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Experimental Archaeology and Tacit Learning: Textiles in the Classroom

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Archaeology benefits from the integrated approaches generated from experimental archaeology and tacit learning because they afford a deeper exploration of our interpretations of the archaeological record. Though these benefits are generally supported by the discipline at large, experimental and experiential studies tend to remain interesting rather than influential. Introducing pedagogical practices which use these methodological

approaches has the potential to raise awareness to their importance in archaeology, while serving as an excellent outreach program in formal and informal education institutions. This paper outlines the pros and cons of experimental archaeology and tacit learning and uses a case study example from a university module to demonstrate its simplicity and efficacy.

> There are several other suitable choices for experimentation with the textile production sequence, depending on time availability, space, equipment, and student expertise. In fact, an entire module can be designed around textual/archaeological research with experimental support or be expanded to address the question of transferable skills between various crafts.

Introduction

Experimental archaeology has undergone a series of refinements in the UK since the original Butser Ancient Farm experiments conducted by Peter Reynolds (*circa.* 1972). Generally, experimental archaeology employs the study of the *chaîne opératoire* as a methodological approach for understanding technology and is particularly useful for studying prehistoric manufacture processes. The inter-relationships between experimental archaeology and *chaîne opératoire* approaches are mutually beneficial and are appreciable for developing learning agendas at a variety of formal and informal educational centres. Further improvements to the discipline of archaeology and experimental approaches can be achieved by maximizing the potential of tactile and experiential learning. A variety of topics would be appropriate for teasing out the utility of such integrated methods, but prehistoric textile production was selected based on the author's expertise.

Textile production is the technical process by which humans convert animal fur/fleece and plant cellulose into a variety of textiles, from clothing to bedspreads, from rugs to bags. They are mundane requirements of our modern world and were daily necessities of our past. However, as integral to our lifestyle as they are, scholarship surrounding their production in prehistoric societies remains sparse. Reconstructing the past is an intricate endeavour which is rife with incomplete narratives and unknowns, and often results in speculation. This is particularly true for Iron Age Britain, where researchers are restricted by limited textual accounts and scarcity of textile remains.

A new suite of methods must be employed to obtain a greater understanding of textile production in prehistoric societies. Such methods include experimental archaeology, ethnography, and the development of theory, but also storytelling and role-play (Miller and Pennycuff, 2008). The accessibility of textiles makes them a good teaching tool. Textiles are familiar to everyone and are a superficially easy topic of discussion. Depending on the level of engagement desired, technical, and social discussions can provide a platform for deeper exploration which crosses disciplinary boundaries. The array of approaches available ranges from the concrete to the abstract. The incredible diversity inherent in the category of textile

also affords a wide assortment of hands-on activities, many of which are very low-cost investments from the point of view of the educator or institution.

Encouraging primary school children to engage in a range of hands-on activities relating to textile production is straightforward. Such activities include hand-sewing hessian fabric, fingerweaving on a cardboard loom, and crocheting. Engaging young adults in similar textile-related activities is more challenging. The demographics of students in university modules based on textiles, dress, and/or fashion shift dramatically towards female-dominated classrooms. This is not necessarily a problem, nor does it break a historical trend of female authors studying prehistoric British textiles and production in the past (eg., Cunnington, 1923; Crowfoot, 1945; Henshall, 1950; DeRoche, 1995; Tuohy, 1995). However, important male researchers (eg., Hedges, 1973; Ryder, 1983) have contributed to the overall picture of prehistoric textile production in Iron Age Britain. Given the pressure placed on current students in archaeology to use more interdisciplinary approaches for cross-collaboration purposes, and the power of textiles to bind many cultures together, it becomes imperative to search for more active ways to engage a broader range of students, including those who express genders that break the male/female dichotomy. Addressing the concerns of young scholars encourages self-reflection within the discipline and the development of enriched methods of conducting archaeology. This paper explores the pros and cons of experimental archaeology and tacit learning and offers a case study which demonstrates how these approaches may be integrated. The case study shows the pedagogical potential of interweaving both concepts, experimental archaeology, and tacit learning, in practice. Crucially, these approaches and the case study are fundamental in encouraging a deeper exploration of the role of technological studies within archaeology, and in demonstrating how they are applied as methodologies.

Experimental Archaeology

Experimental archaeology is an evidence-led methodology for examining the technical process of making textiles and the *chaîne opératoire* is a heuristic for understanding the ways in which people engaged in this process. This includes the full involvement of textile production as it relates to other social, economic, and subsistence tasks, which play out within a mutually interlocking landscape, or *taskscape* (Ingold, 1993).

