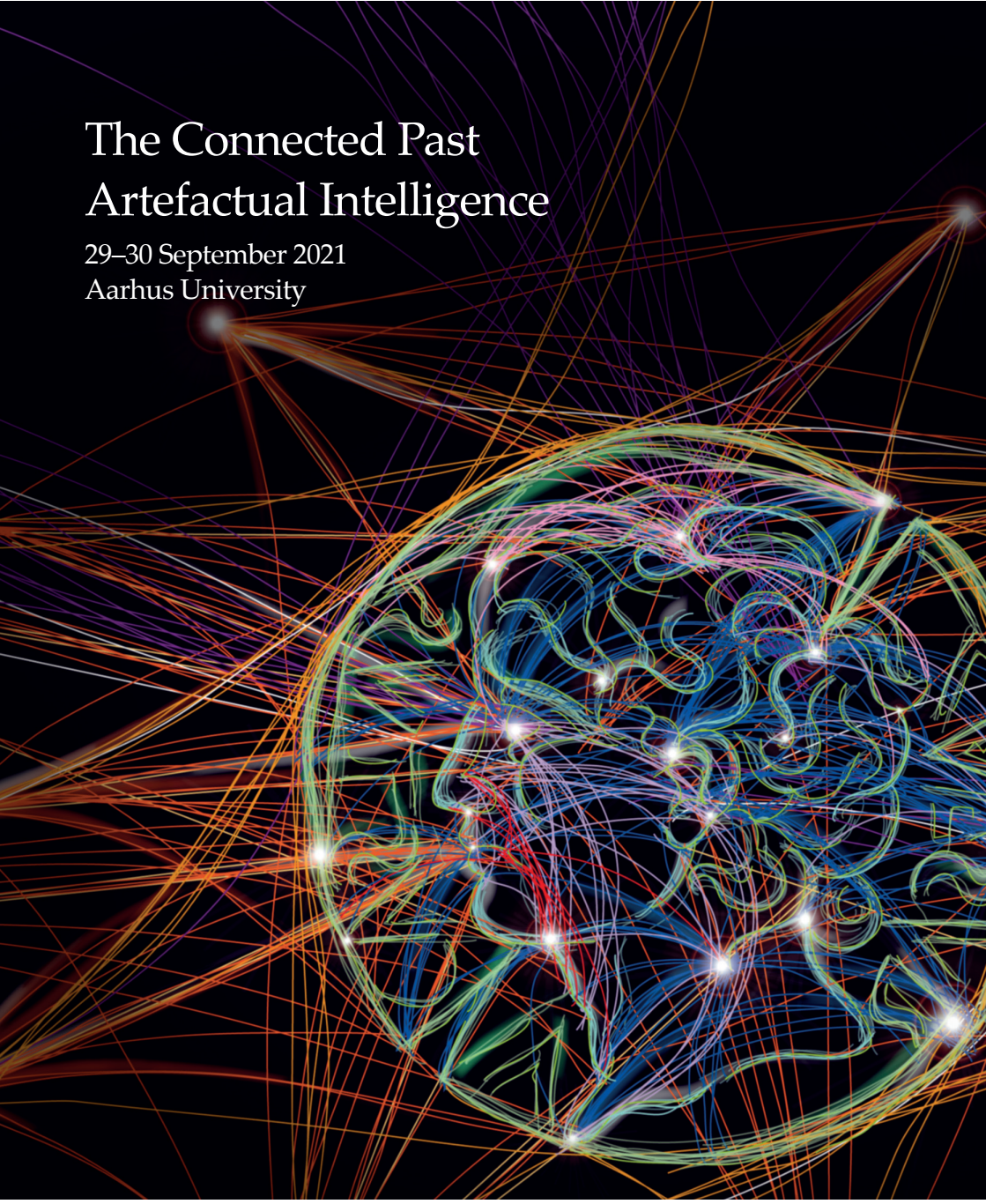
The Connected Past
Artefactual Intelligence

29–30 September 2021
Aarhus University



CARLSBERG FOUNDATION
School of Culture and Society, Aarhus University
The Strategic Pool for Research

UrbNet
CENTRE FOR URBAN NETWORK EVOLUTIONS
The Danish National Research Foundation

Danmarks Grundforskningsfond
Danish National Research Foundation

AARHUS UNIVERSITY

THE UNIVERSITY OF MELBOURNE

Campus Aarhus. Photo: Lars Kruse, AU Foto.

Table of Contents

Outline

Artefactual Intelligence

Computational models used by archaeologists are becoming increasingly complex. We create and tackle ever larger datasets, include more parameters and make machines learn by themselves. Recent approaches to network theory in archaeology, and the historical sciences more generally, have embraced agents, agency and practice theory. But where does this leave objects? Since the earliest days of the discipline, objects have been at the core of the archaeologist's enquiry. However, until recently, objects were left heavily undertheorised. With the advance of object-related theories, such as ANT or the New Materialism approaches, agency is extended not just to humans but to the objects and materials they handle as well. Does this mean that digital archaeologists and historians are to move from Artificial Intelligence to Artifactual Intelligence? And if so, how?

Being a community of scholars interested in recent theoretical and methodological innovations in archaeology and the historical sciences, the Connected Past Conference provides a forum for presenting and discussing ongoing work on the intersection between archaeology, history, digital approaches and theory. The conference will be preceded by a two-day practical workshop (limited capacity, open call for participants to follow soon).

This year's conference focuses specifically on the topic of artefacts, human and material agency, artificial and artefactual intelligence and their place within archaeological and historical network studies. In addition, we also welcome presentations on any topic related to archaeological or historical network research and complexity science.

