This chapter will start by specifying the problems that archaeology has as an empirical discipline, and then its theoretical concerns. Clearly, the evidential issues are not completely separate from the theoretical or interpretive ones, so this division is artificial. Nevertheless, this will provide an insight into the distinctive problems of Archaeology. With this in mind, we can then look at how these problems have been investigated.

Empirical Dilemmas

Archaeology constructs accounts of the past based on physical data. Typically, when we think of Archaeology's data, we think of the intentional products of human behaviour; texts, tools, the remains of dwellings and the surviving pieces of human material culture that fills our museums. However, the increasing sophistication of archaeological techniques means that the unintentional by-products of human activity can be studied as well. For instance, archaeologists can use molecular biology to detect fatty acids on the inside of pottery, providing insights into its use that could only be guessed at from its form. From the high physics and chemistry of various nuclear dating methods, to the microscopic analysis of hundreds of tools, Archaeological evidence gathering level is no single science. It borrows and adapts a wide range of epistemic tools from numerous sciences.

Consequently, the empirical reliability and accuracy of the basic data of Archaeology is no single problem; it is as diverse as the range of

empirical techniques that archaeologists use. This heterogeneity raises an important problem. Some lines of evidence are very secure, while other lines of evidence are tenuous and suggestive at best. Constructing an account of the past is an act of balancing different lines of evidence, and adjudicating between potentially conflicting lines of evidence.

This balancing act can be complicated by the fact that archaeological data can become attenuated through time by processes of decay, or re-configured by human, non-human or geological actions. These post-depositional processes can rearrange the relationships between various data points to create misleading patterns. Archaeologists have to be aware of such processes in order to determine meaningful signal in amongst accumulated post-depositional noise.

In sum, archaeologists face two basic empirical problems. One is the integration of data from various sources, some of which may be at best indicative rather than definite. The second is putting this data together in ways that take into account various post-depositional processes. Once this is achieved, then the archaeologist can make further claims concerned with humans and their history. Initially however, they just need to have the confidence to determine signal from noise.

The interpretive dilemma

The data collecting is to build a picture of the past. Now archaeologists face two distinct contexts for their data; spatial contexts, and temporal contexts.

When confronted with spatial configurations of data the archaeologist assumes that physical contiguity represents social continuity, and seeks to interpret those spatial patterns as representative of various features of human social life. Consequently, Archaeology is a social science.

As a social science, Archaeology engages in anthropology, economics, sociology, religious studies, politics and even interpretive humanities such as art history. Unsurprisingly, given this range of disciplines, Archaeology inherits the philosophical problems of the social sciences. As the individuals who are the object of study can never be observed or questioned, the inference from material remains to behaviour is of course problematic, and much theorising in Archaeology can be traced to this problem. Nevertheless, Archaeological debates echo social science debates about methodological individualism, the interpretation of other agents, and functionalism in the social sciences.

Archaeology also has another dimension, a temporal one. Data through time can show change, displacement, increased inter-group contact, settlement, shifts in subsistence technologies, and so forth.

This temporal dimension comes with its own interpretive tensions. Over smaller time scales, changes look to be the result of individual initiative, and archaeologists can construct a "history." However, over longer times frames, archaeologists frequently look to demographic and environmental causes. Over still larger scales, particularly the archaeology of pre-human evolution, natural selection can play a role.

So, is a historical group a passive victim of demographic and environmental forces, or active agents constructing their own fate? Archaeology inherits all the debates about human history found in the rest of this volume, but at a temporal scale that can vary from millennia, to a few hundred years.

So, to gather together the problems Archaeology faces, we can put this in context of a toy example. An archaeologist, when confronted with an archaeological site may systematically uncover multiple objects; pierced shells, bones, what appear to be stone tools, charcoal, changes in pollen types through time and so on. They may examine these materials with a range of empirical techniques, which may or may not give conflicting results. Should the carbon dating be taken seriously? Or does the patterns of change in tool types give a better chronology? The archaeologist must also decide if the relationships between pieces of evidence are meaningful. Has the pollen been washed through the sediment by rainwater? Has the charcoal for dating been disrupted by later burials?