Experimental archaeology sets out a testable hypothesis and devises a series of experiments guided by research questions (see Outram 2008), the results of which may accept or reject the original hypothesis or may be inconclusive. Experiments also investigate the plausibility of certain actions being required or optional in the sequence. For example, spinning wool into yarn prior to weaving is a required step, whereas wool dyed prior to spinning is optional. The *chaîne opératoire* describes the minimal number of procedures and types of gestures required to create a social product. It also reveals optional steps and where they might have

slotted into the overall sequence. The subsequent interpretation of experimental results can push the boundaries of archaeology into new areas of research.

The foundational principles of the *chaîne opératoire* are based on André Leroi-Gourhan's interpretation of gestures and cognition (Audouze, 2002), and on experimental work performed by scholars such as Jacques Tixier (Audouze, et al., 2017), which was eagerly adopted by lithic analysts (Lin, Rezek and Dibble, 2018, pp.663-664). Although Leroi-Gourhan's research on behavioral and biological coevolution may be largely invalidated today (Audouze, 2002, p.291), there has been a push towards a cognitive understanding of human reasoning and behaviour in past societies since the 1990s (Renfrew and Zubrow, 1994; Burke and Spencer-Wood, 2019). Analyzing the *chaîne opératoire* aids researchers in contextualizing what technologies were used in transforming textile materials from raw to workable state (Miller, 2007). Through this method, we can begin to understand some of the reasons why certain materials were used, whether the maker made certain diversions in the procedures, or whether a material could have had additional significance beyond dichotomous assertions, like domestic or luxury (Hurcombe, 2008).

Importantly, chronological time measures might not have dictated the operational sequence or its place in the wider society. In fact, it is part of an embedded cycle which might also be indeterminately variable (Ingold, 2000, p.197). Thus, activities grouped by spatial or gestural requirements may have dictated the flow and organization of the *chaîne opératoire* and the *taskscape* of production. The *taskscape* is the world all social entities inhabit where activities are carried out simultaneously (Ingold, 2017, p.17). Following this, a single *chaîne opératoire* may operate simultaneously within an embedded *chaîne opératoire* on a broader scale, and each *chaîne opératoire* may be performed by many individuals and at different stages within the sequence. *Taskscape* is an apt description of the indivisibility of the landscape, the people, the objects, and the ideas inherent in every society.

Positive outcomes

Experimental archaeology and *chaîne opératoire* studies have a favorable impact on the discipline of archaeology, and other associated disciplines. Experimental practice has the potential to bring together many research perspectives and encourages a critical evaluation of archaeological theory. To conduct experiments, the researcher can draw upon scholarship relating to the study of technology, biomechanics, psychology and child development, materiality, the *chaîne opératoire*, the *taskscape*, and so on, because each type of study draws upon and influences the other studies.

The collaborative environment of experimental archaeology brings together artefacts which are typically categorized and stored separately. For example, clay loomweights will often be stored with other clay objects, and stone loomweights with other stone objects, despite being part of the same warp-weighted weaving toolkit. *Chaîne opératoire* studies draw together

different materials and technologies for a cross-comparison analysis which transcends typological analysis (Bleed 2001, p.115). Employing scientific, 'lab based' methods (Outram 2008, 3) allows researchers to examine a specific variable, and 'actualistic' methods (Outram 2008, 2) encourage researchers to examine the interaction of multiple variables as part of a collective experiment. This spectrum methodology encourages scientific research in the physical world to reveal phenomena which would otherwise be difficult to produce in a lab. Equally, it allows for 'actualistic' methods to be tested as part of rigorous experimental program.

Criticisms

Experimental archaeology largely investigates the functional attributes of tools to understand the possible range of methods that the tool allowed and the suite of techniques available in the past. Elisabeth Stone (2011, p.28) pointed out that experimental archaeology is 'driven by our expectations of use' and that the constraints inherent in quality experimental programs prevent replicating the lived contexts from being investigated. Isolating variables for detailed examination often prevents the development of layers of different uses. For example, a carved antler handle that has been broken and reshaped into a toggle closure may exhibit two types of wear patterns, but the way an experimental program would investigate these variables necessarily isolates the two functions this antler-handle-turned-toggle had.

Other criticisms of experimental archaeology include time scaling for the experiment. Researchers who engage in use-wear experiments, for example, may be presented with difficulties in scheduling sufficient time for a single activity to develop discernible wear on an object. Others encounter problems associated with the physicality of the activity. Further, experimental archaeology favours researchers who are healthy and able, but children and the elderly comprised a useful workforce in preindustrial societies. As a system, textile production in prehistoric societies calls upon the efforts of a whole community (eg., Hurcombe, 2014, p.42); this is a limitation of the experimental approach which features the work of individuals or small groups only.