Programme

Wednesday 29 September

9:30-10:00 Coffee and tea

10:00-12:00 Session 1

One Ring to Rule Them All? Appearance and Identity of Early Nordic Bronze Age Women (Louise Felding)

Reassembling Identity: Analyzing the Network of Elite Identity Construction in Burials of the Late Bronze Age (Aline Deicke)

Things and People, People and Things: Comparing, Combining and Juxtaposing early Neolithic Networks of the Near East (Fiona Coward)

Geography and Scale in Early Christian and Late Roman Property Structure as Reflected in the Liber Pontificalis (Eivind Heldaas Seland)

Of Texts and Meanings: Challenges of Lemmatization of Incomplete Epigraphic Texts (Petra Hermankova and Vojtech Kase)

An Information Theoretic Approach to Mycenaean Pottery Datasets (Henry Price, Paula Gheorghiade, Ray Rivers, Tim Evans and VaivaVasiliauskaite)

12:00-13:00 Lunch break

13:00-14:20 Session 2 (remote presentations)

Flowscapes and Effectancy of Etruscan Rivers (Mariachiara Franceschini)

Mapping the Growth and Shape of Archaeology through its Documentary Networks (Anthony Sinclair)

The Role of Objects in Cultural Evolution: Insights from a Simulation Model (Eugenio Bortolini, Enrico Crema and Mark Lake)

New Methods for the Steady-State Analysis of Complex Agent-Based Models (Chico Camargo)

14:20-14:50 Coffee and tea break

14:50-15:50 Keynote presentation

Solving Inverse Problems in Archaeology: Bayesian Belief Networks for Causal Modelling (Juan Barceló)

16:00-18:00 Wine reception

Museum of Ancient Art and Archaeology. Photo: Lars Kruse

Thursday 30 September

9:30-10:00 Coffee and tea

10:00-12:00 Session 3

The Role of the Roman Army in Cult Sites in the Hauran (Southern Syria): A Regional Religious Network Study in the Roman Empire (Francesca Mazzilli)

Multi-Scalar Festival Network Agents in the Hellenistic and Roman World: Regions, Kingdoms, and Empire (Adam Wiznura, Tom Britton and Robin van Vliet)

Possibilities of the Network Concept Application in Research of the Barbarian Societies of the Middle Danube Borderlands during the Roman Period (Marek Vlach and Balázs Komoróczy)

The Role of the Roman Army in the Spatial Dissemination of the Cult of Asclepius: A Spatial Network Analysis (Tomáš Glomb)

Mapping Similarity in Epigraphic Monuments across Space and Time: Evaluating the Potential of Network Analysis (Adela Sobotkova, Petra Hermankova, Vojtech Kase and Antonio Rivero Ostoic)

Exploring Classical Archaeology Literature Using Network Analysis and Rule Mining (Michele Coscia)

12:00-13:00 Lunch break

13:00-14:40 Session 4

Rethinking how Public Space Promotes Interaction within Historic Pueblo Settlements: A Network and Agent-Based Modelling Approach (Katherine Crawford, Matt Peeples and Tom Brughmans)

The Coins that Transformed Eurasia: Modelling Islamicate Heritage in Itinerant Assemblages (Sara Ann Knutson)

Past Mobility Approached by Network Analysis Applied to Strontium Isotope Results (87Sr/86Sr) (Sarah Dalle)

Network Imputation for Missing Dating Data in Archaeological Artefacts (Antonio Rivero Ostoic and Srebrenka Letina)

Plantiness: Re-evaluating Plant-Human Relationships in Prehistoric Britain (Molly Masterson)

14:40-15:10 Coffee and tea break

15:10-16:10 Session 5 (remote presentations)

Artificial and Artifactual Intelligence and the Development of Archaeological Theory (Rachel Lane)

Networks of Houses and Networks of Objects: Creating and Interpreting Socio-Material Networks at Çatalhöyük (Camilla Mazzucato)

Connected Making: Relational Approaches to 4th-7th century AD Mediterranean Production Processes (Hallie G. Meredith)

Keynote

Solving Inverse Problems in Archaeology: Bayesian Belief Networks for Causal Modelling

Juan A. Barceló (Universitat Autònoma de Barcelona)

When the causal mechanism –human behavior in the past- is known, historical why-questions can be framed in terms of a direct forward logical problem, and its resolution can be conducted as deduction from what is assumed to be true –the mechanism-. In mechanics and related disciplines, details of the forward problem are given by some physical theory. There is a model (equation) relating the input (observed effect) to the output (most probable cause), and therefore, given the model we can predict its effects in the specific situation defined by the given input.

When what we are looking for is the causal mechanism itself, then we are asking for a reverse or inverse problem In other words, we want to know the cause, once the effect has been observed. Inverse problems deal with determining, for a given input-output system, an input that produces an observed output, or determining an input that produces a desired output (or comes as close to it as possible), often in the presence of noise (incomplete observation, fragmented objects). Most archaeological problems are characteristically inverse.

Since Aristotle, induction has been the cognitive way to solve inverse problems. Machine learning tools and techniques have considerably increased the range of classical induction. In this paper I will deal with Bayesian Belief network and probabilistic causal modelling to relate present observations (the archaeological record) with inferred social activity in the past. The theory and algorithms of BBN will be presented, using archaeological examples related with functional analysis of artifacts and social modelling in prehistoric societies.

