as science.

Having put forward a definition of experimentation, however, it is still not entirely clear what 'experimental archaeology' exactly means. If experiment is the mainstay of modern science, then, strictly speaking, is there really any difference between 'experimental archaeology' and 'archaeological science'? Readers of key works dating to when the term 'experimental archaeology' was first coming into common parlance (e.g. Coles 1973, 1979;

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Reynolds 1979) will clearly note that it relates only to certain types of activities. Coles states that the aim of experimental archaeology is to 'reproduce former conditions and circumstances' (1979: 1), and the same is echoed by Mathieu (2002: 1), who says it is designed to 'replicate past phenomena'. Indeed, most people, when thinking of experimental archaeology, are conjuring with words like 'reconstruction', 're-enactment', 'reproduction' and 'replication', because the activities of those who engage in the subject usually seem geared around, in some way, re-creating activities, artefacts, structures and processes that happened in the past. This concept provides a clear difference between experimental archaeology and other forms of archaeological science, but it is perhaps a defective definition. Reynolds (1999: 159) was very clear about his dislike of the 're-' prefix. After all, in the vast majority of cases, one does not actually know what the past was like, so one cannot reconstruct it. Some aspects of an experiment must be hypothetical and being tested, and, hence, not a reconstruction, otherwise there is little point in doing it. This is the reason why Reynolds (1999: 159) referred to his hypothetical Iron Age houses as being 'constructs'. The European journal devoted to experimental archaeology nods its head at this distinction in its title, while still acknowledging common parlance: *EuroRAE: (Re)construction and Experiment in Archaeology*.

Perhaps a more useful term to use is 'actualistic'. To present an example, one can experimentally study the rendering of tar from birch bark, a material we know was used in the past (Piotrowski 1999). One could test many factors about source materials, rendering conditions and end products within the controlled conditions of a laboratory, using sterile glassware and a gas powered heat source. Each experiment could involve holding all but one variable constant at any one time. The rendering process could be quite well understood, in physical terms, from such experiments and some conclusions might be reached that were relevant to archaeological interpretation. However, a gulf is left between such laboratory work and how such processes may have been achieved in the past, with a limited range of materials, technologies and a lesser control upon the environment. Experimental archaeology comes into its own at this point. What has been learned in the lab can now be taken further; hypotheses can be tested with authentic materials and in a range of environmental conditions that aim to reflect more accurately 'real life' or 'actualistic' scenarios. Such experiments investigate activities that *might* have happened in the past using the methods and materials that would actually have been available. This is not to say that *all* materials and methods need to be authentic in experimental archaeology, but certainly those pertinent to the hypothesis.

The above two approaches to scientific investigation of past activity should *not* be seen as in any way rivals. It is not an either/or situation. These two approaches naturally follow on from, and complement, each other. Laboratory experiments provide a sound understanding of scientific principles through the careful control of variables, while 'actualistic' experiments test out hypothetical scenarios using potentially authentic materials and conditions. In the latter case, unpredictable phenomena are often given more opportunity to act, thus enabling the refinement of hypotheses and archaeological interpretation. Experimental archaeology should certainly be viewed as being in no way separate from the rest of archaeological science. It simply represents a particular type of experimentation that, in some cases, requires the application of skills or materials not commonly available in our modern world. Actualistic experiments should be no less

rigorous than laboratory ones, but that rigour may be based upon a different set of criteria. Maintaining rigour in actualistic scenarios is no mean feat.

Reynolds (1999: 158–62) defined five major classes of experiments that are the mainstay of experimental archaeology. It is worth briefly summarizing them here:

1. *Construct*: 1:1 scale constructions that test a hypothetical design for a structure (e.g. house) based upon archaeological evidence. It is a hypothesis that literally stands or falls.
2. *Processes and function experiments*: investigations into how things were achieved in the past. This includes investigations into what tools were for, how they were used and how other technological processes (e.g. tar rendering or pit storage) were achieved.
3. *Simulation*: experimental investigations into formation processes of the archaeological record and post-depositional taphonomy.
4. *Eventuality trial*: usually combining all three categories above, these are large-scale, often *longue durée*, experiments that can investigate complex systems (such as agriculture) and chart variations caused by unexpected or rare eventualities (e.g. extreme weather).
5. *Technological innovation*: where archaeological techniques themselves are trialled in realistic scenarios. A good example would be the testing of geophysical equipment over a simulated, buried archaeological site.