The extent to which the results of any experiment can be useful will be contingent on the series of decisions made by the experimenter(s) and their reflections on the reasons motivating those choices. Care must be given to prevent overextending the conclusions drawn from experimental archaeological work. For most experiments, these criticisms can be constructive. Thus, experimental archaeology is a useful heuristic for considering both questions of the past, and for developing methodological approaches, thereby holding our theories accountable.

Tactile Learning

Many archaeological textile artefacts are in a fragmentary and decayed state, and this prevents us from fully experiencing them. Their friable nature restricts our handling and exploration of their material qualities. Experimental archaeology creates the opportunity to engage with tactile learning and extends beyond what might be conveyed via description and visualization to include haptic, auditory, and olfactory dimensions. Gustatory sensation is another type of learning for certain types of experiences, namely those which concern food and beverage. By also engaging with the senses, an understanding of *taskscape* can be developed as part of experimental archaeology.

For textile studies, this also brings to light certain types of materials with which we rarely engage today, or techniques with which we have little familiarity. Tacit learning also can inform us of the utility of established typologies and has the power to reveal inconsistencies in the theoretical *chaîne opératoire* (Bleed, 2001, p.109). To understand the material nature of cloth, for example, it needs to be metaphorically made 'living' again. This can be done with reconstructions which follow from an experimental program. Extending beyond the construction, the process of making creates new haptic senses, smells, and sounds, all of which expand our knowledge of the process of making and reflect the processes we already undertake in our own world.

For instance, Susanna Harris (2008) conducted an experiment, via a questionnaire and using modern examples, aimed at understanding how people perceive the material qualities of ancient textiles. A variety of samples were made following different textile production techniques: twining, knotless netting, leather-working, and weaves made of linen and wool and woven with both plain and complex patterns (Harris, 2008, pp.89-94). The participants were provided a questionnaire to record their assessments as they handled each of the cloth types (Harris, 2008, pp.84-89). This experiment revealed some of the problems archaeologists have when it comes to the creation of typologies and the way certain materials are classified, and how modern and Western our understanding might be. Tacit learning is one way to "think about making unfamiliar materials familiar" (Harris, 2008, p.100) and encourages us to look at the social and emotional dimension that materials had for past people.

Positive outcomes

The experiences produced from experimental archaeology encourage deeper reflections on the ways in which past peoples engaged with their world(s). They can also generate new research potential and encourage researchers to highlight these experiences. These experiences also encourage a critical evaluation of the *taskscape* to achieve a sense of the physicality or emotional burdens past people might have needed to endure. Practical engagement, whether it is meant for hands-on learning or for experimental archaeology, influences the manner in which we think about and through processes, reveal gaps in our knowledge and can encourage new methods, or revitalize old methods, of conducting

research (see Hurcombe, 2007). Currently, craft technology researchers are moving towards epistemological understandings of cognition in the past through studies which include *chaîne opératoire* and experimental archaeology approaches (Burke and Spencer-Wood, 2019).

For younger learners, tacit learning breaks down some of the barriers inherent in education pedagogy by making them active in the process (Miller and Pennycuff, 2008, p.39). Knowledge contained in textbooks and taught in classrooms can be perceived as flat. Visualization is key, and a way to further embed learning is through physical engagement. Participating in a lived experience, such as watching a spinner turn wool into yarn and trying it oneself, activates the full suite of senses available to most people. In this way, the experience generates the creation of, and reinforcement, of social memory (Holten, 2014). This allows for a lateral approach to thinking about the past and encourages greater adaptability and neural plasticity (Nelson, 2000) for the learners involved. Furthermore, such a move towards experimental and tacit learning provides the next generation with a more comprehensive perspective of the world.

Criticisms

Practical engagement arguably creates many positive learning outcomes, though tacit learning can often be conflated with principles inherent in 'living' history. The goal of experimental archaeology is not merely to recreate ancient *taskscapes* to make the past seem more realistic, but the application of the results of experimental archaeology will often influence interpretive strategies employed by educators and museums (Hansen, 2014, p.168). The result is typically a memorable experience but will remain disconnected from the research outcomes if no effort is placed on integrating them.

Part of this issue is caused by the absence of a solid methodological framework for experiential and tacit learning in archaeology. The individualistic and subjective nature of experiential or tacit learning makes it difficult to quantify and balance against biases. Conveying skill and experience to an unacquainted reader represents a challenge since the inherent complexity of an experience can be difficult to convey with clarity or conciseness (Mount, 2004). Further, there are issues relating to explaining the 'whys' of experience because they often defy the logic of technological evolution, unless an anthropological view is considered (see Pfaffenberger, 1988; 1992). As is the case with the criticisms of experimental archaeology, such short falls must not prevent archaeologists from considering the usefulness of tacit learning.