Abstracts

The Role of Objects in Cultural Evolution: Insights from a Simulation Model

Eugenio Bortolini (University of Bologna), Enrico Crema (University of Cambridge) and Mark Lake (University College London)

This paper addresses the conference theme by examining the role of objects in cultural evolution. Although the explanatory potential of modern evolutionary archaeology is now well documented in the literature, the exact role of objects in cultural transmission has received relatively little attention. The fundamental question, which can be precisely stated in the language of the philosophy of biology, is whether cultural objects are replicators, interactions or both. Using more familiar terminology this approximately amounts to whether objects are a material instantiation of the cultural genotype, a phenotypic expression of the cultural genotype, or both. The answer to this question has both theoretical and practical implications. Theoretically, it determines whether cultural transmission is Darwinian or Lamarckian. Practically it determines the applicability of quantitative tests used by evolutionary archaeologists to detect the presence of interesting biases in cultural evolution. In this paper we use computer simulation to explore how the dynamics of cultural evolution are altered depending on the role played by objects and whether those differences affect the efficacy of existing quantitative tests used in modern evolutionary archaeology.

New Methods for the Steady-State Analysis of Complex Agent-Based Models

Chico Camargo (Exeter University)

Among all tools used to understand collective human behaviour, few tools have been as successful as agent-based models (ABMs). These models have been particularly effective at describing emergent social behaviour, such as spatial segregation in neighbourhoods and opinion polarization on social networks. ABMs are particularly useful in the study of archaeology and history, being used to address questions ranging from early hominid societies to armies and revolutions. These models, much like the social systems they are used to describe, often do not have unique output variables, scales, or clear order parameters. This lack of clearly measurable emergent behaviour makes such complex ABMs difficult to study, ultimately limiting their application to cases of empirical interest.

In this paper, we introduce a series of approaches to analyze complex multidimensional ABMs, drawing from information theory and cluster analysis. We use these approaches to explore a multi-level agent-based model which was originally introduced by Banisch and Olbrisch to study ideological alignment, but which can easily be extended to the study of the spread of cultural practices. We use the tools introduced here to perform a thorough analysis of the model for small system sizes, identifying the convergence towards steady-state behaviour, and describing the full spectrum of steady-state distributions produced by this model. Finally, we show how the approach we introduced can be easily adapted for larger implementations, as well as for other complex agent-based models of social behaviour.

Exploring Classical Archaeology Literature Using Network Analysis and Rule Mining

Michele Coscia (IT University Copenhagen)

Starting from a bipartite classification network of objects and classification criteria – in our case taken from Archäologische Bibliographie 1956-2007 – we present a way to explore the ecology of classification co-occurrence. Enabling meso-level exploration, we construct and enrich a weighted network of classification co-occurrence with a useful lift-significance measure, based on learned association rules. Enabling global-level exploration, we use hierarchical link clustering HLC to extract sense-making communities from the co-occurrence network, taking into account that classifications can belong to multiple communities, resulting in a community overlap network. Finally, visualizing and exploring the results including evolution in time, we offer important insights regarding the structure of classical archaeology as a discipline, while making an interesting case for applying our technique to similar datasets covering other disciplines.

Things and People, People and Things: Comparing, Combining and Juxtaposing Early Neolithic Networks of the Near East

Fiona Coward (Bournemouth University)

The recognition that material culture is a key element of social interaction in human societies forms the basis for much archaeological network research, which typically uses material culture as the basis for reconstructing past social networks. However, while it is widely recognised by archaeologists and anthropologists that material culture is not simply a passive reflection of sociality, but a highly active agent in our social worlds, the implications of this for the use of material traces in network science remains under-theorised. This paper will compare multiple networks for the same period and geographical region – the Epipalaeolithic and early Neolithic of the Near East – reconstructed using different kinds of material culture, in order to investigate just how variable networks based on, for example, jewellery as opposed to art, as opposed to ground stone might be. Are simple networks based on single types of material culture sufficient to inform on meaningful patterns of interaction? Are multiplex networks combining different types of material culture required, or do they simply blur the picture by conflating different forms of materiality and relationship? Does material culture link sites, or do sites link material objects? And can archaeological network techniques be used not only to reconstruct social networks from material culture, but to better understand how those objects acquire agency and become integrated into our social worlds in the first place, and the implications of this process for human sociality?

Rethinking how Public Space Promotes Interaction within Historic Pueblo Settlements: A Network and Agent-Based Modelling Approach

Katherine A. Crawford (Arizona State University), Matt Peeples (Arizona State University) and Tom Brughmans (Aarhus University)

Public space and its ability to integrate communities has been recognized by scholars as a common phenomenon within Pueblo settlements of the American southwest. Despite this assumption, only minimal consideration has been given to the actual mechanisms that enabled public space to promote social integration. Thus far, the only attempts at formally studying this relationship have been achieved by applying space syntax methods and theories, the results of which suggest that public spaces within Pueblo settlement design existed as connective features for different communities. How social integration occurred beyond spatial proximity, however, remains inadequately addressed. The present study goes beyond current assumptions to question how public space, if it existed as a central node within a Pueblo settlement, affected the interaction potential between people and social groups. This will be done through a methodology that combines network research, space syntax, and agent-based modelling to explore the social networks reflected in archaeologically documented public and private spaces.

Arroyo Hondo, a historic Pueblo with a well understood architectural plan, is used as a case study to introduce a new network and movement focused approach that analyses the different urban interactions that would occur as members of the community took trajectories to different public areas of the settlement. By exploring how urban dynamics were focused around the accessibility of public space, new insights will be gained into the range of social interactions that may have occurred within the settlement.

Past Mobility Approached by Network Analysis Applied to Strontium Isotope Results (87Sr/86Sr)

Sarah Dalle (Ghent University, Vrije Universiteit Brussel)

The CRUMBEL project studies Belgian archaeological cremation sites dating from the Late Neolithic to the Early Medieval period. Several thousands of individual strontium isotope measurements (87Sr/86Sr) are being carried out on cremated human bone, allowing for a thorough study of past human mobility in Belgium. In search for an appropriate method to visually analyse many-to-many structured relations in the data (i.e. humans and their Sr value versus regions and their Sr range) on a map, network analysis was applied to Sr isotope data.

