# The Archaeology of Population Dynamics

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## Abstract

A critical evaluation of the recent interpretation of aDNA data that link the adoption of domesticated plants and animals across Europe with a migration of human populations from southwest Asia and the Aegean. These data have been used to question previous models that argued for the uptake of farming by indigenous hunter-gatherer populations.

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## An archaeological semiotics

Archaeology is the procedure that seeks to understand how the historical conditions of humanity could have been brought about. It is obviously an anthropocentric discipline: the time-span of archaeological enquiries is defined by the period of hominin evolution, and the conditions that are of concern focus upon the various changes that have occurred in the soils, plants, animals, and material-cultural environments of human existence, as well as the various bodily forms of humanity itself, the institutional arrangements of human behaviour, and the patterns of belief and the values of commitment that those ways of living had once expressed. It follows that any reference to the conditions that have emerged in human history will include both material and immaterial things (such as the history of the human body and its beliefs), simply because both kinds of thing existed as part of the historical realities that are being investigated.

The aim of this contribution is to argue for an archaeology that examines the ways in which different forms of human life have brought themselves into being. This historical process was achieved by means of both the interpretation, and the use, of the existing material conditions, and an archaeological analysis must therefore establish the ways that the newly available sources of information that relate to inherited lines of ancient human nucleic DNA (aDNA) might be utilised in such an enquiry. It is to be hoped that this discussion will address the ways that archaeology confronts the different images of scale that have been identified by Ion (2017), between the localised historical processes occurring at the level of a human agency and the large-scale migrations of population that are implied by the study of population genetics.

The need to think again about what archaeology might do, beyond the discovery and preservation of ancient remains, is partly a response to today's calls for a change in the ways that science, and intellectual activity in general, might address the demands for a more reflexive and democratic approach towards knowledge creation, given the current conflicts associated with environmentalism, economic change and political popularism (Gonzáles-Ruibal 2018; Stengers 2018). The call for archaeologists to consider more carefully what their discipline is attempting to achieve has been made by a number of writers (e.g. Domanská 2018; Gero 2007; Kintigh et al. 2014; Olsen 2012; Sørensen 2016; Tringham 2018; Webmoor & Whitmore 2008). These calls are timely, coming when archaeology is confronting the challenge of accommodating the newly won aDNA data that are claimed to be 'rapidly disrupting our assumptions about the past' in ways that 'archaeologists never anticipated before' (Reich 2018:xxii, xxv), and have been taken to indicate the opening of 'a new chapter in archaeological

knowledge' with consequent 'changes in archaeological method and theory' (Kristiansen 2014:12; cf. Ion 2017). The impact of the genomic data upon archaeological reasoning is undeniable (Furholt 2018; Haak et al. 2015; Heyd 2017; Hofmann 2015; Kristiansen 2017), and archaeology now needs to clarify how these data might be accommodated within a wider understanding of the past (cf. Editorial Nature 2018; Ion 2017).

Archaeologists have tended to accept that their first duty is one of empirical interpretation, recognising that the sign (the material residue) must stand in some way for something else (past processes), and that the archaeological task is therefore to establish what the residue might represent (cf. Binford 1987; Hawkes 1954; Lucas 2012; Smith 1955). However, not all sources of information need be read in the same way, and Zoë Crossland (2018) has recently discussed the problems posed by an empiricism in which some forensic data are treated as if they were the unmediated witnesses attesting to past events. She has employed the Peircean theory of the sign to demonstrate the different ways that the sign, which in the examples she offers is given by the corpse or by the traces left by the living body, might be read by an archaeological interpretant to represent the previous presence of that body (Crossland 2018; cf. Hoopes ed. 1991). The moves that Crossland (2018) focuses upon require the interpretant to recognise their need to operate between both the iconic and the indexical relationships that held the sign in relation to the absent being. Iconic relationships are where the sign, such as the shape of the skull, looks like the appearance of the thing it represents (the fleshed face), and indexical relationships are where the sign has been caused by that presence (the example Crossland (2018) uses is the way that a finger might cause the production of a fingerprint).

