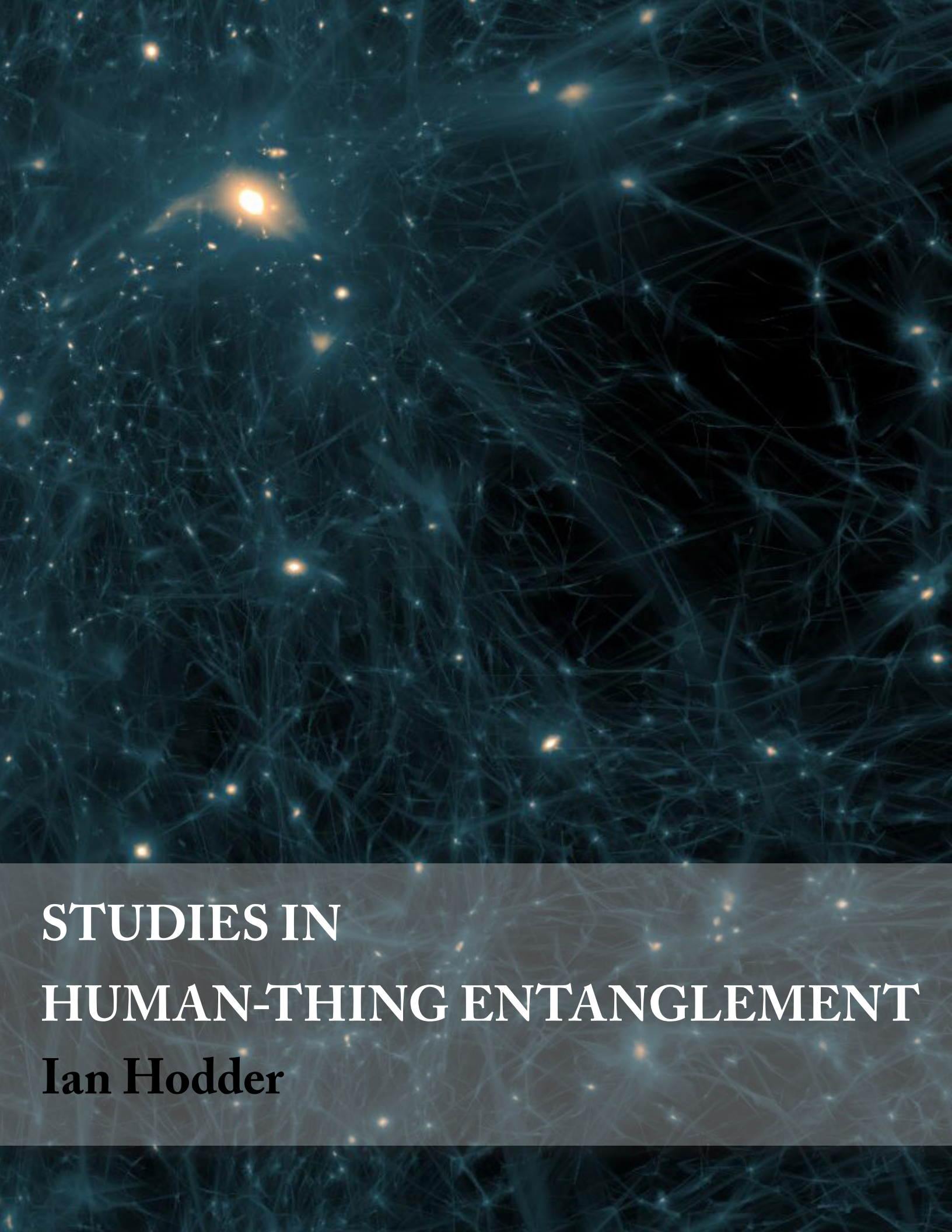

STUDIES IN HUMAN-THING ENTANGLEMENT

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Chapter 1

Introduction

The rich will make temples for Shiva
What should I, a poor man, do
My legs are pillars
The body the shrine
The head the cupola of gold
Listen O Lord of the Meeting Rivers
Things standing shall fall
But the moving ever shall stay

Basavanna, 12th century AD Indian philosopher and poet

'Things standing shall fall, but the moving ever shall stay'. Much contemporary work that seeks to explore the relationships between human society and material culture assumes that the fixity and solidity of material culture provides a stability and continuity to social life. Because material things endure, they help to tie society together through time. The argument in this volume is that material things do indeed tie people together, but at the same time materials are unruly and difficult to manage. Things fall apart. The human dependence on things is productive, but it also draws humans more fully into a dependence on and care for things that is entrapping.

The idea that movement and instability are at the core of human experience is also present in Western thought. In 1651 Thomas Hobbes published his 'Leviathan'. The core of his argument about how society should best be governed is motion. Drives, appetites, aversions are all motions within us that are caused by the actions of external objects (Leviathan Chapter 6) that are themselves continually in motion. Society needs to find mechanisms of government to promote and manage this motion. Today we are more fully aware of the ways in which matter is made of sub-atomic particles that are in continual motion. Modern scientists and philosophers describe the fundamental uncertainty and relationality of the physical and biological worlds. For example, John Dupré in his book 'The disorder of things' asserts 'the extreme diversity of the contents of the world' (1993, 1) such that it is difficult for science to come up

with discrete categories or species. Things such as biological species keep changing. 'An assumption that dates back at least to Aristotle is that organisms can be unambiguously sorted into discrete, non-overlapping kinds on the basis of gross morphological properties. Since the theory of evolution undermined the belief in the fixity of species this position has become increasingly difficult to defend, and has indeed been almost universally rejected' (ibid., 54).

It is this unstable messiness that is at the heart of the idea of entanglement. Things are unruly (or at least they appear so to us). We try and manage, and categorize and order them. We try to use them to create enduring structures. But these efforts are continually undermined. So we work yet harder, and enlist yet more things, to help us manage them. There is a continual dialectical tension between our dependence on things, our reliance on their various affordances, and the constraints and entrapments that the reliance on things entails. We can talk of and study the networks, meshworks, symmetries and engagements between humans and things as so many have done over recent years, but this is to miss the key nodal point about human-thing relations, that they involve asymmetrical tensions and a dialectical co-dependency.

Defining entanglement

In Chapter 2 in this volume I reprise the theory of entanglement and discuss the four component forms of dependence and dependency between humans and things (HT), things and humans (TH), things and things (TT), humans and humans (HH). The notion that humans depend on things is of course unremarkable; indeed the concept of *Homo faber* has a long history in the study of human evolution. Humans have long been identified with tool-making, and the use of tools has been linked to human biological traits such as upright posture and cognitive functions. In the social sciences and humanities there has been for many decades recognition that humans use material culture to symbol, to exchange and to manipulate social relations. Humans are dependent on things in cognitive and psychological development, in terms of power and authority, in terms of identity, perception and being. In this volume, therefore, HT relations are rather taken for granted. It is accepted that human 'being', in all its dimensions, is radically dispersed and distributed, and is thus dependent on material things.