In a first part, the seemingly most logical connection between humans and their region of origin has been studied, resulting in a two-mode network. Because the Belgian data are still being produced, the methodology for this part is tested on British published data. Although numerical data seem quite straightforward to use within network analysis, the application revealed to be highly complex. The problem occurring here is primarily due to the occurrence of multiple regions with the same and even overlapping Sr ranges, resulting in a large number of hits. To try and overcome this issue, extra variables, such as distance, have been introduced.

In a second part, human Sr results are paired directly to each other, resulting in a one-mode network, showing resemblance in region of origin between individuals in a first step, and between sites in a second step. Belgian data were used to test this method. This approach proves to be highly interesting to compare statistical spread of the Sr isotope data between sites on a map.

Reassembling identity: Analyzing the Network of Elite Identity Construction in Burials of the Late Bronze Age

Aline Deicke (Academy of Sciences and Literature, Mainz)

The late Urnfield period shows a re-emergence of rich burials that – as a precursor to the Hallstatt "princes" – serves as a distinctive step in the evolution of social hierarchies. The artifacts, features and practices surrounding these funerals present (un-)conscious materializations of the identities of the deceased and proxies of the social dynamics embodied in them. However, the highly individualized composition of these graves complicates any closer study. Therefore, a multi-method network-analytical approach was used on 82 finds containing 1321 objects. As a secondary goal, the analysis evaluated the methods used for application on bigger datasets and identified challenges in their application.

Modeling the graves and the objects as a bipartite network, fuzzy c-means clustering was used to detect overlapping, non-standardized groups of grave goods. Ego-networks of selected artifacts helped to further define these groups. To identify objects representing core traits of elite identity, a bipartite clustering coefficient was calculated that also measured the degree of standardization in the inventories. Lastly, a unimodal similarity network of the artifacts was created to analyze interdependencies between different aspects of identities.

In this way, several core aspects of Late Urnfield elite identities and their interactions could be determined. Furthermore, the wider structure of the network allowed inferences on the degree to which norms and thus social cohesion existed in the different funeral communities. The analysis can therefore hint at distinct strategies employed by these societies to deal with the upheaval at the first stages of the transition to the Iron Age.

One Ring to Rule Them All? Appearance and Identity of Early Nordic Bronze Age Women

Louise Felding (Aarhus University)

Through a multi-scalar approach using network analyses this paper investigates identity through a comparative study of 270 female gendered burials from Jutland, Funen, Bornholm and Northern Germany. The understanding of the societal structure in the Bronze Age is based on a binary gender system and the variation within these gender categories is emphasised as highly significant for our understanding of gendered social roles in the Early Nordic Bronze Age (NBA). This paper demonstrates that elite women in Early NBA (c.1600–1100 BCE) held high social standing as well as holding multi-facetted social roles, reflecting both status and identity but with a change in status observed from NBA period II to III (c. 1300 BCE onwards).

Network analyses using the concepts of degree, centrality and hierarchical clustering were applied in order to investigate the dataset at different scales. Combined they were able to demonstrate key features in our understanding of the gendered structures of the Early NBA. The centrality network of all female graves demonstrated that one arm ring in particular was dominant in the material and is seen a key identity marker for Early Nordic Bronze Age women. Networks based on degree revealed distinct groupings that on a large dataset including male and female graves could demonstrate a gendered division in the Bronze Age; yet on a smaller dataset (only including armbands in female graves) showed clear groupings of object-type combinations that potentially point towards dual identities of some individuals in the network.

The paper finds great potential in relational (network) approaches to identity studies based archaeological assemblages.

Flowscapes and Effectancy of Etruscan Rivers

Mariachiara Franceschini (Albert-Ludwigs-Universität Freiburg)

Recent historical, anthropological, and ecological contributions on the cultural status and the materiality of water, as well as its influence on modern socio-political changes, have inspired my new theoretical and methodological approach to the archaeological research on rivers. Highlighting the entanglement of ancient communities and riverine landscapes, I focus particularly on the effectancy of rivers on human activities. By considering the river basins as geographical and cultural limits (which allows a coherent analysis of the relationship between landscape and material culture) and incorporating four archaeological key-factors (infrastructures, settlements, sepulchral and cult places) into a GIS for a comprehensive analysis of human relations to landscape and hydrography, I aim to emphasise the importance of river-networks as catalysts of social and cultural changes. Waterways, valleys, archaeological remains, flows of ideas, knowledge, and phenomena create 'flowscapes', which are, according to Matt Edgeworth, communication systems to evaluate the impact of rivers on social, historical, and ideological contexts. Thus, in my contribution the 'flowscapes' of the two Etruscan rivers Paglia and Fiora in the archaic and classical period will serve to demonstrate how rivers deeply affected human reactions. Focussing exemplarily on the material evidence of the sepulchral factor, and discussing the changes in funerary landscape, custom, art, and architecture related to riverine ways, I will highlight how rivers influenced both the preservation of social and cultural identities as well as the communicative strategies of power.