The archaeologist also has a range of theoretical questions that they can pose. Is this site representative of a regional pattern? Is it representative of a hunter-gatherer adaptive suite? Does the change of tool types represent the evolution of a technology? Do the pierced shells represent a unit of exchange and what economic value do they have? Are changes due to environmental fluctuations? Are these my ancestors, or the ancestors of a different ethnic group?

As noted at the beginning, the theoretical problems are not divorced from the empirical ones. Clearly, they inform each other. The decision to apply the tools of evolutionary biology to artefacts is partly a means to assess the data, but it is equally a contentious claim that cultural change mimics changes in species, with processes of adaptation, drift and the splitting of lineages. Nevertheless, with these background questions in mind, we can begin to examine Archaeology and Philosophy.

Archaeology and Philosophy

Although much theoretical work had gone on prior to the 1950s, (Trigger 1990) as Archaeology became more professional, it became more self reflective about its empirical endeavour and its status as a science. Building on the earlier work of people like Julian Steward and Leslie White, the American archaeologist Lewis Binford articulated a view of Archaeology that became known as the "New Archaeology," and later Processual Archaeology. (Binford, 1962, 1965, 1972) Binford argued that the "New Archaeology" was anthropology, and Anthropology's goal was to...

> ...explicate and explain the total range of physical and cultural similarities and differences characteristic of the entire spatial-temporal span of man's existence (Binford, 1962, p.217).

Binford was not fooling around here. Archaeology had a crucial role to play in Anthropology's grand project, as it was the branch of

Archaeology concerned with the human past.

Archaeology also needed to be scientific. Binford took the Hempel's Hypothetico-deductive model of science as the template for a scientific archaeology. This adoption of the Hempelian model was clearly problematic. Archaeology possessed nothing that looked even remotely like the covering laws that are needed for the Hypothetico-deductive method to work. Despite this, Binford's adoption of a philosophical position achieved two things. Firstly, it prompted archaeologists to ask meta-theoretical questions about their discipline. These questions centred upon the aims of being a science, how this was to be achieved, and whether this was good aim to have. Secondly, it gained the attention of a small number of philosophers. The resulting mix between Archaeology and Philosophy became a "meta-Archaeology." On the philosophical side, the contributors were Merilee Salmon, Peter Kosso, Patty Jo Watson and Alison Wylie among others (Watson, LeBlanc et al., 1971, Salmon, 1982, Kosso, 2001, Wylie, 2002). This self-reflection was on the whole productive. Perhaps the lasting legacy of this was explicit theorising about the empirical issues of archaeology.

Middle Range Theory

As Peter Kosso notes: "Evidence in Archaeology, since it is an informational link between the unobservable past and observable data in the present, must be accountable to justification that the link is secure and accurate" (Kosso, 1993, p.163). Before archaeology engaged in

anthropology, it had to secure the relationship between observations of data and past human behaviours. The theorising, and the theory building, designed to deal with the empirical aspects of archaeological practice came to be known as Middle Range Theory (Binford, 1977, Raab and Goodyear, 1984, Kosso, 1993).

Middle Range Theory is a term borrowed from the sociologist R. K. Merton. In its sociological formulation, it is supposed to be low level, or localised theorising about social phenomena. Rather than attempting to create high-level theories that applied to all people at all time, Merton advocated a construction of general theories from localised theories (Raab and Goodyear, 1984).

In practice, a lot of archaeological theorising takes this form. Because much data is linked to human behaviours in particular contexts, Middle Range Theory (MRT) can look like a local anthropology. However, MRT can include more than anthropology. Because detecting signal from noise is important in the process of bridging from data observation to behavioural claim, MRT includes accounts of geological processes or other post-depositional distortions.

Thus, MRT includes theories about non-human causes of archaeological noise, theories that link physical remains and human behaviours, and localised anthropology.

Regardless of what MRT actually is, in practice, MRT makes archaeologists critically aware of data interpretation. Moreover, because

MRT attempted to identify regularities in the relationship between data and past behaviours, it made possible experimental Archaeology.