It is the TH and TT relations that constitute the driving force of the entanglement account. Humans depend on things, but so too do things depend on humans (TH). Certainly this is true of all man-made material culture. Made things depend on human action for their production, use, maintenance and discard. One might argue that 'natural' things exist outside this purview. But the opposition of culture and nature is difficult since in many ontologies they are inter-mingled, with 'nature' involved in various types of relation with humans (Descola 1994). Certainly since the Palaeolithic, humans have had impacts on their environments such that the 'environment' is always already part of human culture (Roberts 1998). Humans and the 'environment' are always already entangled. Humans are not entangled with things in a separate exterior 'environment'. There is just an overall entanglement in which things have to be managed, cared for, looked after if humans are going to remain dependent on them.

The things that depend on humans also depend on each other (TT). This is obviously true of human-made things that usually involve other tools in their production, use and discard. As will be discussed at length in Chapters 3 and 8, things are involved in 'chainworks'. Archaeologists are used to describing the sequences of operations that are required to make and use, for example, a cooking pot. But each of these operational sequences or chains is tied into other operational sequences. Thus, the cooking of food on the hearth requires that the making of a pot, the making and firing of a hearth, the obtaining of food to place in the pot, have been scheduled in relation to each other. Each step in the operational sequence has to wait for other steps to be completed. Thus making or using one thing is entangled in the making or using other things. But what of things not made by humans? Human-made things depend on clay to make the pot, or animals to kill and stew in the pot – in other words they depend on the supposedly 'natural' world outside entanglements. Biological beings in this environment are entangled in ecological relations, Darwin's 'entangled bank', subject to evolutionary processes and processes of death and decay. Humans also depend on non-biological physical things such as clay to make houses or stone to make tools. These materials are subject to the geological, chemical and physical processes of lifting up, erosion, gravity, transformation, deposition, breaking down, wear and tear. Human being is entangled in evolutionary and non-evolutionary processes of things in their relations to each other. Things are tied up or chained to other things, whether human-made or not, in heterogeneous ways. Humans are drawn into these TT dependencies because of the TH and HT relationships, and indeed it is difficult to isolate a sphere of TT relationships in which humans are not involved. As noted above, humans are always already involved in the 'external' world of biological, physical and chemical processes.

As some commentators have pointed out (e.g. Mills 2013), I have not discussed HH dependencies at any length. This was for a number of reasons. The first is that there are very few dependencies between humans that do not involve things in some way. For example, power relations in which one human dominates another are often concerned with the control of property or rights to property in some form. Exchange relations between humans involve the giving and receiving of gifts, or the bartering, buying and selling of goods. Marriage and kinship involve the passing down and exchange of rights to resources. Communities may form to protect access to land or agricultural products, and so on. Many of these HH relations in which things are involved lead to entanglements. The receiving of a gift implies the obligation to reciprocate and may involve the entanglement of debts that cannot easily be repaid. Notions of property and rights may entangle humans in co-ownership or the exclusion of claims by others. Marriage involves vows and promises that involve co-dependency.

There are certainly HH relations that little involve things, such as notions of honor, shame, pride. Many verbs specify ties between people that do not involve things. Thus love or hate, emulate or shun, respect or disrespect, dominate or resist, value or devalue can all occur without material things being involved. And many of these terms lead to various forms of entanglement between people. As the Roman poet Catullus wrote in an admirably short poem '*odi et amo*', I hate and I love. Co-dependency relations between two people often involve enabling and constraining sides, positive and negative components. Similarly, core-pe-

riphery or master-slave relations may be both enabling and constraining and destructive, the development of one partner very much at the expense of the other. The second reason for not discussing HH relations in any great depth is that these types of relations have been the foci over centuries of psychological, sociological and political analysis.

A third and final reason for limited discussions of HH relations is that I have focused too narrowly on material things. This was a mistake. Many forms of HH relations involve words and ideas. If we follow Heidegger (1971) and define a 'thing' as an entity that draws other entities together, then words and ideas are both things. Humans get entrapped in words and ideas in both trivial and non-trivial ways. In learning to speak we take on or react to the accepted meanings of words and thus get entangled in a history of associations, meanings and assumptions that guide our thought processes. When I start speaking a sentence I am already entrapped in those meanings and grammars such that I can only end the sentence in a limited number of ways. I am entangled in the broader cultural meanings of words and in the way that I have started the sentence. Ways of speaking are deeply embedded and habituated and it is not easy to break out of them. Similarly, humans become attached to ideas that they come to believe in and may be willing to die for, from religious ideas, to ideas of freedom and democracy, to notions of nation and community, and so on. In this volume, these types of entanglements in ideas are discussed with regard to concepts of hunting in the Neolithic of the Middle East (Chapter 4), theories about evolution in Chapter 6, and religious ideas in Chapter 7.

It can be objected that this extension of entanglement to words and ideas is a watering down of the original concept. The key idea in entanglement is that humans get caught in a double bind, depending on things that depend on them. This double bind occurs because material things are unruly and follow biological, chemical and physical processes of transformation and decay. While it cannot be argued that words and ideas (as opposed to the paper and ink they are written with) follow these same processes of unruly transformation and decay, words, ideas and their meanings require constant vigilance and care in order to sustain their coherence. They need to be looked after. It is also the case that words, ideas and their meanings are always entangled in other words, ideas and meanings, as well as usually in different forms of material practice. Thus to change a word or idea usually involves changing other words, ideas and practices with which it is tied up. Examples of this type of entangling are provided particularly in Chapters 6 and 7 in this volume. In summary, then, it seems possible to extend the entanglement of humans and things to words and ideas.

Another type of entity that was, again mistakenly, excluded in earlier discussions of entanglement, are larger-scale human groups, nations, institutions, bureaucracies. These are again things in the sense that they bring entities, other humans and things, in relation to each other. Many are largely concerned with HH relations. They often come into being so as to manage the unruliness of human-thing entanglements at a lower level. Thus conflicts regarding human access to things require the development of law and institutions of the law. The distribution of goods to people requires bureaucracies. The management of knowledge, ideas and the meaning of words requires schools and universities. All of these institutions and

bureaucracies marshal things in the management and regulation of humans and their relations with each other. They need supervision and require organization; they draw humans into their care. Their size often leads to their being unruly and contradictory. They often become both enabling and entrapping; people get caught up and diminished in the intricacies and lack of humanity of bureaucracies – the 'iron cage' or 'the shell as hard as steel' described by Max Weber and Talcott Parsons (Baehr 2001). Indeed, such bureaucratic entities have given us the term 'Catch 22'. The novel of the same name by Joseph Heller published in 1961, is set in World War 2. The paradox, the bureaucratic 'Catch 22', is that airmen who were mentally unfit did not have to fly missions; but if you did not want to fly missions you must be sane. So you had to fly missions. This type of double bind or logical contradiction is common in bureaucracies and the term 'Catch 22' neatly captures the entrapment that occurs.