The Role of the Roman Army in the Spatial Dissemination of the Cult of Asclepius: A Spatial Network Analysis

Tomáš Glomb (University of Bergen)

The paper introduces the two-year research project "Favorable Conditions of the Spread of the Cult of Asclepius across the Transportation Network of the Roman Mediterranean: A Quantitative Evaluation" (acronym AscNet; 2020-2022) affiliated with the University of Bergen, Norway. The presented case study focuses on analyzing the potential impact of the Roman army on the spatial distribution of the cult of Asclepius in the Roman Empire by employing the methods of spatial network analysis. The hypothesis produced by the academic debate claiming that the Roman soldiers transported the cult of Asclepius is, so far, supported by generalizing interpretation of selected pieces of archaeological or literary evidence and unable to reflect the complexities of this historical process of cultural transmission such as the role of transportation network or differing regional/provincial dynamics. The presented AscNet case study aims to bring further detail to this research problem and overcome the potential limits of traditional historiographical approach by analyzing potential patterns in shortest distances measured on the ancient transportation network between the archaeological evidence of the cult of Asclepius and Roman military structures (e.g. legion bases, forts). The preliminary results presented in the paper reveal that there is a strong spatial correlation between the religious and military proxies, however, with significant regional variability. The paper aims to demonstrate that the quantitative methods from the portfolio of Digital Humanities represent a vital supplement to the established methodology of historiography and a promising way towards the interdisciplinary science of history.

Of Texts and Meanings: Challenges of Lemmatization of Incomplete Epigraphic Texts

Petra Hermankova and Vojtech Kase (Aarhus University)

Inscriptions provide direct and often quite vivid insight into the past communities. The inscribed monuments come from various social groups of different linguistic, ethnic and economic backgrounds. Although the surviving texts reflect the colourful reality of ancient peoples, the reasons behind the creation of inscriptions are similar across the Mediterranean, e.g. managerial needs of society, maintenance of societal cohesion, and the reaction to ever-changing realities of life. Such a diverse array of texts comes with its own peculiarities that our project (SDAM) needs to tackle before any further quantified analysis of inscriptions. In this paper, we address one of the biggest challenges – how to extract meaning from non-standardized, inconsistently preserved and discontinuous texts? By sharing the insights from our process of the computer assisted lemmatization of Greek and Latin epigraphic texts with the community, we hope to spark fruitful discussion and kick-start collaboration.

The Coins that Transformed Eurasia: Modelling Islamicate Heritage in Itinerant Assemblages

Sara Ann Knutson (University of California, Berkeley)

This project explores how archaeologists can think through cross-cultural contacts, social relations, and economic commerce more broadly than simply the 'hand to hand' exchange between two humans. To do this, I am investigating the long-distance social relations between the expansionary, imperialistic movement of the Islamic Caliphates and the commercial endeavors and migrations of Northern European communities (ca. 700- 1400 AD) in modern-day Eastern Europe, from the Baltic Region to the Caucasus. The social activity that brought these groups to form enduring interactions and expansive networks that stretched across Eurasia left substantial material traces, including mobile Islamic coinage which moved throughout the Eurasian seaways and Eastern European river routes and became deposited as silver hoards. This evidence will be used to develop a network-supported database and network model through Social Network Analysis (SNA) methods and will place current network approaches in conversation with anthropological perspectives on itinerant objects, assemblage theories, theories of monetary exchange, and migration. My work will build on New Materialist theory to suggest that materials, in this case coins, are also powerful actors in their own right in these long-distance Eurasian networks; greater attention to them as such will help reconfigure the ways that archaeologists traditionally tend to think about object assemblages.

Artificial and Artifactual Intelligence and the Development of Archaeological Theory

Rachael Lane (The University of Sydney)

The late Russian archaeologist and theoretician, Leo Klejn argued that artificial or computer intelligence could solve issues of incoherency in theoretical archaeology. "When it comes to the future of archaeology, I expect most decisive steps from research on artificial intelligence… This will lead to an intelligence which is almost natural but more exact, objective and free from emotions and engagement with social movements (2003: 68)." Klejn's argument coincides with the debate between Bruce Trigger and David Clarke on coherence versus variability in theoretical archaeology. In the 1984 article "Alternative Archaeologies: Nationalist, Colonialist, Imperialist," Trigger demonstrated the way archaeology has developed in different parts of the world. He concluded that a unified and coherent theoretical construct is not likely to occur in the future. This position is at odds with Klejn's hopes and Clarke's general theory proposition, particularly as stated in the latter's 1973 essay, "Archaeology: The Loss of Innocence." Clarke also focused on technology as a key player in the future of the discipline's success. It rested to a certain degree with the belief that science could provide ultimate answers to all questions, and power and ability of the computer. Placing Klejn, Trigger, and Clarke in dialogue I hope to draw out the relationship between artificial intelligence, artefactual intelligence, and the future of archaeological theory. Additionally, I consider the question, is general theory and/or an exact language for archaeology possible or desirable?

Pre-Columbian Interaction Networks and Circulation of Obsidian Objects in the Atacama Desert - CANCELLED

Rodrigo Loyola (Université Paris Ouest, Universidad Católica Del Norte)

We study the circulation of obsidian artifacts among the pre-Columbian societies of the Atacama Desert (22º S / 67º W; 2000 to 4000 masl) in order to address social interaction networks. This encompasses a temporal framework ranging from the early peopling of the region (12,800 cal years BP) to the Early Formative Period (3500-2,200 cal years BP) marked by the adoption of a sedentary lifestyle and pastoralist economy. Obsidian artifacts from ten archaeological sites are studied combining compositional analysis (neutron activation analysis and x-ray fluorescence), technological studies ("chaîne opératoire" approach) and network analysis. The spatial and temporal variability of the circulation of obsidian objects allow us to suggest three major conclusions: 1) the existence of long-distance contacts through the Andes mountain range (< 4500 masl) since the Early Archaic period; (2) the relevance of ceremonial centers and collective hunts as nodes of inter-band aggregation within non-centralized networks; and 3) the development of wide interaction and exchange networks between hunter-gatherer and pastoralist societies, prior to the explosion of caravan traffic and the arrival of the Central Andean Empires. Along with other complementary evidence, we discuss the implications of these trends for regional archeology.