Archaeologists have assumed that the relationship between the dynamics of the past and their material residues was established in ways that were both intellectually uncontentious but methodologically demanding. Crossland's (2018) discussion demonstrates that things are not so clear cut. Terrence Deacon, for example, has emphasised that the differences demarcating the relationships of reference are established by the interpretant. Consequently 'no particular objects are intrinsically icons, indices, or symbols' (Deacon 1997:71), and this raises the important problem of deciding how it might be best to read the sign of aDNA. The aDNA data are treated as mapping the spread of various haplogroups, sections of inherited DNA mutations. The difference between reading these data as either iconic or indexical signs is that the former tends to treat the sign as indicative of a reproducing population, whilst the latter treats the sign as indicative of a lineage that was inherited over time through biological reproduction. The difference might appear subtle, however treating the distribution of haplogroups as icons that represent the overall distribution of a particular

population can result in representing that distribution as if it signified a 'massive migration' of people or the arrival of a 'replacement' population (Haak et al. 2015; Brace et al. 2018; cf. Furholt 2018), whilst treatment of the same data indexically is to treat them as a complex network of biological transmission that required perhaps the minimal migration of individuals and might have extended over a lengthy period of time. However, from a sociological, historical and archaeological perspective, populations must also be regarded as cultural constructs into which biological individuals are inculcated by a combination of biological inheritance and by learnt tropes of behaviour. Populations are not, therefore, purely biological products but are constructed both biologically and culturally.

## The historical construction of a human population

The central thrust of my argument is that the aim of the archaeological project should be to understand the history of how earlier populations had constructed themselves, and this is not the same thing as mapping the distribution of aDNA haplogroups. These constructions arose as the agents involved discovered the ways that they might successfully interpret the world to which they belonged, interpretations that arose practically from their experiences of the things that they confronted. The interpretants could only have been understood by others when their actions were capable of being judged as appropriate, or inappropriate, with reference to a common understanding of things. The significance of things was not therefore locked away privately in the minds of individuals, but was publicly expressed by their understanding of how things worked, and consequently how those things should be approached. The interpretant's actions thus became the signs for others to read and to understand, and the material contexts in which this performed understanding had occurred included the things that archaeology recovers today. The material context of action was likely to have represented quite different things to those earlier interpretants than it does to us, and it was with reference to these things that those earlier interpretants could be recognised by others as belonging to the same community of understanding.

Anthony Giddens (1982) once characterised the interpretive challenge facing the social scientist as that of a double hermeneutic. He noted that the social scientist 'studies a world, the social world, which is constituted as meaningful by those who produce and reproduce it in their activities' (Giddens 1982:7), whilst Michael Shanks and Christopher Tilley (1987:107) compared this challenge with the one confronting the discipline of archaeology which is 'a process of overcoming the distance between one frame of

reference (the present) and another (the past)'. I doubt that archaeology can ever *overcome* the distance to which Shanks and Tilley (1987) refer, and I would suggest instead that the important point is to acknowledge the difference between our present-day understanding of past material conditions and the understandings developed by others who lived their lives with reference to some of those same conditions. The past is therefore always unfamiliar in ways that necessarily challenge our interpretations of it. It is in this way that we must recognise the distance between a biological inheritance that was once either understood to cover one or two generations of kinship before grading off into a more general understanding of an ancestral past, or as an inheritance by which others and outsiders could be defined, compared to the analytical precision that is demanded by the archaeological interpretation of aDNA sequences (cf. Ion 2017). In understanding *the processes of history*, it is therefore quite wrong to treat aDNA data as if they were the only secure basis upon which to base that understanding.

Lewis Binford once complained that while archaeology had provided increasingly detailed accounts of human cultural variability it had made 'essentially no contribution' towards establishing an explanation for that variability (Binford 1962:217). We might now be in a position to understand why archaeological attempts to 'explain' the variable conditions of the past have proven to be so problematic. The material residue, by acting as a sign for the archaeologist, is widely assumed to signify the mechanisms of its formation. Those mechanisms are taken to range between the indexical and therefore the mechanical relationship linking the dynamics of process to the statics of a material consequence, and the symbolic relationship in which things supposedly represent the ideas in the minds of those who had created them. By ignoring the biological and cultural growth and development of the historical interpretant, neither of these archaeological interpretations can ever allow us to appreciate the full range of the historical mechanisms that had once made the construction of the self possible. The archaeological sign that demands our understanding must therefore include that by which we might grasp something of the ways that the material afforded the possibilities for the development of the human interpretants themselves (Barrett 2014a), a process that Ingold has characterised as an emergent state of 'becoming' (Ingold 2013). This should prompt us to understand both the ways that cultural materials were used as a sign for the interpretants to bring into existence their own kinds of self-hood, and the ways that our understanding of this process might now be enhanced by the recovery of such data as aDNA.