Overall, then, it is difficult to hold fast to the original definition of entanglement as the sum of HT, TH, TT and HH dependencies. Such a characterization appears to separate subject and object, culture and nature, in ways that have long been critiqued. As discussed above, human being is always already dispersed and distributed into the world; there is no environment separate from human culture and society. It is thus difficult to talk of TT dependencies without human involvement, or of HH dependencies without things. Separating out TT, HH, TH and HT dependencies from overall entanglements is difficult. A more satisfactory definition of entanglement starts with the overall inter-dependence of humans and things and focuses more on the double bind, the tension between dependence or reliance between humans and things, and the dependency or constraint between humans and things; thus entanglement is the dialectic of dependence and dependency between humans and things (Hodder 2012). Below we shall see that there are problems with even this definition since humans too are things or are often treated as things. It can also be said that the definition of things depends on humans; things flow into each other and are separated out from each other by humans. We will need to return to the issue of definition later in this introduction.

New directions

We have seen that it is important to extend the discussion of entanglement to HH relations, and to a consideration of words, ideas, institutions as things that can entrap and channel. As already noted, the various chapters in this volume explore various aspects of this extended perspective. Indeed, in comparison to an earlier publication (Hodder 2012), the present volume explores several new avenues that seem opened up by the idea of entanglement. This book is in part a mopping up of ideas inadequately dealt with in the previous volume, and partly an exploration of new directions that the concept of entanglement seems to afford or promote.

For example, a focus on the idea of entrapment or path dependency in relation to the origins of farming and settled life in the Middle East leads to the new and initially counter-intuitive notion that social and ritual entanglement in hunting practices led to a delayed adoption of farming, and later to a take-up of farming in such a way that hunting could be more effectively pursued. In the end, it is argued in Chapter 4, farming was adopted so that people could hunt better. This account derives from a consideration of the entanglements of hunting and

the multiple ways in which it had become the core of social and ritual life. Another example of a new perspective provided by entanglement is the discussion of power in Chapter 5. The entrapments of entanglement might be thought to be closely allied to the power of dominant over subordinate groups, and core-periphery and master-slave relationships have been discussed above. But in Chapter 5 it is argued that it is important to distinguish entanglement and power. Even if subordinate groups are relieved by the removal of dominant groups, they may remain trapped in circumstances from which it is difficult to escape. While dominant groups often have the resources to disentangle themselves, subordinate groups suffer two forms of marginalization. First, there is the subordination produced by dominant groups. But even if those dominant groups are removed, a second form of marginalization is produced by constraining and limiting entanglements which entrap and bind. The links between entanglement and poverty traps are explored; entanglement is argued to contribute to understanding of the ways in which humans get caught in poverty.

Chapter 7 aims to contribute to debates about religion from the perspective of entanglement. As will be discussed further below, it is difficult to identify the boundaries of entanglements, both in space and time. The analyst as much as the social actor knows that everything depends on everything else, well beyond what is immediately understood and experienced. Religion too deals with the beyond, the transcendent. Religion can be understood not as the contemplation of a set of abstract intellectual beliefs, but as a technology for dealing with something real. It is difficult for human actors to follow all the strings and filaments of entanglements and to understand them in all their complexity. And yet these distant unbounded filaments affect us, cause death and suffering, impinge on our daily lives. Religion can be seen as the mobilization of existing knowledge in order to intervene in remote parts of entanglements that matter to us. Religion often seems to be a practical attempt to fix problems in areas that are not fully understood, to disentangle. Rather than, for example, seeing religion as an ideology serving the interests of dominant groups or as creating community cohesion, the entanglement view is that humans are caught in filaments and threads that extend into a real beyond. Religion is a pragmatic attempt to make sense of and intervene in that beyond.

The discussion of entanglement in this book also raises epistemological issues. One such issue, already addressed in the discussion of entanglement and religion, concerns the boundaries and limits of study. Spatially we can follow all the dependencies between humans and things. For example, we can look at the impact of cars on global warming by isolating all the 20,000 or so individual parts, identifying where they were made, what types of materials and labor were used, how the parts were transported and assembled. To focus on a thing is to explore all the other things that make it possible. To study the entanglements of a thing is to ask what are the conditions of existence of that thing. In the case of the car, those conditions of existence include all the parts, their production and sourcing, the international trade agreements, labor relations, financial transfers, social values placed on cars, impacts on the environment, the construction of roads and so on. One might limit the study to only these factors, or only to the sourcing of parts, but it might also be argued that the machines used to make the parts, and indeed the machines used to make those machines are also relevant. Where does one draw the boundary? Temporally too, where are the limits to the study? For

example if we are interested in the impact of cars on global warming, how far back do we go? Do we limit study to the present-day impact or do we also include the contribution of cars to global warming since the start of the 20th century? Or do we look even deeper at the effects on the environment of carriages drawn by horses and carts drawn by cattle? Or is the real culprit the invention of the wheel in Eurasia at around 4000 BC?

The answers to these questions used to be relatively simple. Study was limited to the system of interest and everything outside the system was defined as an external variable. The 'region' and the 'period' were defined based on a domain of interest or on a perceived coherence or homogeneity of content. External influences on the region or period were then sought. In studies of cultural systems, the external world was frequently described as the environment, the natural world to which the cultural system adapted. Culture was defined as man's extra-somatic means of adaptation. But from an entanglement perspective there is no environment. As noted above, everything is always already entangled. And there is nothing extra-somatic, outside the body, because the body, mind and meaning are distributed. Culture/nature, subject/object have all been very effectively critiqued. In exploring the conditions of existence of a region, period or cultural system, entanglement studies follow the filaments, the threads that make those entities possible. The value of the study is precisely to go beyond boundaries that have been set and explore their construction.

From the earliest of human entanglements in the world, the 'environment' has been the production of a heterogeneous multiplicity of forces in which humans have played their part. There is no 'external' environment impinging on a cultural system. Everything is always already entangled so that there is only 'internal' adjustment and adaptation. Rather than elements of a system being 'selected for' in different 'environments' there is just one overall whole moving along as a mass, unhinged, unfettered, unconstrained by external limits. There is just a heterogeneous entanglement juggernaut held together by cross-cutting dependencies between stones, rivers, humans, made things, ideas, institutions and so on. It is these internal ties and constraints that provide direction, taking the mass as a whole down particular pathways.

There are of course hubs and concentrations in the overall mass, and some examples are identified and explored in Chapter 8. In the Neolithic of central Anatolia, the house acts as a central node through which many relations of dependency are defined. It is indeed possible to explore the concentrations of dependencies around such nodes. In any set of dependencies some things are more entangled than others, and there are troughs and margins between the concentrations. It is possible to confine analysis to the hubs and concentrations. This is a bottom-up approach. The boundaries are discovered through in-depth empirical research in relation to specific questions and research interests, and always recognizing that the boundaries are ultimately arbitrary, best seen as stages in the research process.