Kathy Schick and Nicholas Toth in "Making Silent Stones Speak" (1993) outline some fine examples of experimental archaeology. Controversies in the study of human evolution made it important to discriminate between marks made by animals, and marks made by early stone tools on animal remains. Schick and Toth could engage the services of their pet dog to gnaw on bones, and under a microscope, compare marks made with marks made on bones from an animal butchered with stone tools. This "testing" of alternative hypotheses helps ensure the reliable interpretation of archaeological remains (Schick and Toth, 1993).

At its most extreme, this experimental archaeology manifested itself as "Garbology," the cataloguing of human's relationship with their refuse. Michael Schiffer in particular attempted to document the relationship of people to their material culture in a way useful for Archaeology (Schiffer, 1976, Schiffer and Miller, 1999).

Whatever we may think of the goal of searching for laws of archaeology and anthropology, the New Archaeology of Binford made archaeological inferences much more explicit, rigorous, and in some cases, reproducible. But it was problematic. The difficulty emerges with the range of human behaviours archaeologists wish to make claims about. It is one thing to infer that an animal has been butchered by humans and not dogs, it is quite another to infer an artefact's religious

significance. As early as 1954, Christopher Hawkes had outlined this problem in a talk at Harvard University (Hawkes, 1954).

Hawkes suggested that inferences about the physical facts of artefacts are very secure, and reliable. As we saw above, such inferences can in some cases be tested. He then suggested that economic-subsistence facts, while slightly less obvious, are still reasonably inferred from physical evidence. But as archaeologists try to infer facts about past political institutions, and then on to ideologies and religious beliefs, inferences become increasingly difficult and open to question. Hawkes Hierarchy, as this range of inferences became known, captures nicely the difficulties of archaeological inferences from remains to a range of human behaviours. In many ways, Middle Range Theorising, in its initial sociological formulation, was supposed to attack all these levels. In Archaeology, MRT became somewhat stuck at the lowest levels, working with the empirical problems of evidence, and basic claims about artefacts and subsistence technologies.

The Science of Archaeology

Despite the practical success of Middle Range Theory in raising the empirical bar for archaeology, there are still no laws of archaeology that a Hypothetico Deductive approach demands. There is no set of general theories for dealing with archaeology's empirical issues, or its interpretive problems.

One solution that philosophers offered was to abandon the flawed

law-based approach to archaeology. Merrilee Salmon suggested that archaeologists could use statistical induction, rather than just Hypothetico-deductive methods that require laws. She also suggested that this process could in fact be Bayesian (Salmon, 1982). Nevertheless, while Watson et al could argue for positivism in the early seventies (Watson, LeBlanc et al., 1971), by the late 80s, the energy was going out of the positivist law orientated project in Archaeology. Philosophers who had worked in an era that had dealt with fallout of the radical critiques of Kuhn and Feyerabend attempted to evaluate archaeological practice with a view to understanding how it worked, rather than proscribing how it should work. The result was that the philosophical understanding of Archaeology as a science was not prescriptive in the way that early positivism was inclined to be. Rather, philosophers in the latter part of the 20th century took their lead from archaeological practice.

Two philosophers in particular were well positioned to do this. Peter Kosso co-wrote articles in meta-Archaeology that utilised the practical experience of archaeologists in the field (Kosso, 1993, Kosso and Kosso, 1995, Kosso, 2001), and Alison Wylie was a trained archaeologist, as well as a philosopher (Pinsky and Wylie, 1989, Wylie, 2002). Both were uniquely positioned to contribute to the interfield discipline of meta-Archaeology.

Alison Wylie's description of archaeological practice is one where

initial hypotheses are proposed, and then confronted with evidence. The hypothesis is not then "tested" as such, but rather modified to accord with the evidence, and then re-examined. She refers to this process as one of "tacking" between hypotheses and evidence, gradually refining hypotheses over time. Hypotheses are modified in response to failures and successes in accounting for the data (Wylie, 1989, 2002).

This approach is echoed in the work of Peter Kosso, although he comes to this position from working with historical archaeologists. According to Kosso, theories should cohere with the evidence and background theories and vice versa, in a network of information and understanding. We should abandon or modify theories, or re-examine evidence, when this coherence is lacking (Kosso, 2001).