Plantiness: Re-evaluating Plant-Human Relationships in Prehistoric Britain

Molly Masterson (University of Oxford)

Out of the 'material turn,' new theories regarding materiality and 'thingness' have emerged and caused archaeologists to reconsider how we interpret cultural material. Important contributions have extended this thinking into the landscape and the natural world. Curiously, plants have remained silent within this developing narrative, and we must consider how plantiness can add to discussions of materiality and agency. Expanded from previous work, the concept of plantiness questions plant passivity and seeks to understand how plants, across extensive timescales, have influenced and shaped human becoming, and have thus been influenced themselves. Plants should be viewed not as people, animals, or things, but as plants; they should be interpreted both for what they are and what they represent. In my research, I argue for a more-than-human approach to understanding past peoples' relationships with plants, considering a range of plants from cereal grains to trees. It is deterministic to assume that, across diverse temporal and spatial landscapes, humans have always interacted with plants in the same manner that we do today. It is not our innate desire to separate ourselves from the natural world, but rather, a modern and Western design. This presents us with an obvious opportunity for re-evaluation. I question plant passivity and consider the idea of plant cognition, highlighting the importance of plant characteristics and plant-human negotiations. These topics come together to form the idea of plantiness. To contextualise plantiness, I focus on Iron Age Britain, and examine archaeobotanical assemblages, cultivation methods, field system organisation, and mechanisms of storage to understand the entangled relationships between people and plants. I aim to understand the dynamism of plant-human relationships across expansive timescales, from the Bronze Age up to the Roman period. In order to reconstruct plant-human relationships, we must begin to engage with plantiness.

The Role of the Roman Army in Cult Sites in the Hauran (Southern Syria): A Regional Religious Network Study in the Roman Empire

Francesca Mazzilli (University of Bergen)

Based on the concept of religion as 'continuously in the making', discussed especially in recent studies (see, for instance, Albrecht et al. 2018), my Marie Skłodowska-Curie project (RENE) aims to re-evaluate cult sites as the product of a dynamic socio-political context as well as the product of movements of different agents and ideas through social network analysis (SNA). Whereas recent studies on religion using SNA, such as work by Anna Collar (2013; 2017; Work-in-progress) and GEHIR project, have focused on the diffusion of specific cults across the Empire associated with movements of people, my project is a multidisciplinary study of cult sites in two areas at the margins of the Roman Empire (roughly modern-day southern Syria and Portugal). This involves examining architecture of temples, gods worshipped in cult sites, their benefactors through SNA and spatial analysis.

This paper will propose how SNA and spatial analysis will offer a better understanding of the following research questions: how religious and cultural transmissions developed; how the movement of people affected religious and cultural transmissions; the role of cities in relation to the rural religious landscape and vice versa; the identification of religious and socio-cultural subgroups; and how the landscape affected or shaped religious cultural transmission and mobility of elite. This paper will show the impact on the Roman army in shaping cults and religious architecture in cult sites situated on the road network in the provincial period through two-mode network and landscape analysis (distribution maps and point proximal analysis).

Networks of Houses and Networks of Objects: Creating and Interpreting Socio-Material Networks at Çatalhöyük

Camilla Mazzucato (Stanford University)

This paper explores the potential of network analysis to disentangle patterns of social relations that emerged within large early agricultural communities at the beginning of the Holocene in Southwest Asia. Using Çatalhöyük as a case study, the methodology permits us to elucidate the ways in which such Neolithic communities were internally organized and to identify the main principles of social organization, as well as track their development through time. Both buildings and the material features associated with them are used as vertices in networks; these networks map patterns of building co-affiliation in groups and trace the behavior of object assemblages at the site. In the current study, a selection of archaeological datasets representing a variety of material classes is used in the construction of networks. This broad-spectrum approach aims to dissolve artificial categories such as ritual vs. domestic, while permitting the formation of meaningful connections between materials and practices across different spheres. Additionally, this research proposes an integrated approach to the investigation of the socio-material networks constructed that employs elements of the main methodological components of network science.

Connected Making: Relational Approaches to 4th-7th century AD Mediterranean Production Processes

Hallie G. Meredith (Washington State University)

Interdisciplinary approaches deconstruct ontological distinctions between humans and their creations whilst simultaneously highlighting function, breakage and other disruptions to purposeful action (cf. for example, Igor Kopytoff 1986; Bill Brown 2001; Lambros Malafouris 2008; 2013). Yet, studies concerning production and retail activities among urban networks tend to prioritize surviving architecture. Arguably, built spaces are important as part of a changeable site within which work is produced; one prompting interactions. However, the main focus of late Roman producers, sellers and consumers themselves was surely objects made for sale. Despite only a handful of surviving, identifiable Mediterranean production-retail spaces, a notable increase in working-shops are known from the 4th-7th centuries AD. This examination foregrounds objects as a means of reconstructing production processes from this period. Ranging from in-process to unfinished, objects not only provide access to evidence concerning experimentation and interactions, but also document ephemeral production activities.

How do theoretical relations foregrounding objects contribute to our understanding of emerging objects? This paper will consider relational approaches grounded in a core case study with material that does not – yet – have any purposeful action, that is: in-process and unfinished 4th-7th century AD carved work from throughout the Mediterranean. Central to this investigation are: (a) production sites in marble, ivory, rock crystal and other media in working-shops and production-habitation sites as contexts for approaching (b) artefactual evidence of production processes inherent in extensive carving. This presentation considers object-related theories as a way to enrich our understanding of artefacts in relation to the processes used in their creation.