A number of epistemological issues are raised by the notion of entanglement as an unbounded and externally unfettered messy totality. In particular it becomes very difficult to identify causes. In Chapter 3, arbitrary starting points such as the collapse of mud-brick walls are selected from numerous other possible 'causes' such as the use of dung fuel or the making of cooking pottery. In fact all these 'causes' have their antecedents and they multiply interact.

Causality is dispersed into the entanglements as a whole. Small things can have big effects, but only by being compounded by numerous other factors and processes. Archaeologists can identify some of the small-scale events, the small things forgotten (Deetz 1977). They are better suited than many other sciences to be able to examine mundane acts in all their grainy specificity. But archaeologists are also well placed to explore the multiple heterogeneous dependencies of those acts, the moving juggernaut as a whole. The notion that small perturbations can have big effects is common to a number of approaches that model complex systems. In different ways, Catastrophe Theory, Chaos Theory and Complexity Theory all explore ways in which sudden large-scale change can be produced through the gradual change of variables within highly complex but gradually changing systems. They all try to find mathematical models that normalize, predict or make sense of large-scale and often sudden changes; they attempt to discover regularities where at first sight there appears to enormous complexity. There are important links between these approaches and entanglement, and in particular there is much to be gained from the study of the ways in which highly complex systems work. There is great value in studying complexity itself rather than reducing complex interactions to simple formulae. But entanglement differs in that it does not seek to 'clean up' the messiness and build general models. Rather it focuses on the specific sets of heterogeneous interactions within radically open systems. A similar point is made by Lewontin (2000, 113-4) in relation to biological systems.

If entanglement provides an opportunity to examine the relationships between small everyday acts and events and the large-scale movement of a socio-material totality, then it has obvious parallels with behavioral and evolutionary approaches in archaeology. In these latter cases, traits are seen as selected for in particular environments or niches. I have discussed the problems with such approaches in archaeology (Hodder 2012), including the reductionism involved (everything is reduced to reproductive or replicative fitness). Entanglement provides an alternative in that the fittingness of traits is assessed not in terms of reproductive or replicative success but in terms of contributions to the heterogeneous web of dependencies. Kristiansen (2014) is thus right to argue that entanglement attempts to bridge materiality studies and evolutionary theory, although it tries to do that in a non-reductive way. Entanglement also tries to bridge to behavioral and ecological approaches, although redefining costs and benefits to include social, religious and other dimensions of being. After the processual-postprocessual debates in archaeology in the 80s and 90s, Kristiansen sees a return to big questions as a result in advances in the analysis of ancient DNA and the amassing of big data allowing large-scale modelling. Kristiansen argues that entanglement tends to lead to a focus on the small-scale at the expense of big questions. I hope this volume puts that view to rest. Several chapters deal with large-scale questions such as the origins of agriculture (Chapters 3 and 4), the nature of power and poverty (Chapter 5), the origins of religion and creativity (Chapters 6 and 7). This volume argues that it is only by considering the small-scale everyday practical dependencies between humans and things that the larger-scale transformations can be adequately understood.

Conclusion

Entanglement proves to be a fruitful and productive lens through which to explore a variety of contemporary issues in the social sciences and humanities, from archaeology and anthropology to history, philosophy and classics. What entanglement offers is the study of large-scale and long-term issues solidly grounded in the socio-material practices of daily life. While other writers, such as those influenced by Actor Network Theory, have explored how daily practices take place within a heterogeneous mix of human and non-human processes, entanglement adds the notion that the human-thing relationship is fraught and constraining so that directional change is generated. Other approaches to materiality have focused on relationality, ontology, engagement, symmetry (Graves-Brown et al. 2013; Malafouris 2013; Olsen et al. 2012). Entanglement accepts these contributions but argues further that human and things do not just relate to each other. Rather they are dependent on each other in ways that are entrapping and asymmetrical. Entanglement argues that things are so caught up in other things and in other human-thing dependences, that daily practices are directed down specific pathways, that humans are drawn in specific directions that create further entanglements. Entanglement teaches us to look away from whatever is the immediate object of study, to explore the networks of dependencies that constrain and drive the human condition. It invites us to trace the threads that spread out from each action, entangling that action within wider socio-material realms.

In contrast to a previous account of entanglement (Hodder 2012), this volume introduces a number of new dimensions.

- The things with which humans are entangled include ideas, thoughts, emotions, desires, as well as larger-scale phenomena such as institutions and bureaucracies. As Pauketat (2015, 911) notes in a review of relational approaches in archaeology, we need 'to open up the discussion to include more than things. We need to make an affective turn'. If things can only be understood relationally, it is important to consider all the threads that contextualize things, to explore the full heterogeneity of relations. In this volume wider definitions of entanglement are particularly explored in Chapters 5 on power, 6 on creativity and 7 on religion.
- At another level of analysis, however, there are no things at all, only flows. It may be convenient analytically, as I have done throughout this book, to use the conventional classification of the world into things. But in reality the things are themselves just flows of matter, energy or information. Things are unstable and unruly. Material things decay and erode, institutions crumble, ideas and thoughts pass fleetingly. Some appear to stay, to have duration, but looked at from sub-atomic or long-term perspectives, all is in flux. There are physical, biological, chemical, informational, social, ideological processes that occur at different rates and rhythms, jumbled up and tumbling over each other. We call this cup, bull or mountain a thing, but it is itself just a very slow flow, intersecting with many others. The flows of things are particularly explored in this volume in Chapters 2 and 3.

- There are similar problems with networks. Again, it may be convenient to analyze the relations between things, the flows, in terms of networks with nodes, as in Chapter 8 in this volume. But the idea of a network seems to assume a set of stable nodes with links or edges between them along which flows of matter, energy and information can pass. But in fact the network is a by-product of the flows. The different types and rates of flow generate nodes and generate the pathways, relations and interactions between them. It is the 'taskscapes' (Ingold 1993) that produce the nodes and their interactions, not the other way round. The study of networks may allow us to map and model human-thing interactions, but we should not confuse the study of networks with an understanding of the complex interacting flows that produce them. In this volume, the more static analysis of networks in Chapter 8 can be compared with the complex intersecting flows uncovered in Chapter 3.
- If everything is relational, mixed, heterogeneous, messy, then analysis must proceed in a bottom-up way, refusing to consider things out of their contexts, always building up from the daily practices of everyday life and the mundane fixes that people find themselves in. This point is made most forcefully in this volume in Chapter 3 where it is shown that the complex mixes of human and things produce problems that need fixing with further mixes of humans and things in an endless flow. The approach aims to be thoroughly anti-essentialist, building up towards generalization from careful empirical analysis. Concepts such as the social, the economic, population increase, agricultural intensification are nothing but by-products of daily practical problem solving within the heterogeneous mix of human-thing entanglements. Exploring things involves seeking the conditions of their existence, which involves moving away from the things, both in space and time, to expose the entangled threads that produce them. Rather than reducing the analysis to a limited number of variables, such as reproductive or replicative success, or adaptive efficiency, or ideological impact, or social inequality, the analysis attempts to map the full domain of intersections. The approach thus aims to be fully anti-reductionist, despite the problems entailed (see below).
- While entanglement starts with detailed empirical studies of the specific ways in which humans are caught up in the flows of matter, energy and information, it also encourages the analyst to delve into the long term and large scale. This is partly because the refusal of reductionism leads the analyst to keep asking 'why', to follow the long threads that lead backwards and forwards in infinite regress, and that lead outwards to connected domains and struggles that may seem initially far removed from the problem at hand. In these ways time and space are collapsed. The smallest of events in the most distant of lands and eras are seen to reverberate and to interlock in the present. As explored in Chapter 6, events in the 19th century such as Darwin's writing on evolution, can be followed back and connected to events across centuries and millennia. Contemporary events such as global warming have deep roots, as shown in Chapter 2. Understanding the micro-scale turns out to have

immediate relevance to big questions. Indeed, it is argued that large-scale processes are best understood as the product of micro-scale processes (as shown in Chapter 3).