Despite differences, in the end, meta-archaeologists seem to have come to the conclusion that the best Archaeology engages in some form of reflective equilibrium to generate reliable claims about the past. There are details to be worked out here of course; details about which claims take priority or possess more "epistemic weight" (Kosso, 2001, p.174), and when a hypothesis modification is reasonable, as opposed to ad hoc. However, one suspects that the refinement of this basic idea will be on a case-by-case basis, for the Hybrid nature of archaeological data gathering is important, and some contributing sciences to the archaeological project seem more reliable than others.

This reflective nature of archaeological practice informs both the

empirical level and the interpretive levels. But despite the general convergence on reflective equilibrium as an account of archaeological practice, there are still debates to be had within archaeology. For if theory and evidence really are intertwined in important ways, then which theories one chooses, and where hypotheses come from, matters. Archaeology is not solely driven by its data. It is also driven by the questions archaeologists wish to ask. It is this theoretical side of archaeology that now generates the most debate.

Where Do Hypotheses Come from?

It is one thing to acknowledge that theories are capable of modification, but there remains a question about what theories and what hypotheses are appropriate to Archaeology. What follows is an outline of various "Post-processual" strands of archaeological theory. The first set of theoretical alternatives came as a direct response to Processual Archaeology.

The Processual Archaeology of Binford came with a thesis about what cultures are that meshes with the highly empiricist and positivist viewpoint he was trying to promote. For processual Archaeology, the mental lives of past peoples are unobservable, and hence out of bounds for study. The alternative view of culture promoted by the Processualists was to see a culture as a system of integrated adaptations to the environment (Binford, 1962). The advantage to this view is that a past culture can in fact be studied, for its material remains are key

components. While some of the material remains of a culture will decompose and not be available for study, the integration of the parts of a culture make it in principle possible to reconstruct the whole from fragments.

However, this view of culture is at odds with a view that sees cultures as ideational; a shared set of beliefs, language and so forth. Processual Archaeology's focus on material culture as an adaptation missed this ideational component to culture. Archaeology's professional alliance with anthropology aggravated this concern over a lack of ideational components to culture. In Anthropology, there is a continuum from physical anthropologists that look to the biological sciences, to the ethnographers and cultural anthropologists who look to the humanities. Within Cultural Anthropology, the ideational, ideological, and belief systems of cultures are considered to play a crucial causal role in change and response to external events. Consequently, Archaeologists exposed to these ideas started asking questions about the causal roles of people's beliefs, ideologies, symbolic systems and intentionality that Processual Archaeology was not in a position to answer.

The most overt response to this problem was "Interpretive Archaeology,"[i] which attempted to elucidate agency and meaning in the past. The full range of options explored within a broadly defined Interpretive Archaeology cannot be explored here. Interpretive Archaeology has utilised not only ideas from Cultural Anthropology, but

also hermeneutics, semiotics, Marxism and the various strands of post-structuralism (See Hodder and Hutson, 2003).

One of the key workers in this area has been Ian Hodder. Hodder has actively engaged in building a Post-processual archaeological theory that pursues the recovery of human agency and meaning, and has also been pro-active in trying to implement this as a methodology in the field (Hodder, 1991, 1996, 1997, Hodder and Hutson, 2003).

This move in archaeological theorising has engendered some justifiable self-doubt about how much of the past can be reliably known. There is a natural path here to relativism and scepticism about archaeological knowledge. As Stephen Shennan points out, it can lead to a certain "loss of nerve" (Shennan, 2002).

Despite this, it is worth noting that Interpretive Archaeology has on the whole avoided a full-blown relativism with its anti science overtones. This is partly because archaeologists in their data gathering are so intimately connected to the sciences. Ideological relativism denies too much of their own discipline that they can see is useful, reliable, and independent of any ideological or cultural bias. One cannot probe the meaning and intention behind archaeological data if one remains ideologically dubious about the science that produced that data in the first place. Nevertheless, there remains a residue of suspicion about western Meta-narratives, and "neo-evolutionary" approaches to Archaeology.

