Integrating Theory and Science in Archaeology

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Within archaeology a degree of epistemological division still persists between ‘two cultures’ - with science and theory often poorly integrated in archaeological studies. However, as we experience archaeology’s third scientific revolution, driven largely by the increased application of biomolecular methods, the theoretical power of scientific and technological data is becoming increasingly apparent. As such, it is now important for the theorist to engage with scientific and technological approaches, and for the scientist to engage with theoretical frameworks. Can the gap between these ‘two cultures’ be meaningfully bridged? How do we achieve this in practice and across diverse periods and research specialisms?

This session aims to explore how science, technology and theory can be integrated, and the impact such an approach can have on our understanding of the past. The primary aim of the session is therefore to create a forum for the discussion of how diverse scientific techniques and theoretical approaches can be combined to explore innovative research questions in archaeology. Building upon the success of our foundation session on prehistoric archaeology at TAG 38 (2016), this session has a wider focus, extending its range to all theoretical persuasions and technical or methodological specialisms, from any historic or prehistoric period and region. We therefore welcome speakers from all research backgrounds, archaeological specialisms and periods to submit a paper.

Keywords: archaeological science; epistemology; technology; theoretical approaches.

Papers
Experimental Archaeology: A Conceptual Bridge? Experiences of Mediating Science and Theory through Antler Working Experiments
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The recent advancement of ‘fast science’ within archaeology and an ever-increasing breadth of theoretical approaches, has resulted in a divide. Theory and science are frequently perceived as in opposition. Science alone lacks the epistemological grounding of archaeology; archaeology explores specific human behaviours, whilst science creates generalised principles that transcend time and place. The conflicts need to be mediated and resolved.

We propose, through our own experiences with researching prehistoric antler working, that experimental archaeology can act as a conceptual bridge. Experimental archaeology interweaves theory and science to construct specific conditions pertinent to testing theoretical hypotheses about past behaviours. Throughout our research, we have mediated the theoretical and scientific to better understand the chaîne opératoire of antler working, appreciating the merits and limitations of both sides. This paper will therefore critically reflect on our research, presenting experimental archaeology as a potential solution to resolve issues with integrating theory and science.
All the Colours of the Rainbow: An Archaeological Exploration of Mesolithic Britain through the use of Sight and Colour
Mai Walker (Archaeology South East, maiwalker@msn.com)

As Archaeologists we often find ourselves focusing on the materiality of the past. Are we dehumanising our understanding of the people themselves and the colourful worlds they lived in? What if we start back at the beginning, examining the very thing we take for granted often ourselves – sight, and how we use this to build up our own worlds and understand our environments.

Approximately 30% of the brain’s cortex processing is used on sight alone, our eyes create a world using colour as an indicator of understanding and meaning. But, what if we use this process to see through the eyes of Mesolithic peoples in their daily lives, especially when it comes to engaging with colour? Through basic neuroscience, experimental pigment production, and an understanding of Mesolithic environments, we will explore one of the 5 senses to illuminate a more human past of an era so dark to archaeological understanding.

Archaeology Stinks! Can we find Smell in Archaeology?
Rose Malik (University of York, rm1567@york.ac.uk)

Smell is a language, communicative and interpretive. It connects the physical, social, emotional and semantic, informing meaning and understanding.

How can we engage with smell – often considered intangible, invisible and incorporeal? Bringing science-based analysis and theory together, we can create strong evidence-based metanarratives of past cultures. This presentation will discuss a technique that can bring odour molecules to life by exploring analysis in the lab and some of the methods and techniques available for collecting samples in the field. Delving into test case evidence from the first millennium BC burial sites in Yemen this talk will demonstrate how we can bring tangible empirical evidence to archaeological theory to a possible meta narrative around the treatment of the body in ancient Yemen and understanding mortuary practices at this time. Furthermore, what could the future hold for a technique that bridges the gap between science and theory in the world of archaeology?

Recording Archaeological Senses in Subterranean Environments: A methodological and technical approach
Konstantinos Trimmis (University of Bristol, Kostas.trimmis@bristol.ac.uk)

Sensorial and emotional approaches in archaeology always have been criticized due to the difficulty of the analytical documentation of the past senses (see Tringham 2015). This paper tries to correlate current trends on archaeological theory about non-rational decision-making factors in prehistoric communities (such as senses, emotions and feelings) with current mapping and geo-analytical techniques. Caves from the Balkans works complimentary as case studies but a discussion on how the application of the proposed methods can alter the current understanding of the human use of the Neolithic Balkan caves will take place, in order to showcase if a geosophical approach (after Gillings 2008) can offer a better understanding of the past.