- Entanglement often appears to have a negative emphasis because of its focus on entrapment. The harnessing of energy and information through the use of things has of course led to enormous advances in the human condition. Agriculture and animal domestication were attractive to early farmers because they allowed more resources to be obtained from a given unit of land. But they also drew humans into greater labor, and into denser communities, greater disease and worsening health, into conflict over property and increasing social inequality. All technologies have their positive and negative components and entanglement cannot be understood unless both sides are examined. It is also important to recognize that disentanglement is possible. In Chapter 5 in this volume, elites and non-elites are discussed in terms of their differential abilities to disentangle. In Chapter 7 religion is defined as a technology for fixing, disentangling entanglements. In Chapter 6 creativity is defined as a moment of disentanglement. Indeed, all social agency can be seen as a clearing of a space, a moment of disentangling the messy filaments in which our being is embedded.

These new discussions of entanglement also raise problems that remain difficult and unresolved. Some of the problems in terms of analysis and method are discussed in Chapter 8. But the two most intractable problems are as follows.

- If everything depends on everything else in the heterogeneous mix of humans and things, where is the boundary of study? If complex entanglements cannot be reduced to a limited set of variables, how can one study everything? If everything depends on everything else in an infinite regress, how can we set the boundary to a period of study or a region of study? 'Why limit our archaeologies by partitioning our subject matter into discrete theories or subfields, or by accepting pre-defined categories of things, beings, systems, etc.? We need richer interrogations of the multiplicities and entanglements that produce people, other-than-human-beings, places, qualities and things' (Pauketat 2015, 911). But how do we decide where the boundaries occur in these limitless domains of interest? The methods discussed in Chapter 8 allow nodes or concentrations of dependencies between humans and things to be identified, with less dense zones between them. But even here much depends on how the nodes and connections are defined. In practice some degree of tacking back and forth between full descriptions of entanglements and some reductive bounding will be necessary. In practice, some restriction of study to immediately relevant connections can often be justified. But exactly how to strike a balance between the full exposure of dependencies and some reductive bounding and limiting remains a challenge.

- If everything depends on everything else in the heterogeneous mix of humans and things, how can one define causality? This is effectively the same as the first problem, in that analysts are often attracted by the strategy of enlisting external vari-

> ables as causal. So, population increase, climate change, or social competition, are often argued to be external factors that cause change within entanglements (see examples in Chapter 3). But in the entangled mixes there is no external, no outside. Population increase, climate change and so on are themselves produced within the entanglements. There can thus be no external causative 'kick'. There are only internal perturbations that generate change. But since these internal perturbations are often multiple and very small, and because they are also multiply connected, there can be no clear 'cause'; and even if there were, it would be unlikely that archaeologists would stumble over a small specific event. Causality is thus radically dispersed and it may be fruitless to try and identify specific causes. All the analyst can do is continually explore entanglements from different perspectives, understanding new dimensions within a multi-dimensional world, opening up new links and connections. Such an approach may allow 'richer interrogations' but the lack of explanatory capability in terms of cause may seem problematic to some.

In the chapters that follow, these new aspects of entanglements and the associated problems are explored. In the Afterward, criticisms are debated. The overall effect is not to establish a coherent domain of research but rather to probe towards new perspectives, pursuing the affordances that the notion of entanglement opens up. We work always with metaphors, and the value of the metaphor of entanglement can best be assessed in terms of whether it provides fruitful new directions and understandings. We can define entanglement as a metaphor that tries to capture the contradictory messiness of the flows and counter-flows that produce, enchain and encompass entities (humans, animals, things, ideas, social institutions).

The value of the entanglement metaphor can also be assessed in terms of whether it contributes to an understanding of the current world in which we live. As noted above, entanglement has a negative hue, imparting a sense of being trapped in pathways that lead in specific directions. Part of the attraction of the term may be that it resonates with a wider global sense of being trapped. Increasingly we seem met by intractable problems such as global warming, or the gridlock of international agencies such as the UN that seem powerless to act, or by the inability to introduce gun laws in the US despite repeated mass shootings. In terms of food consumption we are trapped in the nonsense of throwing away large amounts of the food that is produced; and campaigners such as Alice Waters argue that we are imprisoned in fast food leading to obesity and a high incidence of diabetes. In small and large ways we seem increasingly stuck. These everyday senses of being cornered and unable to find a way out are perhaps what provide entanglement its traction in the contemporary world.

Chapter 2

Human-Thing Entanglement: A Long-Term View

Over recent decades there has been widespread recognition in the social sciences and humanities of a 'return to things' (Candlin and Guins 2009; Domanska 2006; Preda 1999), in contrast to the earlier focus on representation, and in contrast to the long scholarly tradition that separated subject from object, mind from matter. For example, the scholar of American literature Bill Brown (2003) called for a 'thing theory', while the philosopher Don Ihde's 'material hermeneutics' denies the opposition between positivism and hermeneutics and explores ways in which technologies and machines shape the way we do science and see the world (1999). A similar point regarding the history of science has been made by Shapin and Schaffer (1985) in their work on the air-pump used in experiments by Boyle. Like the microscope and the telescope, the pump allowed new things to be seen. Numerous different perspectives from Actor Network Theory to anthropological accounts of materiality and the build-up of 'stuff' in our contemporary lives to discussions of the agency, vibrancy and vitality of mute things have converged on some version of the idea that subject and object, mind and matter, human and thing co-constitute each other (Bennett 2010; Gell 1996; Ingold 2013; Latour 2005; Miller 2010; Ryan and Durning 1997). In these different approaches it is accepted that human existence and human social life depend on material things and are entangled with them; humans and things are relationally produced.

There is a darker side to the entanglements of humans and things that is often missed in these relational approaches. A key aspect of our relationships with stuff is that they involve more than networks of humans and things, a symmetry of relations. Rather, our relations with things are often asymmetrical leading to entrapments in particular pathways from which it is difficult to escape.