What experimental archaeology is *not*

There is little doubt that the term 'experimental archaeology' is closely associated in many people's minds with re-enactment groups, outdoor education and public presentation centres, and other demonstrations of past life and technology. The journal *EuroREA* certainly covers all these aspects. Reynolds made his view, that these activities are *not* part of experimental archaeology, bluntly and acerbically clear. The activities of re-enactors dressed in period costume were, to him, 'at best theatre, at worst the satisfaction of character deficiencies' (1999: 156). Indeed, such activities are clearly not, in philosophical and research terms, experiments. It is perhaps unfortunate that the boundaries between experimental archaeology (a research tool), experiences and demonstrations (educational and presentational tools) and re-enactment activities (a recreational pursuit) have become blurred in the minds of many. In some cases, one fears that this has coloured academic perception of a valuable approach to research. Perhaps this is why Reynolds put forward such a strong rejection of anything not truly experimental.

Of course, real-life demonstrations, three-dimensional (re)constructions and first-hand experiences all have huge pedagogical benefits and are an excellent way to translate archaeological research into a presentable form for the public. There is also no need to deny re-enactors their fun. Furthermore, most true experimenters need to gain a degree of competence through experience before conducting their experiments (e.g. those who conduct flint-knapping experiments). However, from an academic point of view, it is clearly beneficial to maintain a clear distinction between what is 'experimental' and what is

'experiential'. Experiential activities can be very valuable and can be easily associated with an experiment to add a public or educational (translational) element, but that potentially positive by-product should not be allowed to create confusion over experimental aims. This volume deals only with experiments for the purpose of research, but this editor has no wish to do down other valuable activities.

Publishing experimental archaeology: pitfalls and how to avoid them

Through editing this volume, reviewing for many others and teaching experimental archaeology to graduate students, this editor has noted five major pitfalls that potential authors of experimental publications regularly succumb to. Below, these are outlined along with a discussion about how best to avoid such difficulties.

1. *Lack of clear aims* One of the most frequently encountered problems with experimental articles is the lack of a well-thought-out hypothesis or a specific archaeological question that is being addressed. It is likely that the authors are, in fact, simply writing up a practical, experiential activity, after the fact. The content may be interesting to like-minded specialists, but, in many cases, the decisions relating to materials and recording methods would be very arbitrary because of the lack of a clear aim. This may limit the usefulness of the activity somewhat. Such experiential reports are not without value, however, and are frequently found published in journals like *EuroREA* (in Europe) and the *Bulletin of Primitive Technology* (in America). Such works are less likely to be accepted in more academic publications.
2. *Insufficient detail on materials and methods* If a paper does not outline enough information about materials and methods then it seriously limits its usefulness, as other researchers will be unclear what exactly has been tested, and they will not be able to replicate those experiments or build upon them. *EuroREA*, recognizing both of the above common flaws, through feedback from its editorial board, has attempted to encourage its contributors to move towards a more 'scientific' mode of publication by printing a number of papers on producing good experimental reports (Mathieu 2005; Outram 2005; Schmidt 2005).
3. *Compromises over authentic materials* Most experimenters will face difficult decisions over when to compromise by using more readily available modern materials (and methods) instead of using rare or totally unavailable authentic ones. The key question is whether the compromise will materially affect the testing of the hypothesis. To illustrate, it is unlikely to matter that one pours iron ore into a smelting experiment from a plastic bucket, but the use of a modern high-grade ore, not available in the past, could fundamentally defeat the purpose of the experiment. An experiment that contains too many compromises risks losing any real value. A compromised actualistic experiment neither has the control of the laboratory nor does it test the authentic scenario it was designed to.
4. *Inappropriate parameters* This editor has seen a number of experiments that were carried out apparently very well with authentic materials, but the basic parameters

were very badly set to answer the question being asked. Examples of this might be that the timing of recording points was spaced too far apart or that the starting temperature was too high. This is suggestive of a lack of experience that could be addressed through collaboration with experienced craftspeople or technologists, or through carrying out pilot studies first.