“But that’s how my grandma used to make it!” Using Cheese-making to start Dialogue on the Relationship between Theory and Science
Penny Bickle (University of York, penny.bickle@york.ac.uk)
In 2015, a group from the York Archaeology department started experimenting with Neolithic cheese making, primarily as an outreach activity. The conversations held at cheese making events since have been varied, but a central theme emerged of how results from scientific methods are integrated with questions of social value and decision making. The role of dairy in Prehistoric diet has thus proved an informative route into discussing natural vs. cultural processes; in other words, how Cartesian dualities can shape understanding - and are easily challenged. This paper will explore how debates about dietary shifts across the Mesolithic-Neolithic transition, and the introduction of farming, have inspired such discussion about theory and science. The aim is to consider how epistemological divides shape the conception of, and presentation of, the past; and how we can use creative engagement with past technologies to include the public in our dialogues about science and theory.

**What Did Cheddar Man Look Like and Why Does it Matter?**

Tom Booth (Natural History Museum, London, t.booth@nhm.ac.uk)

Recent analysis of DNA extracted from the 10,000-year-old British Mesolithic skeleton known as Cheddar Man found that, like other Mesolithic Europeans, he was likely to have had dark skin. These data, alongside other analyses predicting that Cheddar Man would have had blue-green eyes and brown hair was used in a facial reconstruction made as part of a Channel 4 documentary, provocatively titled ‘The First Brit’. The strong reaction to the reconstruction on traditional and social media exposed how far understandings of nationhood and heritage amongst the public still often underpinned by implicit ideas of ancestry and common descent. The way in which the Cheddar Man result disrupted these ideas provides a stark example of how new scientific findings can subvert widely held popular understandings of the past and can suddenly imbue ancient remains with new contemporary meanings.

**Reinterpreting Upper Palaeolithic Burials in Light of Recent Genetic Evidence**

Sophy Charlton (Natural History Museum, London, s.charlton@nhm.ac.uk)

European Upper Palaeolithic burials, although few in number, have held particular interest for prehistoric archaeologists, being the focus for much study and a range of theoretical approaches. Concurrently, recent advances in DNA sequencing technologies have resulted in the publication of a raft of new ancient DNA papers and whole genome analysis of prehistoric human skeletal material. Amongst this work are included a number of Upper Palaeolithic burials for which genome-wide information is now available. As yet however, this new genetic data has been little integrated with theories surrounding Upper Palaeolithic funerary practices. This paper will consider the information which ancient DNA analysis can provide on Palaeolithic burials, and explore a framework through which early prehistoric burials can be analysed, incorporating both theoretical approaches and new genetic data.

**The ‘Toolbox’ Paradigm**

Johnnie Gallacher (Guard Archaeology, j6525wg@gmx.com)

If archaeology is to maintain its academic worth and its status as a cardinal system to understand the human past, then archaeology must adequately come to terms with methodological advances in genetics. The ‘toolbox’ paradigm is the solution. This relativist, eclectic, multi-disciplinary, evidence-based theoretical approach holds optimum insight into the past as its goal and recognises that there are many ways of achieving that. It sees genetics as an archaeological tool, albeit one which has been sharpened. Rather than blindly accepting findings from not-strictly
archaeological disciplines, it applies extra scrutiny to them. My paper discusses current understandings of the archaeo-linguistic origins of Celtic and Indo-European, embodying the ‘toolbox’ paradigm whilst doing so.

**Genetic Relatedness and Societal Groups: Ancient DNA Analysis of Anglo-Saxons at Barrington A (Edix Hill) Cambridgeshire**

*Jessica Bates (University of Cambridge, jsb206@cam.ac.uk)*

Barrington A (Edix Hill) is an important Anglo-Saxon site in Cambridgeshire with 115 burials (148 individuals) spanning from AD 500–700. The site was used by a rural community of around 50-65 people with a complete burial record of all ages and sexes, and material culture suggesting a mixture of cultural identities (Malim and Hines 1998). This research presents the first ancient DNA evidence from the site, where 22 individuals have been analysed genetically in context of nearby contemporary Anglo-Saxon populations. The study will address ideas of relatedness, social groups and cultural identity by exploring correlations between genetic information and burial data. Variation in burial rites within Anglo-Saxon cemeteries will be assessed through an exploration of site organisation and the identification of clusters of individuals sharing biological or cultural similarities. The conclusions of this research have demonstrated that collective burials do not necessarily indicate the presence of related individuals. Therefore, the study highlights the value in interpreting genetic data from an archaeological perspective, which can elevate results to enable an insight into the lives of individuals in the past.

**Approaching Hominin Healthcare**

*Andy Needham (University of York, andrew.needham@york.ac.uk)*

The analysis of palaeopathology in early hominins is primarily published in case study format, following strict scientific protocols, with restrained interpretation. This data is essential to any consideration of ancient healthcare practices, but approaching this subject requires the integration of theoretical tools. Two theoretical strands have emerged in recent years, sensitive to different research questions at varying scales. The bioarchaeology of care approach, pioneered by Lorna Tilley, works at the scale of the individual, touching on specific lives and experiences. The evolutionary approach works at the scale of the species, plotting the importance of healthcare within a species as it interacts with specific environments and ecologies. I will illustrate some of the applications of these approaches using Neanderthals as a case study. Together, these theoretical tools, when integrated with palaeopathological data, reflect one viable routeway to approaching hominin healthcare.