Entanglement

I initially defined entanglement (Hodder 2012) as the sum of four types of relationships between humans and things: humans depend on things (HT), things depend on other things

(TT), things depend on humans (TH), humans depend on humans (HH). Thus Entanglement = (HT) + (TT) + (TH) + (HH). In this definition it is accepted that humans and things are relationally produced. But the focus on dependence rather than on relationality draws attention to the ways in which humans get entrapped in their relations with things. Humans get caught in a double bind, depending on things that depend on humans.

It is helpful to distinguish two forms of dependence. The first and more general focus on dependence recognizes that the human use of things is enabling. Human use of things allows humans to be, live, socialize, eat, think. I use the term dependence in the sense of 'reliance on'. But dependence also often leads to a second focus: dependency involves some form of constraint, as is seen in various dependency and co-dependency theories from World Systems Theory to psychology (Rice 1998; Wallerstein 1976). Humans become involved in various dependencies that limit their abilities to develop, as societies or as individuals.

Dependence and dependency create a dialectical struggle within entanglement. On the one hand, humans depend on or rely on things to achieve goals (dependence). This is the enabling part of the human use of tools and symbols in order to form the subject, society and adaptation to environments. As stated by Elizabeth Grosz (2001, 168), "it is matter, the thing, that produces life". On the other hand, dependency and co-dependency occur when humans and things cannot manage without each other and, in this dependency on each other, they constrain and limit what each can do. The thing has been associated with a malevolent "biological materiality that is or may be the result of our unknowing (usually atomic or nuclear) intervention into nature, the revenge of the blob … which imperils man" (ibid., 167). These two components of dependence and dependency, positive and negative, produce and constrain human action and lead humans into entanglements from which it becomes difficult to become detached. Because humans rely on things that have to be maintained so that they can be relied on, humans are caught in the lives and temporalities of things, their uncertain vicissitudes and their insatiable needs. Things appear as Hydra-like, requiring Herculean skill to stop them multiplying and entrapping, and yet the entrapment is enticing and productive.

Entanglement can thus be redefined as the dialectic of dependence and dependency between humans and things (for further discussion of definitions see Chapter 1). The term entanglement seeks to capture the ways in which humans and things entrap each other. But it also seeks to recognize the ways in which a continual and exponentially increasing dynamism lies at the heart of the human experience. From the first moment when as *Homo faber* we invested in stone axes, we found we could do more and yet we found ourselves entrapped in the needs and demands of things and their limits and instabilities. It proved difficult to make things entirely social – they seemed to have lives of their own that we could not predict or control.

Surely it is an exaggeration to say that things are always falling apart, always changing and drawing us into their care; all that is solid does not melt into air. When we wake up each morning, the house is still there, there is sugar on the table for the breakfast cereal, and the milk for the cereal is still cold in the fridge, the car is still in the garage and we can drive to work, the streets are still in place. And when something does go wrong, surely I can deal

with it because on the whole I can trust that all the other things I need to fix it will be stable enough to get the job done. I can still call for help on my smartphone. On the whole, is it not the case that self and society depend on the stability of things, as Hannah Arendt (1958) argued?

An answer to this objection is that yes, things do seem stable on the whole. But this is because we are, or someone is, working very hard to produce that stability. We depend on the sweetness of the sugar, and the milk in the cereal, and the electricity grid to light the shops and streets. But in order to produce this ready-to-handedness, this everyday expectation of stability and order, a vast apparatus of humans and things has to be mobilized on a global scale. To get the sugar to the table, to maintain the electricity grid, and to assure supplies of slippers, smartphones and bikes, a massive mobilization of resources, humans, dependencies is involved. Things have lives of their own that we get drawn into, and society depends on our abilities to manage this vibrancy of things effectively, to produce the effect of stability. We often manage to live relatively unaware of the full complexity of what and who provides us, but we are nevertheless deeply entangled in the vitality of things and the assemblages of their relations.

The notion that things are unstable is, from one perspective, the product of modern physics. For Newton, matter consisted of a stable mass and the forces that set mass in motion through attraction and repulsion. But Einstein showed that mass and energy can be converted into one another and so can be seen as equivalent (Coole and Frost 2010). We now see matter as made up of atoms that are very active, with a positively charged nucleus surrounded by spinning electrons. At a lower level there are protons, quarks, leptons and so on. So at the atomic and sub-atomic level we see that matter 'becomes' rather than 'is'. And at large scales, complexity and chaos theory suggest that the natural environment is more complex and unstable than was thought, with unpredictable and non-linear effects. Recent work in philosophy and the social sciences has come to similar conclusions and there are descriptions of new materialisms that explore the ways in which matter 'becomes' within complex social-material worlds (Bennett 2010; Coole and Frost 2010).

Some problems with the relational view of humans and things

Many scholars have described the complex networks, meshes, mixes, chains, engagements that result from the dependence of humans on things, things on things, and things on humans. Mauss (1954, 25-6) wrote that "souls are mixed with things; things with souls", and in this anthropological tradition others such as Marilyn Strathern (1988) have talked of enchainment or distributed personhood. The term 'enchainment' as used by Strathern refers to Polynesian and Melanesian cultures where an artifact is not 'a thing-in-itself'. It does not acquire identity from those who use it nor give identity to people. A thing is part of a chain of obligations and desires as things circulate, passed around as gifts. "If in a commodity economy things and persons assume the social form of things, then in a gift economy they assume the social form of persons" (ibid., 103). In this context persons are 'dividuals' or 'partible persons' – that is persons are the products of chains of socially reproductive acts, so there is no

division between the social and individual persona. So every person is a product of others, or has an identity which is produced from all the social actions that were involved in marriage, giving birth, nurturing, etc. Enchainment is created because of the 'hau' of things – that is their need to be moved on, to be mobile. Gifts are treated as responsibilities that are to be quickly got rid of – it is wrong, impossible, for something to be stationary (for entanglements and dependence in post-colonial studies see Dietler 2010; Gosden 2004; Martindale 2009; Nuttall 2009; Thomas 1991).

Sociologists have tended to see the social world as about interpersonal relations. But Latour, Law and Knorr-Cetina have come to see how engines, measuring instruments, laboratory probes, detectors play a part as actors in structuring social relationships (Knorr-Cetina 1981; Latour 1990, 1993; Law 1999). These authors explore the production of scientific knowledge in the laboratory, but they also argue that similar social/thing processes occur more widely. They focus on the actor networks of big things like the computerized rail transportation system called ARAMIS (Latour 1996), but they also look at small things like pipettes, paper blueprints, computer screens and so on.

The aim of this type of approach, often termed Actor Network Theory (ANT), is to focus on relationality rather than on apparent fixed and essential dualisms such as truth and falsehood, agency and structure, human and non-human, before and after, knowledge and power, context and content, materiality and sociality, activity and passivity. It is not that there are no such divisions, but that the distinctions are effects or outcomes. "They are not given in the order of things" (Law 1999, 3). Thus ANT conducts a 'semiotics of materiality'. It takes the semiotic focus on relationality and applies it to all materials, producing a relational materiality.