Experiments in Class – A Case Study

The following case study demonstrates the ways in which textiles and textile production can be integrated in a cross-disciplinary study. Working with textile production in the classroom highlights the participatory nature of experimental archaeology and encourages experiential

reporting among students. Textile tools are usually very simple in design, typically made of inexpensive materials, can handle wear-and-tear, and are ubiquitous in cultures past and present. Wool is exceedingly easy to find, is relatively inexpensive, and is plentiful. These features make textile production a relatively safe and cost-effective hands-on activity. The pedagogical principles outlined above can be easily implemented with a topic centered on textile production. The complexity of the gestures required to process and spin wool can highlight the importance of experimental work and the *chaîne opératoire*, as well as emphasize the value of tacit learning and developing the conceptual framework for conveying experience.

Masters level students from a module relating to dress and identity in the Roman world participated in a brief experiment. The commonality of clothing bridges gaps between different perspectives which include historical and archaeological accounts alike. Despite operating the course from a prehistoric archaeological perspective, students of ancient history were able to contribute to the discourse. Concepts of identity are comparatively limited in prehistoric textile studies, but the common ground established through experimental and experiential approaches generated important discussions. The efficacy of this type of exercise is basic enough to convey the ways in which cross-disciplinary studies can be approached.

Spinning yarn can be a slightly more complex process, comprising a set of bodily movements, fibre management, and a conceptual framework to produce a length of yarn. In the modern world, spinning yarn is often secluded and only accessible to most members of western society in open air museums and at reenactments, so the chances of an individual interacting with this process is often minimal and peripheral. Thus, combing wool - a simpler option for experimentation based on the likelihood that students would already have some familiarity with it - was selected. Aligning fibers is much like brushing hair. The principles involved in combing hair allow for the transference of muscle memory and skill to combing wool.

This tacit exploration encourages lateral thinking. Contemporary textual accounts of ancient Romans engaging with textile production can be enhanced with a simple experiment designed to examine one aspect of the *chaîne opératoire*. By combing wool, the students could use their personal experience to consider fibre cultivation and management, the use of processing tools and time expenditures, and to contemplate the functional and social aspects that this engagement engenders.

Objectives and Aims

The students were introduced to the experiment and told how they were going to be involved in the process. The students were asked to turn washed wool into a rolag (See Figure 1) by using a set of modern hand carders (See Figure 2). They were shown an example of the finished rolag and were directed to creatively experiment with the tool and the wool. It was

stressed that they were not meant to uncover the 'correct' way of carding wool, but rather that they were meant to form a dialogue with the tool, wool, and series of bodily movements to produce the same effect in the modern example (See Figure 1). A couple of students remarked that they had seen such a tool before but had never previously used it.

The students were also aware that their actions would be observed and recorded throughout the process. They therefore knew that the task should be relatively simple to complete and that they should try to keep the number of actions as small as possible. No visual demonstration was provided. The specific details of how to make a rolag were omitted to encourage the experimenters to be creative in their approaches.

Experiment Design

The students were split into two Sets, 1 and 2, then further subdivided into Groups A and B. Each Set comprised a portion of members of Groups A and B (diagram A). Set 1 and Set 2 were arranged on opposing sides of the classroom. Approximately one hour was given for the experiment, and it was broken up into three distinct parts. Each of the three parts was designed to achieve one learning objective and were annotated as Experiment 1, 2, and 3. The specific activities and objectives are listed below. Experiment 1 established the primary learning objectives; subsequently, each follow up experiment built on the previous objective. It was assumed that once the students had completed all the parts of the experiment, they would have developed a sense of the strengths involved in experimental archaeology, as well as an understanding of how it can impact a wide range of peripheral disciplines, such as history and anthropology. They would also become aware of the drawbacks and the limitations of the method. The overall object of this hands-on activity was to explore the strengths and limitations of experimental archaeology by building upon practical experience.

For the first experiment, no verbal communication was allowed. Group A was given a set of hand cards and a pile of washed wool and were instructed to spend two minutes working the wool into a rolag. Group B observed Group A of each respective Set and recorded what they saw. By the end of Experiment 1, they were able to:

1. Understand how the tools work from two different perspectives. Group A was able to understand the haptic perspective from engagement, whereas Group B was able to understand the holistic perspective from the visualization of the method.
2. Either convert the goal of the experiment into a series of actions or create a method of descriptive writing that captures the engagement verbally.