Cognitive Archaeology and the Archaeology of Cognition

A second strand of Post-processual archaeological theory also took cognition seriously. Archaeology is a crucial discipline in understanding hominin evolution and the evolution of cognition, but theorists have rarely individuated this work from the archaeological project as a whole. Meta-Archaeology has typically focussed on the Archaeology of *Homo sapiens*.

The philosophical interest in this area of archaeology is twofold. Firstly, Archaeologists investigating the evolution of human cognition have adopted particular cognitive frameworks to make sense of the past. For example, Steven Mithen utilised a modified version of Jerry Fodor's modular mind hypothesis in "The prehistory of the mind" (Fodor, 1983, Mithen, 1996), and Thomas Wynn adopts a Piagettian framework for his work in understanding stone tool technology (Wynn, 1995, 2002). The utilisation of psychological models in Archaeology adds yet another potential problem in archaeological thought, for these hybrid works cross the boundaries of Psychology, Biology, Neuroscience and Archaeology. Consequently, these syntheses potentially import errors from their contributing disciplines. It is important that archaeologists do not use cognitive science models uncritically.

Clearly, this work can be seen in light of Wylie's "tacking" version of archaeological science outlined earlier. In these cases, the starting hypothesis is not an anthropological or behavioural claim, but a

psychological one. This leads us to the second philosophical interest in this work: Theory refinement and modification need not be one way, with Cognitive Science informing Archaeology. As Peter Kosso notes, we are looking for coherence between hypotheses and evidence, so there emerges the real possibility for Cognitive Science that archaeological evidence can add an extra empirical constraint on its speculation. Is the emergence of art in the upper Paleolithic really the result of the emergence of consciousness? (Mithen, 1996, 1998). If so, what have we just learnt about consciousness?

Utilising the cognitive sciences and their models need not confine itself to the evolution of cognition. Cognitive science can be useful to archaeologists reconstructing past human behaviours in general. The possibility of "Cognitive Archaeology," research that explores archaeological questions utilising appropriate tools from the cognitive sciences, has in fact been actively discussed. (Renfrew and Zubrow, 1994, Shennan, Renfrew et al., 1995, Renfrew and Scarre, 1998, Whitley, 1998). As yet Cognitive Archaeology remains somewhat tentative. However, its development promises to be one of the more interesting areas of archaeological theorising

Darwinian and Biological Archaeology

Two further strands of post-processual Archaeology embraced a richer Darwinian approach than that provided by Processual Archaeology. The first attempts to utilise the tools of Behavioural Ecology, which analyses

an organism's behaviours and their adaptive costs and benefits. (Krebs and Davies, 1997, Winterhalder and Smith, 2000) To an extent, Behavioural Ecology in archaeology is a natural successor to the view that cultures are adaptive. The distinction is that Behavioural Ecology looks at individual behaviours, as opposed to an entire culture. Behavioural Ecology when applied to human behaviours is clearly a social science, and it overlaps with economic approaches, which take subsistence and economic problems seriously.

The second strand of Darwinian archaeology is more problematic. The long-term records of human material culture show change, stasis, optimality, and cultural lineages analogous to biological lineages. The idea that processes similar to natural selection can play a role in changes in technology is clearly tempting.

Natural selection acts on a population. In biology, debate over what counts as a population is in part debate about different levels at which natural selection can operate; genes, individuals, groups, or perhaps species. Archaeology faces an analogous debate: What is the relevant unit of selection? There are various prospects on the table: One is Memes, the replicator analogy of Richard Dawkins. (Dawkins, 1989, Cullen, 1996) Human individuals are an option, but so are entire cultures, and the tools themselves are also potentially Darwinian populations.

Robert Dunnell argues that natural selection operates on artefacts (Dunnell, 1971, 1986, 1989, Embree, 1992, O'Brien, 1996). Like

Processual Archaeology, the "Selectionist Archaeologists" who embrace these ideas downplay human intentionality, claiming cultural changes to be the result of adaptation or drift. They have also utilised phylogenetic techniques to investigate cultural lineages (O'Brien, Darwent et al., 2001).