In Latour's study of the 'pasteurization of France', the microbe comes to be seen as an 'essential actor' (Latour 1988, 39). Microbes as things connect people and they connect people and things. Those in our guts connect us to what we eat. They also connect us through the spread of contagious diseases and because we depend on each other to be hygienic and defeat microbes. So there is a clear focus on dependence here. We depend on the microbes that pasteurize beer in order to have economic relations between brewers and customers. We depend on sterilizing milk in order to be able to feed our children milk products. At the end of the 19th and early 20th centuries, the triumph of hygiene allowed the First World War to be conducted, since "without the bacteriologists, the generals would never have been able to hold on to millions of men for four years in muddy, rat-infested trenches" (ibid., 112). The dependence has costs – the costs of "setting up new professions, institutions, laboratories, and skills at all points" (ibid., 39).

In this case Latour describes the actors as heterogeneous, made up of linked entities such as hygienists, drains, Agar gels, chickens, farms, insects of all kinds. The actors are human, non-human, individual entities, and large institutions. The aim is to avoid reductionism and to focus on the dispersed networks through which such actors come to have form and come to act. In such work there is often an interest in what happens when things don't work and go wrong. Knorr-Cetina (1981) discusses a broken laboratory instrument and the effects this

had. The scientists started to use a centrifuge in place of the broken instrument. By tinkering with the centrifuge, the measurement process came to be redefined, leading to a reworking of the scientists' problem. The humans, their research and the instruments were thoroughly entangled in each other. The network required continuous "social, technical, *and* financial maintenance, surveillance, and repairs" (Preda 1999, 363). There is a "practical codependency between knowledge embodied by the researchers and knowledge incorporated in the instruments" (ibid., 352). Latour talks of this co-dependence as "a work of hybridization" (Latour 1993, 11).

Given this strain in ANT of incorporating dependence and dependency into analyses and interpretations of human-thing interactions, the use of the term 'network' might seem inadequate. Latour argues that indeed the idea of network has lost its critical valency because of the emphasis on information exchange and networks of global interaction in the World Wide Web (Latour 1999). He suggests that in ANT 'network' originally meant transformations and translations. It referred to the complexities of linkages that made things related beyond their supposed existence as stable regional entities. In Spanish 'network' is translated as 'red' and in French as 'réseau,' both of which have the connotations of web or mesh. Ingold suggests that such terms give a better sense of rhizomic flows than does the term network (Ingold 2010). The spider's web is an extension of the spider and makes possible the life of the spider. Ingold prefers the word 'meshwork' to give a better sense of flows of force and lived gatherings, rather than objects connected by networks.

And yet there remains a tendency for ANT to give insufficient attention to the ways in which humans and things in their physical connectedness entrap each other. Latour's focus is often on the mixing of humans and nonhumans, and he rejects culture/nature oppositions. Indeed the whole of ANT is built upon a move away from fixed essentialist dualisms such as materiality and sociality, human and nonhuman. Pierre Lemonnier took Bruno Latour's symmetrical approach to task for its tendency to overlook material constraints and focus on sociological issues. In his response Latour agreed that pure, asocial material constraints did not exist in his perspective (Lemonnier and Latour 1996). Because Latour is intent on moving beyond subject/object dualisms and dialectical relations, he often appears to show little interest in objects and object relations themselves and the non-human ecologies in which they interact. "Objects are never assembled together to form some other realm anyhow" (Latour 2005, 85). ANT analysis is "not a matter of giving priority to 'the material world alone'" since the aim is to supersede subject/object oppositions (Olsen 2010, 149). For Latour, the lack of dualism is a positive aspect of Actor Network Theory (Knappett 2005). But to bring everything into the dispersed human/non-human network risks losing one of the main motors of change – the limited unfixed nature of things in themselves and their relationships with each other. There are many changes in natural cycles, in daily, monthly, annual, decadal, millennial rhythms. There are many processes of decay and loss and depletion that impinge on human society and in which things have unacknowledged and unforeseen effects. Because humans and nonhumans are thoroughly embroiled in each other, these material changes entangle humans, they force responses and adjustments. In 2005 Latour abandoned the principle of symmetry between humans and things because "the last thing I wanted was to give nature

and society a new lease on life through 'symmetry'" (Latour 2005, 76; see also Olsen 2007). As a result, in Latour's analyses things are always already caught up in networks of humans and non-humans and the object nature of things is not a key part of the analysis.

There are problems with the idea of a total mixing of humans and things in networks or meshes. In ANT everything is relational and this insight is important. But it is also the case that materials and objects have affordances that are continuous from context to context. These material possibilities (whether instantiated or not) create potentials and constraints. So rather than talk of things and humans in meshworks or networks of inter-connections, it seems more accurate to talk of a dialectical tension of dependence and dependency that is historically contingent. We seem caught; humans and things are stuck to each other. Rather than focusing on the web as a network, we can see it as a sticky entrapment. Entities are both 'things' and 'objects'; they are both relational and they 'object', oppose or entrap. It is this dialectic that is missing in many relational approaches but which is central to entanglement. Entanglement theory accepts that the material world is always already social and relational, while asserting that things can provide material constraints and lead humans down pathways.

Entanglement as entrapment

Take the example of an apparently trivial and quite frivolous bit of stuff – Christmas tree lights. In many parts of the world, these have become an important constituent of the Christmas mix, replacing hazardous candles. It can hardly be said that humans in some cultures have come to depend on Christmas tree lights, but they add to the spirit of joy that is supposed to dominate this festival. Their use has extended into streets and the exteriors of shops so that they have become a key part of the commerce of Christmas. In America whole streets and whole houses and gardens can get covered in lights. The scale of use of these lights results in large numbers of jobs in production worldwide. The lights use large amounts of electricity, such that we are encouraged to switch from incandescent bulbs to LEDs (light-emitting diodes) in order to be more energy-efficient. As we take them off the tree or house or street after Christmas, they tend to get tangled up, or in some cases one of the bulbs fails so the whole string will not work. For various reasons, we throw a lot of them away every year.

Adam Minter (2013) starts his recent book *Junkyard Planet* with Christmas tree lights. A single strand weighs almost nothing in the hand. But a hay-bale-sized block weighs 2,200 pounds. There are lots of such blocks in the southern Chinese town of Shijiao. In fact the factories in Shijiao import and process 2.2 million pounds of Christmas tree lights every year. Cheap labor and low environmental standards meant that the town became an important center in the recycling of the lights. The container ships that traveled from China to the United States did not want to go back empty; they offered low costs for taking back junk of all types, including Christmas tree lights. Until recently, many factories in Shijiao burned the lights to melt the plastic and recycle the copper wire, releasing toxic fumes into the environment. Today, as Minter describes, a cleaner method is used. When the Chinese started to buy cars in large numbers, the price of oil went up, as did plastics made from oil. So people started looking for alternatives to making plastic from oil. Instead of burning plastic off the copper wires

of the lights, people figured out a way to strip it off and reuse it. The lights are now tossed into shredders and the resulting material is then sorted on vibrating tables spread with water. The resulting plastic that is separated off is of a good enough grade to be made into slipper soles, and the copper that remains is made into plumbing, power cords and smartphones.