**The Mesolithic Body: Articulating Science and Theory**

*Amy Gray Jones (University of Chester, a.grayjones@chester.ac.uk)*

Across north-west Europe, Mesolithic human bodies were treated and deposited in a number of different ways after death; as well as inhumed in formal cemeteries bodies were also disarticulated, fragmented, and deposited in a variety of contexts, including occupation layers, middens, caves, and pits. Recent analysis of this disarticulated material has shown the varied forms of funerary practice through which it was generated. However, theoretical approaches to the body in the Mesolithic have generally focused on evidence from inhumations, seemingly struggling to address the implications of practices that involve the manipulation of the body after death. This paper aims to show that approaches that combine a theoretical framework grounded
The Power of Plants: Using Palaeo-ecology to Rethink Human-Environment Relationships

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Recent developments in archaeological theory have highlighted the potential agency and animacy of plants, animals and other aspects of the 'natural world'. The challenge, however, is how to integrate these theoretical approaches with the empirical data provided by environmental archaeology, upon which our understanding of these non-human actors is ultimately based. This paper will draw on recent palaeo-ecological and archaeological research on the early Mesolithic landscape in the Vale of Pickering (North Yorkshire, UK), to examine the differing interactions between humans, plants and topographic features. In doing so it will demonstrate how such interactions were structured by the agency of non-human actors, and how their potential animacy was bound up in the relationship between humans and their environment.

Curious Case of Scottish Crannogology, or, Why the Relationship between Archaeological Interpretation and Technological Advances is (Co-)predicated by the Archaeological Record Itself

Piotr Jacobsson (Scottish Universities Environmental Research Centre, University of Glasgow, pt.jacobsson@gmail.com)

In the plenary session of the 2009 TAG at Durham Dan Hicks argued that the nature of archaeological remains themselves has a profound impact on our theoretical approaches. This argument extends to the relationship between scientific methods and their application in archaeology.

There are in excess of 400 lacusterine structures throughout Scotland (referred to as ‘crannogs’). Majority of these sites is waterlogged; this means that throughout Scotland there is a wealth of environmental, economic and technological information pertaining to the Iron Age and the Early Medieval period that can be hauled in using scientific techniques. Yet this potential is, for the most part, unfulfilled. This paper argues that this lack of research is driven by the very different nature of the material remains across the wetland/terrestrial divide and that these differences precluded emergence of debates that would benefit from excavation of wetland sites and scientific analysis of the materials recovered.

Animals and Activity areas: Integrating Faunal, Spatial and Geochemical Analysis to Better Understand Environmental Interaction at the Mesolithic Site of Star Carr (POSTGLACIAL Part I)

Becky Knight (University of York, becky.knight@york.ac.uk)

The Mesolithic site of Star Carr is famous for amazing preservation of organic remains, iconic artefacts (antler frontlets and barbed points) and, later, for the dramatic change in preservation quality that affected most of the site. To maximise information drawn from this unique site, along with the usual excavation techniques, the most recent research has emphasised the integration of scientific approaches and spatial analysis to aid with artefact interpretation, taphonomy and to identify otherwise ‘invisible’ activity foci. This enabled identification of various faunal depositions that reflect interesting nuances in the ways the Mesolithic inhabitants were living and interacting with other animals across the site. This included purposeful reconstruction of ‘individuals’ as well as different intensities of activity in association with
different structures and areas. We will review here some of the interesting examples and explore the implications for what that might mean about Mesolithic human-animal interactions.

**Integrating to Disintegrate: Understanding the Palimpsests, Place and Community at Flixton Island 2 (POSTGLACIAL Part II)**

*Charlotte Rowley (University of York, charlotte.rowley@york.ac.uk)*

Flixton Island 2 is only a couple of fields over from the more famous Mesolithic site at Star Carr but is very different in nature. It is a composite of sites from the Palaeolithic and Mesolithic within which there may be multiple occupations represented as well. The challenge is that at Flixtor, the dryland occupation layers are very close to the surface, potentially affected by plough damage, and there are no clear features or structures to immediately suggest activity. Furthermore, the Palaeolithic material mainly dominates the wetland areas but the Mesolithic material is up on the dry so there is a contrast within Flixtor itself. Using a similar scientific ‘toolkit’ as applied at Star Carr, this becomes a case study in how we can learn more about more enigmatic and challenging prehistoric sites but also how we consider those sites in terms of place, identity, memory, persistence and even community.