The archaeological interpretation of aDNA data offers a commentary upon the organic inheritance of skeletal material but, as I have already indicated, the full development of any organic form can only ever have oc-

curred by means of its own recognition of the things that had significance for it. Crossland (2018:636–638), for example, details the ways that parasites can sense the presence of the decay products of the cadaver as signifying a sustaining environment in which the parasite might develop and reproduce and, as a consequence, move to colonise that corpse. It is by acting as an interpretant in this way that the parasite is able to sustain, and to reproduce, its form of life. Life as an interpretant is therefore brought into being through the processes of 'becoming', the process that Maturana and Varela (1980) referred to as 'autopoiesis' or 'self-making'. Life is therefore always more than a biological form predetermined by a supposed 'genetic blue-print', it requires the ability to recognise, and thus to utilise, the sustaining environment that accommodates the reproduction of a particular line of biological inheritance.

Given that all forms of life are conscious of the environments which they inhabit, and that there are contexts that either sustain, or constrain their development, to the point of threatening a form of life's very existence (Kauffman 1995; Thompson 2007), then any form of life must understand the ways that it can develop through its actions as an interpretant. Forms of life seek to define themselves against those conditions of signification that they can recognise, and one way in which we might redesign archaeology is as a method that seeks to understand the histories of how certain forms of life might have developed within given historical conditions. This moves archaeology away from adopting the Darwinian model that presents the trace of history as if it were drawn by the natural selection of an inherited but undirected variability of traits, and towards the view that life has always been responsible for its own development within the conditions that it inherits.

## Neolithic practices as semiosis

One factor that has complicated the interpretation of the transition to farming in Europe lies with the ways in which the sign requiring an archaeological interpretation is taken to comprise the changes occurring in a number of different kinds of residue. These changes range from the early occurrence of ceramics, new forms of lithic working, the introduction of domesticated crops and animals, and the traces of complex domestic and monumental architectures. Each of these signs has been treated indexically, and thus as indicative of the behaviours that brought that material into existence. As Andrew Jones and Emilie Sibbesson (2013) have argued with reference to the British sequence, the grouping of all such changes into a single horizon that is equated with the beginning of a 'Neolithic' might be more the

product of an archaeological expectation that a horizon of change must have existed, than the recognition of a long term, and diverse, series of behavioural changes. This objection would conform with Julian Thomas's view of the Neolithic as the 'heterogeneous assemblages of persons, animals, structures, and artefacts' that had emerged from 'new relationships between people and material things' (Thomas in Robb 2013:678). The clear implication of Thomas's view is that the newly available resources were being drawn upon in different ways by an existing population. It is this model of human genetic continuity, in which a biological population of hunter-gatherers supposedly adopted the trappings of agricultural practices, that is now challenged by the aDNA data.

The spread of agriculturalists westwards across a continent that already sustained an existing population of hunter-gatherers implies that a geographical frontier must have existed between the two modes of existence at various stages of agricultural colonisation (Dennell 1985). The radiocarbon chronologies for early agriculture certainly support the view that such a frontier will have stabilized in parts of Europe for substantial periods of time before then advancing westwards as various systems of agriculture encroached upon the landscapes of hunter-gatherers (Bogucki 2000:figure 8.1). It is clear, as the resolution of the archaeological data becomes more detailed, that the patterns of colonisation by systems of agricultural management were localised in their impact (e.g. Hofmann et al. 2013), rather than exhibiting a broad wave of advance across the continent as a whole. It was across this patchwork of frontier zones that Marek Zvelebil and Peter Rowley-Conwy (1984) had originally envisaged the occurrence of the slow adoption of farming by hunter-gatherer populations. Their 'availability model' proposed that a long term 'substitution phase' of exchanged materials existed between the two systems, resulting in the eventual adoption of farming by foraging communities (Zvelebil & Dulokhanov 1991; Zvelebil & Lillie 2000:59). The behavioural change that drove the supposed adoption of farming by the indigenous communities of continental Europe has been variously explained as being prompted by the depletion of traditional resources (e.g. Rowley-Conwy 1984), or by the pressures of social competition (e.g. Bender 1978). It is however this model of an indigenous adoption of agriculture that Rowley-Conwy came to reject; a rejection that was based in part upon his recognition that no such substitution phase could be identified in northern Europe (Rowley-Conwy 2004:97). It is also this model that would seem to be refuted by the recent aDNA analysis with the claim that agriculture was established across Europe from the tenth millennium BCE onwards as the result of Europe's colonisation by domesticated plants, animals, and by the colonisation of the human DNA by haplogroups, all of which had derived ultimately from southwestern

Asia. In other words, agriculture in Europe arose from the colonisation of the continent by new breeding populations of plants, animals and humans, and not by the indigenous adoption of domesticated plants and animals.