An Information Theoretic Approach to Mycenaean Pottery Datasets

Henry Price (Imperial College London), Paula Gheorghiade (University of Toronto), Ray Rivers (Imperial College London), Tim Evans (Imperial College London) and Vaiva Vasiliauskaite (ETH, Zurich)

Archaeological data sets are typically large and sprawling, which makes them very difficult to curate. In this paper we use ideas from information theory and elsewhere to give spatial and temporal shape to a 13,700+ ceramic data set from five Cretan sites spanning the period LM II – LM III B collected by one of us (PG).

A major problem in curating assemblages lies in deciding which artefact ontologies to privilege, since different choices extract greater or less information from the same underlying knowledge (the data). [Check out your local Museum of Archaeology!] A natural approach is through decision trees, which partition datasets according to ontology in an information-theoretic way; the 'better' the decision tree the more information we gain from that ontological choice. We further address the entwined issue of the cohesiveness of the total Cretan assemblage and its relationship to the sub-assemblages at the five Cretan sites that provide it using diversity metrics.

From this starting point we try to identify the diachronic evolution of the assemblages. Underlying our analysis is the suggestion, expressed in the recent literature, that the social trajectories of these key sites will be reflected in changes in assemblage diversity. We identify some of these changes.

Network Imputation for Missing Dating Data in Archaeological Artefacts

Antonio Rivero Ostoic (Aarhus University) and Srebrenka Letina (Linköping University)

Both archaeology and history seek to reconstruct the past based on the available information from today, and in all cases, some information got lost in time. The process of replacing missing data with substituted values has occupied statistics for many years, and the link prediction problem becomes highly relevant when networks either represent relationships among archaeological artefacts or represent ties between history variables.

In archaeology, the available epigraphical evidence from the ancient Mediterranean Sea seems to be an ideal case to apply diverse approaches to link prediction of boundaries of existence for the inscriptions inception dates. For this, we use stochastic and general blockmodeling to identify groups of similar artefacts based on typology in a set of artefacts for which dating is available. Besides similarity metrics, we apply algorithms mainly for probabilistic inference in assigning statistics to missing-link values like the fully conditional specification for multivariate imputation by chained equations.

Since inscriptions stand for the artefacts and messages at the same time, there is also place for a further exploration to artefactual intelligence.

Geography and Scale in Early Christian and Late Roman Property Structure as Reflected in the *Liber Pontificalis*

Eivind Heldaas Seland (University of Bergen)

The collection of papal biographies known as the Liber Pontificalis ("Book of Popes") contains the lives (biographies) of the bishops of Rome until the late ninth century. The account of the papacy of Silvester (r. 314-335) contains a list of endowments made by emperor Constantine (r. 306-337) to churches in Rome. While the work as it has come across to us is a late and heavily edited document generally considered of little historical value, there are historical and textual reasons to consider these lists as originating in archival sources that have been copied without major alterations.

These lists consist of names of estates, their geographical location in the form of district, and if outside Italy also province, their annual revenue is calculated in gold-coin, and in some cases also in-kind.

These clusters of churches with their estates may be approached as spatial, economic and transport networks that can be visualized as such. This allows us to assess and compare the distribution and value of endowments to different churches in Rome. We may investigate connections between church location, size, prestige and endowment. Processing data through the Stanford University Orbis network model of the Roman Empire enables us to address the distance and time dimensions of managing estates and moving revenue. Churches were landowners akin to large temples and private estates. Many of the groups of estates seem to represent confiscations by or testamentary gifts to the emperor, and the material might also shed light on property structures in the late Roman Empire in general.

Mapping the Growth and Shape of Archaeology through its Documentary Networks

Anthony Sinclair (University of Liverpool)

Archaeology is an increasingly multidisciplinary form of enquiry, connecting specialists and techniques of enquiry across the arts, social sciences and other sciences. A quasi-exponential growth in published research outputs has made it difficult for new scholars to acquire an understanding of its shape and development or for historians and philosophers of the discipline to chart its developing structure since no scholar can read but a small sample of the documents available. As a result, the range of knowledge and forms of enquiry within archaeology are poorly known in the public realm. A new project – The Atlas of Archaeology: a scientometric analysis of disciplinary growth 1960-2023 – aims to present a new visual analysis of the growth of the discipline based on networks of bibliometric data extracted from the Web of Science and Scopus to explore developments in multi- and interdisciplinarity, the international development of knowledge networks and the changing nature of the threshold concepts that characterise our understanding and representation of the past. This paper will set out the nature of the project and present some examples of the potential of the visualisation and analysis of bibliometric networks through explorations of conceptual development in the archaeological study of human origins (1970-2020), the geographical networks underlying developments in archaeological theory (1985-2010), and the potential of ego-centred networks to understand the contribution of scholars and institutions to archaeology as a whole.

Mapping Similarity in Epigraphic Monuments across Space and Time: Evaluating the Potential of Network Analysis

Adela Sobotkova, Petra Hermankova, Vojtech Kase and Antonio Rivero Ostoic
(Aarhus University)

Archaeological raison d'etre is to study past human behavior by monitoring variation in material and textual residues across space and time. In the last decade, this endeavour has seen massive advance thanks to efforts in data aggregation, standardization and sharing (e.g. Seshat, tDAR, ADS, etc). Grand challenges such as those underlying societal resilience, social complexity and mechanisms of cohesion and coordination (Kintigh, Greene, etc.) are only tractable if large-scale trans-regional comparison is possible among the aggregated datasets. Methods that can slice through the mass of data and reveal connections between evidence and past human behavior are therefore essential for the archaeologist's toolkit. Network analysis is one such promising recent addition. In this paper, our project (SDAM) shows how to extract meaning out of the Heidelberg Epigraphic Database with the networks approach. Given a Mediterranean-scale dataset, with large amounts of incongruous self-expressions of ancient individuals, communities and institutions, incomplete spatial, uncertain temporal attributes, and a mass of unstandardized text content, the process involves data science and creative thinking. We shed light on possible solutions when handling uncertain data, wide temporal horizons and spatial attributes, and showcase how archaeologists and IT experts can co-develop and finetune tools to make answering of archaeological questions possible.