Diagram A:

Set 1	Set 2
Group A: Experimenters Group B: Record Keepers	Group A: Experimenters Group B: Record Keepers

The second experiment was roughly similar as the first experiment, but with one key difference. The members of Group B from Set 1 moved to Set 2 in order to observe a new Group A, and vice versa (diagram B). Again, Group A worked the wool into a rolag and Group B observed. With additional practice, Group A was better able to work with the wool to form the rolag, and Group B was able to observe contrasts in the way different individuals approached the challenge. By the end of Experiment 2, they were able to:

1. Think laterally through problems as there are often many approaches to the same problem and many solutions can exist.
2. Understand that the *chaîne opératoire* is not a fixed progression.

Diagram B:

Set 1	Set 2
Group A: Experimenters Group B: Record Keepers	Group A: Experimenters Group B: Record Keepers

The last experiment brought Group B members back to their original Set. This established the first opportunity for verbal communication. By this stage, Group A had become sufficiently familiar with the tools, the wool, and how to manipulate the wool with the tools. Group B had observed two different approaches to the same problem, and its job now was to communicate an alternate method to its Group A members. Once Group B had described this alternate approach, Group A members were given two minutes to either fully accept this new information and abandon their previous approach, integrate the new information with their learned experience, or completely reject this new information. This experiment was more subtle than the previous two, but the learning outcomes from Experiment 3 combined the objectives and outcomes into a complex picture. By the end of Experiment 3, they were able to:

1. Evaluate the conflicting evidence in the technique and recording practices.
2. Describe the consolidation process when two different approaches are combined into one as written text.

The culmination of the experiment brought both Sets back together. Each Group A member was invited to the front of the room to present how they formed a dialogue between tool and wool, and how they interpreted new information throughout the experiment. Each Group A member was recorded individually and the students from both Groups were encouraged to reflect on the process as a whole.

Learning Outcomes and Feedback

This set of small group experiments afforded the students an opportunity to practice being an experimenter and an observer. By adhering to strict guidelines set out in each respective experiment, each Group built certain skills. Group A became adept at using the hand carders

and working with the wool. Some members became more proficient than others. The experiences and insights developed by each Group A member contributed to the collective knowledge as their engagement with the process was observed and recorded by Group B members.

Being able to observe two different Group A members, Group B members honed the terminology they developed for describing physical actions and produced a way of communicating these actions with clarity. The creation of this ability in Group B members was important when conveying description to an audience (Group A members) who were unable to see the actions of the other Group A members. With more practice, Group B members would have become excellent teachers, and Group A members would have benefitted from this. Repetition of the experiment with the same group of students would have driven this point succinctly.

There are several other suitable choices for experimentation with the textile production sequence, depending on time availability, space, equipment, and student expertise. In fact, an entire module can be designed around textual/archaeological research with experimental support or be expanded to address the question of transferable skills between various crafts. A deeper exploration of related crafts could improve our understanding of how we interpret archaeological or historical records.

Though this is a contrived scenario for experimentation and learning purposes, it does illustrate how experimental archaeology provides critical information on possible techniques. It does not prove what people did in the past, nor does it claim that a modern experience is a proxy for a past one. However, it does begin to dispel the static interpretations that can form the basis for further interpretation. Experimental archaeology represents a holistic understanding of the making-process, including the limitations of the materials, tools, and the body.

Conclusion

Experimental archaeology is not about getting things ‘right’; rather it is about developing robust methods for approaching the study of the past, for textiles and production, from the ancient past to the modern day. Science and art push the boundaries of what we think textiles can do and a comprehensive view of experimental archaeology as a method can achieve this understanding. The rich (pre)history of textile production fuels our exploration now and in the future.

Experimental work in textile studies interweaves the research collective of more than just archaeologists and crafters. It draws upon studies relating to use-wear, materials analysis, taphonomic processes, technological development processes, behavioral studies, chemistry, physics, environmental studies, and more. By integrating experimental archaeology with tacit

learning, new methods and approaches can be devised to glean more useful data about past experiences, lives, emotions, objects, landscapes, and the myriad relationships connecting these worlds.

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Gallery Image

FIG 1. WOOL ROLAG MADE FROM CASTLEMILK MOORIT SHEEP (FOREGROUND). UNCARDED WOOL (BACKGROUND). PHOTO BY JENNIFER BEAMER

FIG 2. STRAIGHT-BACKED WOODEN VINTAGE HAND CARDS WITH 72TPI CARDING CLOTH. PHOTO BY JENNIFER BEAMER