The aDNA haplogroups currently associated with the spread of agriculture represent the consequence of long-term processes of biological reproduction that had, by the fifth millennium BCE, left a biological trace in the human burials distributed across large areas of the European continent (e.g. Hofmann 2015). Given the increasingly detailed archaeological resolution that is now available from all other cultural and biological data for early farming communities at this time (cf. Bickle & Whittle 2013), along with the necessary unevenness in the sampling of the limited assemblage of epi-Palaeolithic skeletal material from Europe (although see Hofmann 2015:458), and our recognition of the complexity of the analysis (Reich 2018:99–114), it might seem to be unwise to place too great a reliance upon a reading of these first aDNA data. Nonetheless the link between human population growth, its resulting expansion westwards, and the colonisation of Europe with the practice of agriculture is now widely accepted (Shennan 2018). The link between these two factors implies that while hunter-gatherer populations might have eventually become subsumed within the reproduction of populations of agriculturalists, the spread of farming in Europe was not the result of the adoption of the newly available domesticated plants and animals by the indigenous populations (e.g. Brace et al. 2018; González-Fortes et al. 2017; Olalde et al. 2015). The implication is that archaeology should not only offer an understanding of why the growth and expansion of this human population was necessarily linked to the practice of agriculture, but why hunter-gather populations on the European continent did not achieve their own transformation by adopting the practices of agriculture.

Stephen Shennan (2018) has sought to describe the establishment of agriculture across the European continent from the perspective of natural selection, and thus from the perspective of understanding the processes by which the biological reproduction of farming populations might have outcompeted those of the hunter-gatherers. Shennan (2018) proposes that 'life history theory' enables him to assess the allocations that the members of a population might make to take the best advantage of the limited energy resources that were available to them at the various stages of their biological development. The optimum allocation of energy resources for a population's development should be expected, in Shennan's (2018) model, to produce higher levels of fitness, expressed as reproductive success, and if the shift to agriculture marked an optimum allocation of energy resources in a beneficial trade-off between the labour input required for food production against the labour-input required for reproductive success, then this

should explain the demographic growth-transition that accompanied the transition to farming (Bocquet-Appel 2002, 2011). One problem with this argument is that while it might help us to understand the basis for the demographic growth that drove the colonisation of Europe, it does not explain why hunter-gatherer communities did not seem to adopt the more effective strategies of energy allocation that were offered by the available agricultural resources, and thus achieve their own higher levels of reproductive success. A second problem concerns the mechanism by which a population might have actually monitored the options for reproductive success. To pose the questions suggested by Shennan, such as 'to be successful is it best to devote most effort to mating or to parenting at a particular stage in life?' (Shennan 2018:4), requires that mechanisms must have existed to both formulate such a question and to evaluate the options available for an answer. Indeed, Shennan has stressed the importance of 'locally adaptive individual "decisions"' (Shennan 2002:110), for the success of a population, although if a Darwinian approach is implied by his commitment to an 'evolutionary perspective', then natural selection should have acted upon the reproduction of an undirected range of options.

In his discussion of the evolution of agricultural origins in Asia, David Rindos (1980:752, 1984:138–189) distinguished between the processes of domestication of certain plants, and the processes of agricultural management. Domestication occurred, according to Rindos's (1980, 1984) model, as the result of an evolving symbiotic relationship between humans and certain indigenous grass species. By this process an increasingly domesticated plant population began to emerge in the form of a morphological divergence from the progenitor species. This change was the consequence of the two plant populations becoming reproductively isolated, although the time taken for this morphological divergence to have occurred is likely to have been longer than Rindos envisaged (Shennan 2018:35–36). By adopting a Darwinian perspective on the processes of co-evolution, Rindos (1980, 1984) was keen to emphasize, as is Stephen Shennan (2018:36), that this reproductive isolation of the proto-crop species was not the result of any 'invention' of agriculture by a human community. This may be so, but the entwined dependency of human practices that employed food production, its service and consumption as a way of interpreting the order of people in terms of their rights and obligations (cf. Goody 1982), will have bound together the reproduction of the understood categories of people with their management of crops, land management, and the labour of grain collection. As a result, the reproductive isolation of areas of plant growth and the human interpretation of food and drink preparation and service became the mutually reinforcing manifestation that signalled the existence of different kinds of being.