Possibilities of the Network Concept Application in Research of the Barbarian Societies of the Middle Danube Borderlands during the Roman Period

Marek Vlach and Balázs Komoróczy (Czech Academy of Sciences)

Large part of the long-term archaeological research of chiefdom type societies within the scoped region of the Middle Danube during the Roman Period has been traditionally anchored within the cultural-historical paradigm, where singularities and individual phenomena generally tended to overcast quantitatively based and structurally oriented issues and questions. Despite relatively low complexity of the societies in scope, there has been recorded several phenomena of structure development (e.g. emergence of specialized production and its distribution, changes in burial practices or settlement distribution pattern etc.), above all through the decoding and interpretation of archaeological record. Yet, some of them also represent convenient subjects for implementation of other research perspective through the application of digital modeling (agent based modeling, network research). The presently launched project (Grant Agency of the Czech Republic) builds on previous and present research activities, such modeling settlement structure and its demographic properties, simulation of complexity and hierarchy of political organization or wealth redistribution and economy networks. It is the aim of the presentation to outline some of the presently developed and deployed model frameworks aimed to provide further insights to the mentioned topics. Digital representations and formulations of the featuring theories and their key aspects are based on variety of archaeological proxy data, written sources and other relevant input data and estimates. As well, in most of the topic are also reflected forms of political and economic interactions between the Roman and barbarian worlds within the Middle Danube Limes borderlands from the change of Eras till the Great Migration Period.

Multi-Scalar Festival Network Agents in the Hellenistic and Roman World: Regions, Kingdoms, and Empire

Adam Wiznura, Tom Britton and Robin van Vliet (University of Groningen)

In this paper we will present a joint project (NWO and OIKOS Anchoring Innovation) that envisions the spectacular rise of festival culture in the Hellenistic and Roman period as a driving force constantly forging ties and linking the world of Greek communities together. We consider the development of this shared festival culture, embedded in Greek practices, as a key factor in the creation of an imagined community of cities within the Hellenistic world, paving the way for the Roman Empire. The object of analysis is the networks of interaction and ideas produced by agonistic festivals with a focus on the agency behind the networks. Artefactual data on the movements of athletes and the diffusion of prizes and festivals is provided through inscriptions and coinage and is subject to analysis using network-theoretic approaches in combination with agent-based modelling. This paper studies agonistic festivals from several angles, and comprises distinct but interrelated research projects conducted on different scales: At the regional level, festivals in Thessaly are examined using network theory in connection with regional identity processes. Following will be a discussion of Hellenistic kings as agents, using agonistic festivals to legitimize their authority. Lastly, we examine how festivals during the Roman period were anchored in pre-existing Greek practices, connecting the two worlds into a global empire centered on Rome.

Organisers

Tom Brughmans
Aarhus University

Phone: +45 8716 2546
E-mail: t.b@cas.au.dk

Lieve Donnellan
The University of Melbourne

Phone: +61 383442179
E-mail: lieve.donnellan@unimelb.edu.au

Rubina Raja
Aarhus University

Phone: +45 2718 8390
E-mail: rubina.raja@cas.au.dk

Søren M. Sindbæk
Aarhus University

Phone: +45 4087 8334
E-mail: farksms@cas.au.dk

Administrative Support

Eva Mortensen
Aarhus University
E-mail: klaem@cas.au.dk

Registration

Registration for the conference is necessary. Deadline is 1 September.
Register through this link: https://events.au.dk/connectedpast2021/registration

Conference Website

Also visit the conference website, where you will find information on:

- Travel to Aarhus
- Getting around in Aarhus
- Accommodation possibilities in Aarhus
- Conference programme changes

Participating Online

A Zoom-link will be sent out to all registered participants approximately 1 week before the conference starts.

Participating in Aarhus

Venue

The conference will take place in:

The Museum of Ancient Art and Archaeology (Antikmuseet, building 1414)
Aarhus University
Victor Albecks Vej 3
8000 Aarhus C

From the current special exhibition in the Museum of Ancient Art and Archaeology, 'People from Greek Vases'. Photo: Rasmus Laurvig.

Getting to the venue:

From the city centre, you can get to the venue by walking (approx. half an hour), or you can take the L2 Letbane (light rail/tram) (direction: Lisbjerg, Universitetshospitalet or Lystrup). It has stops at the central railway station, Dokk1 and Skolebakken (see Letbane map). Get off at Aarhus Universitet (Ringgaden). From here, there is a five-minute walk.

From Nordre Ringgade (see red circle on the map), take the stairs down toward the university park. The museum entrance is on your left, before you enter the park.

Photographs:

Please note that we will take photographs during the conference, which will be used for archival, non-commercial or educational purposes as well as reporting to funding agencies. If you do not want us to use photos in which you are depicted, please contact Eva Mortensen.

Internet access:

Guests at Aarhus University also have the possibility of accessing AU's internet. You can find more information about it here: internet access at Aarhus University.

The Connected Past, 29–30 September 2021

Organisers: Tom Brughmans (UrbNet, Aarhus University), Lieve Donnellan (The University of Melbourne), Rubina Raja (UrbNet, Aarhus University) and Søren M. Sindbæk (UrbNet, Aarhus University)

Book of Abstracts
Editors: Eva Mortensen and the organisers

Back cover: Museum of Ancient Art and Archaeology, Aarhus University. Photo: Eva Mortensen, UrbNet