5. *Lack of academic context* Very able and experienced practitioners of ancient crafts have much to offer experimental archaeology, but a problem that affects some papers submitted by such individuals is a lack of academic context and appropriate reference to the literature. This significantly weakens the work.

The last two points are perhaps best addressed through good collaborations between craftspeople and academics.

Perhaps the most effective experiments are those that are totally integrated into a larger scheme of academic research with the experimentation being just one of the methods being employed in pursuit of a research goal. Where possible, there should be close collaboration between different specialists and those with academic and practical skills. If all these elements are present, then it seems far less likely that any of the above five mistakes will be made.

In this volume

The papers in this volume address experiments relating to wide range of different artefactual or ecofactual materials. These include phytoliths (Mithen et al.), bone (Seetah; Domínguez-Rodrigo), stone (Aubrey et al.), pottery (Jeffra), metal (Molloy), organic materials (Hurcombe) and residues (Evershed). Most of the papers deal with, on some level, 'process and function' experiments. Two which fit very clearly in that category are Jeffra's study into the possible use of hair as an organic temper in pottery and Molloy's investigation of the functionality of Bronze Age weapons. However, these two have very different approaches. Jeffra's paper takes a very quantitative approach, whereas Molloy's work is qualitative. Molloy's work is experimental, because he is addressing hypotheses about the use of particular weapon designs, but his tests rely on qualitative observations from an experienced martial artist (himself). This opens up an interesting line of debate. Various quantitative measures about weapons and the damage they inflict could be recorded, but this does not go very far in evaluating their actual use as a weapon. Rather than putting these too extremes in opposition to each other, perhaps it is best to acknowledge the value in both types of investigation, while understanding their respective limitations.

Molloy's paper is not the only one that relies heavily upon experienced practitioners. Aubrey et al. make use of a large number of very experienced flint knappers in order to try to interpret the spectacular lithic assemblage from Maitreaux, France. This assemblage represents a Solutrean knapping floor (apparently *in situ*) which was recovered with amazing spatial resolution. Much refitting work has been carried out, and the experiments are designed to understand the *chaîne opératoire* in the reduction sequences and potentially identify the activities of individual knappers.

Both Domínguez-Rodrigo and Seetah are concerned with bone surface modifications. The former concentrates on the identification of cut marks, while the latter investigates wider patterning created by butchery practices. Both investigate in detail the relationship between experimental work and analogy. They are interesting companion pieces.

Hurcombe's paper is a broad-ranging one that demonstrates how experiments, combined with the analysis of inorganic finds, can shed light upon the use of perishable organic materials. Organics almost certainly formed a huge proportion of the material culture of prehistoric peoples, as glimpsed when preservation is exceptional, but, otherwise, it is necessary to be inventive and develop new ways to enlarge our understanding by proxy. Another way to understand organic products is through residue analysis. Evershed shows how actualistic experiments have been used to help understand the results from analysing lipid residues from ceramics. In this work there are elements of both 'process and function' and 'simulation' experiments, but this is also an example of Reynolds' (1999) fifth class of work, 'technological innovation', where the experiments support the development of new techniques of archaeological investigation. Mithen et al. are also using experiments to help underpin new methodologies, in this case in the field of phytolith analysis, but, as with any agricultural trial with multiple plots and a degree of time depth, this also represents an 'eventuality trial'.

It is hoped that this volume demonstrates the value of actualistic experimentation within archaeological science, and how such experiments can be integrated into much broader programmes of research.

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