It was surely the complex relationships between the reproduction of kinds of human, and the evolving populations of plants and animals, that resulted in all those populations maintaining the various ecological flows of energy and information that had enabled them to occupy the sustaining environments of security within which they had been able to grow. If, as Deacon (1997:72–73) has argued, humans had evolved the additional potential to develop a symbolic reading of these ecological relationships, then it was the relationships between labour and ecology that could have symbolically represented the presence, actions and values of different categories of people. Different kinds of people might therefore have been represented by the land over which they held rights, the work that they did, the food and the drink that they were served and that they consumed, and the places that they could occupy. The ways that food and drink were prepared and served represented, and thus made visible, the different kinds of people who were involved, as did their occupancy of the spaces that were provided by increasingly complex forms of architecture (cf. Watkins 2010).

These symbiotic systems would have grown in scale and complexity as the result of the intentions of people to distinguish themselves from others. This was a kind of behavioural grammar and syntax that could only have evolved in south-western Asia and was quite different from that which was employed by the hunter-gatherers of Mediterranean, Temperate and Baltic Europe. Different kinds of agriculturalist would have lived, and have been recognised, by the differences in their labour, their rights over resources, their obligations of service, and their immediate biological lineages. This means that an intentionality had evolved alongside the plants and animals of Asia and was directed towards the development of the self by such means as the production, preparation, service and consumption of food and drink (cf. Braidwood et al. 1953). It was amongst such processes in Asia that the consequent impact upon indigenous crop morphogenesis occurred. The distinctions that archaeologists have created between the processes of subsistence, adaptation, cultural production, and social evolution, in their attempts to read the ways that the material residues might signify such things, would have been meaningless when considered from the perspective of those who engaged with materials in ways that signified their own forms of life. The complex processes of bread production recently attested at Shubayqa 1 in north-eastern Jordan at around 14.6k–11.6k cal. BP, a production that was occurring before the development of systems of agricultural management in that region (Arranz-Otaegui et al. 2018), was as much a semiotic process as it was the product of subsistence practices. The same realisation must also accompany the interpretation of the cult site of Göbekli Tepe with its monumental architecture dating to around 10k cal. BP in south-eastern Turkey, which witnesses the production

of beer and the consumption of meat, presumably in feasting ceremonies (Dietrich et al. 2012). The gods were not born along with these origins of agriculture (Cauvin 2000) for the simple reason that their presence could always have been recognised indexically as having created the form of the landscape and the cosmos. What was new was that by the symbolic representation of sacred beings, such as those found at Göbekli Tepe, it had become possible to experience their presence under the controlled conditions of the more localised and restricted space of a building.

The hunter-gatherers of continental Europe could not have become a halfway stage on a path towards the Neolithic by the exchange and adoption of some elements of the neighbouring 'farming strategies', as Marek Zvelebil once suggested (Zvelebil 1986), because each of these populations sustained their own, quite different, ways of becoming human by the processes of interpreting the land, plants, animals and cosmos of their different environments, and from which they extracted their food requirements. This goes some way to explain the clear distinction that exists between the archaeological residues resulting from the indigenous lives of hunter-gatherers and those resulting from the lives of agriculturalists that spread across the European continent (Rowley-Conwy 2004, 2011).

The success and intermittent expansion of agricultural populations into Europe resulted from the effectiveness with which the fertility of the land could be stored in the growth of the colonising and domesticated animal bodies and in the annual harvested product that was derived from domesticated grasses (Barrett 2014b). The vulnerability of these populations lay in their development of a restricted resource base for food and their colonisation by viruses and bacteria, resulting in the archaeologically observable consequences represented by the patterns of population growth and contraction.

## Conclusion

If we were to restrict our understanding of the newly won aDNA data to signifying various population dynamics, and then employ those dynamics to explain such things as the origins of European agriculture, we would not begin to understand the ways that those other lives were lived, and that gave these various histories their direction. The means by which we claim to know the past must include both our readings of the signs of the past that we see around us as well as our interpretation of the ways that others might once have experienced and interpreted those same material conditions. Symmetrical analysis was introduced by David Bloor who showed that all forms of knowledge must be understood 'symmetrically' as different

ways of becoming part of the same world (Bloor 1991). The present does not explain the past but if we were to recognise the dissonance between our own perceptions of the residual materials, and of ways that those forms of life brought themselves into existence with reference to those same materials, then we might begin to engage more effectively with the lives that archaeology enables us to study.

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