However, this view is at odds with the Behavioural Ecologists, which take human behavioural flexibility and intentionality seriously. Consequently, there has been heated debate among these "Darwinian Archaeologies" over what counts as a "unit of selection" for Archaeological investigation. (Boone and Smith, 1998, Lyman and O'Brien, 1998, Maschner, 1996).

The debate between the various Darwinian approaches is far from settled (Jeffares, 2002, 2005). It is also a reflection of a broader debate about the role of Darwinian explanations in the Social Sciences. (See Laland and Brown, 2002, for a good overview of the options in the social sciences.) Nevertheless, Darwinian explanations are explanations that claim history matters. Consequently, Archaeology plays a crucial role in assessing the worth of Darwinian Social Science.

Environmental Archaeology

Concerns about the future, concerns that stem from our understanding of what we are doing to our world now, have driven an area of Archaeology also not previously given much theoretical thought. Past models of human-environment interaction have typically been shaped by

the notion of adaptation to external pressures. The model of culture advocated by the Processualists embraced this approach. However, this sits uncomfortably with environmental history, which emphasises the omnivorous and highly flexible technologies of human beings, and a somewhat damning recent history of over-exploitation of resources.

Human interactions with their environments and other organisms are likely to be very complex, and inter-related. We are not passive adapters to an unchanging environment; we actively shape our world, and have for thousands of years (Jones, 1969, Barton, Bernabeu et al., 2004). This shaping changes the organisms that live in these environments with us. And while we have clearly exploited some organisms, the exploitation has not been purely one sided. Both domesticated and parasitic organisms have hitched a highly successful ride with us, benefiting from our modifications of areas of the world. A myriad of organisms have followed human migrations across the planet.

An alternative set of models for the interactions between human beings and their environment and their cohabitant organisms is an emerging project for Archaeology. This means that the target for archaeological research expands to include not just human beings, but their physical and biological world. This project also ties into the concerns of the humanities investigating the boundaries of human relationships with the natural world (Cartmill, 1993, Schama, 1995).

Archaeology as Social Science

However, the core debate within Archaeology still remains; is it a Humanity, or is it a science? Because of its reliance on sophisticated techniques of data recovery, it can be a science, complete with test tubes, white lab coats and the complete paraphernalia of the laboratory. Despite this, the notion that human beings, their behaviours and beliefs, are capable of being scientifically studied remains an anathema to some, and simply incomprehensible to others.

In many ways, the problem for archaeology is the appropriateness of model acquisition from other disciplines. Because of the hybrid nature of its explanatory project, there are many options available. As we have seen, Interpretive Archaeology looked to the Humanities for explanatory strategies and tools. Cognitive Archaeology has looked to the cognitive sciences. Darwinian Archaeologies look to an adaptive account of long-term changes, and economic accounts of short-term proximal biological goals.

Are these views necessarily incompatible? In some cases they may be, but one suspects that much of the time, there is simply different archaeological questions, and these shape the appropriateness of a particular starting hypothesis. The sheer scale of some archaeological questions —the evolution of human cognitive capacities, the spread of agriculture, the impact of human migration on environments— are such that they are probably beyond the scope of meanings, and the agency of

single individuals or groups. The flipside of this is that the archaeologist can be confronted with the achievement of an individual; a spectacular piece of cave painting, or even something as mundane but as elegant as a well made pot. Some remains need to be seen as the acts of individuals engaged in the process of constructing meaningful things, individuals who made choices we wish to make sense, choices driven by various beliefs and desires. Sometimes we want both descriptions at once; the economics of an artefact and its function, the beliefs and meanings associated with its decoration, embellishment and use. There is a continuum of options and explanatory targets in Archaeology, and the boundaries are not yet set. So despite this compatibility, or perhaps because of it, as a social science, Archaeology finds itself on the front lines of a debate on what it is to be human, and just how we should go about studying that most weird of animals; *Homo sapiens*.

Ben Jeffares

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[i] In its earliest incarnation, Interpretive Archaeology was known as Post-processual archaeology, reflecting its explicit rejection of what was seen as the dominant archaeological theory.