The making and recycling of Christmas lights provide large amounts of jobs for people worldwide; asked why Shijiao achieved its odd status as the center of Christmas light recycling, a local factory manager replied "people wanted to make money…. that's all" (ibid., 2). Christmas tree lights are part of a heterogeneous network of religion, commerce, trade and production (as well as slippers and plumbing) that has global reach. We could do without them, and they use up a lot of resources and their discard can cause pollution. Yet it is in everyone's interests to keep using them. We could say that Christmas tree lights are part of a network of humans and things. But it is also true that they are part of a process whereby economically developed countries export their junk, and the hard and dirty labor associated with them, to other countries. The people that have come to depend on Christmas tree lights in various ways do not want to cease their production, use and recycling, even though pollution may be caused, energy 'wasted' and global inequalities reproduced or strengthened. So we have become dependent on something that we know entraps us.

One of the reasons that we accept to live in Minter's junkyard planet may be that many of us remain distant from the pollution, low-paid labor and appalling work conditions. As we innocently reach up and put the lights on the Christmas tree, we do not see the planetary entanglements and entrapments that we create. China and other rising nations make massive profits out of our recyclables – everything from Christmas tree lights to television sets and cars to mobile phones, paper and cardboard. We recycle, but it is almost as if we seek ways to convince ourselves that our head-long rush to stuff has no implications for our entanglement with the planet. For example, regarding the new digital technologies we use terms such as 'air' book, the 'cloud', the 'web', all of which terms seem light and insubstantial, even though they describe technologies based on buildings full of wires, enormous use of energy, cheap labor, and toxic production and recycling processes. An average iPhone uses about 361 kilowatt-hours each year after factoring wireless connections, data usage and battery charging (Neal 2013). A medium-sized refrigerator with an Energy Star rating only uses about 322 KWh a year. The main problem is not the phone itself, but all the systems that run continuously to support it. There are computers and servers that run 24 hours a day, seven days a week. There are air-conditioning systems needed to keep the servers cool. There are manufacturing centers to build the devices, and nonstop electricity to power the broadband networks. Mills (2013) estimates that the global Information-Communications-Technologies (ICT) ecosystem uses a total of 1,500 terawatt-hours of power every year, equal to the total electricity generated by Japan and Germany combined. Coal is still the main producer of electricity in the US, so Mills can say with some justification that 'the cloud begins with coal' and that cellphone use contributes to global warming. We see social networks as flat. But in fact there is a dimension of depth in which dark matters, coal and rare earths, entrap us. It would be difficult to give up smartphones and Big Data; there is already too much invested, too much at stake. The things seem to have taken us over; at least our relationship with digital

things has become asymmetrical – we need Christmas tree lights and smartphones (or think we do) and depend on them, even if they lead us further towards greater global inequalities and global warming.

The irreversible evolutionary development of entanglement

As an archaeologist, I am interested in when this headlong flight to things, our dependence on stuff, began. In my house, as in most modern houses in developed countries, there is way too much stuff. The internet is rife with advice about how to reduce clutter, how to re-organize one's life and clean up one's house. In my house there are thousands of objects, and objects within objects. Just take the two cars in my garage; each car has about 20,000 parts derived from factories, quarries and sales outlets all around the globe. And we haven't even started with the washing machines, sinks, fridge, lawn-mower, clothes, shoes (and slippers), computers, fire alarms, burglar alarms and so on and so on. We live in a world in which we are surrounded by human-made things. But it wasn't always like that.

For at least 70,000 years, anatomically modern humans, people biologically like us in every way, lived in small mobile groups of 10-30 people, aggregating from time to time, and sometimes producing wonderful wall paintings and magnificent implements. Their success and mobility were partly possible because they carried very little stuff with them. The small bands had clothes made of skin tied together with sinews and plant chords. They had baskets and skin containers and through time they added bone tools such as needles. They had wooden spears and bows, as well as tools and weapons made of chipped stone such as flint and obsidian. They lived in cave entrances or in huts made of various plants or bones from wild animals. You could place on a small table all the material belongings of a man or woman 20,000 years ago. They had very little stuff.

And what is more, when the stuff ran out, wore out, or went wrong, it was easy to replace. Most of the materials used were organic and easily found and re-made. Worn out skin clothes could be replaced with the skins of hunted animals, wooden spears could be replaced from nearby trees, baskets could be replaced by fetching reeds from the river. Stone tools were made from local stones in many cases, but some flint and obsidian was obtained by going to farther sources or by exchanging with others. To some degree people were dependent on others and on access to sources of stone in order to survive, but for the most part people were little entangled in large amounts of human-made stuff, and they could get what they needed fairly easily.

But then, relatively suddenly, about 10,000 years ago in the Middle East, the amount of stuff in peoples' lives increased dramatically. By stuff I mean material things made by humans. Colin Renfrew has talked about the increased material engagement between humans and things at this time, associated with the start of farming and the origins of settled life. As Renfrew put it, "human culture became more substantive, more material" (Renfrew 2001, 128). Those following a mobile existence were limited in terms of the accumulation of materials. But once people had settled, the potential for surrounding oneself with material things

increased. Or we might turn this around and say that increasing material accumulation forced people to settle down and start farming.

The amount of new stuff that became part of the lives of people is quite striking. Over the course of the period between 12,000 and 7000 BCE, people started living in permanent houses made of sun-dried mud brick (Hodder 2006; Zeder 2011). The houses enclosed living and storage areas and often burials and ritual spaces. By 8500 BCE some of the houses were two-story buildings; the roofs were substantial, made of clay and reeds and timbers. In the houses were stored cereals that were now domesticated, changed by human intervention, as were the flocks of domestic sheep, pig and cattle. The latter presented humans with large amounts of meat that could be owned, stored, dried, used in feasting. Ground stone implements were ubiquitous by 12,000 BCE and were used to make a variety of querns and pounders and abraders; finer stones were ground into polished axes used to cut down trees to provide the timbers for houses and burial chambers. Pottery made of fired clay was invented, providing storage, cooking and eating containers for sedentary communities; fired clay was also used for pot stands, figurines, stamp seals. Weaving implements in the form of spindle whorls appeared, suggesting a range of cloth goods which rarely survive, made from wool and flax. There was an increased variety of tools (including spoons and forks) and dress fittings and ornaments made of animal bone, as well as beads and necklaces made of bone, shell, stone. We know that people expanded the range of wooden containers to include bowls and cups, and used an increasing diversity of baskets. It was no longer possible to place on a small table all one's belongings. People now had too much human-made material culture.

And the stuff was no longer so easy to replace. The more material people accumulated, the more they had to look after it and manage it. People were becoming increasingly entangled in things. Especially problematic were the walls of houses. The sun-dried mudbrick absorbed rainwater very easily, swelled and then contracted. The walls had a tendency to crack, buckle, bend and collapse. People had to find solutions to keep them up and stable; for example, they constructed wooden frames within houses or built buttresses against walls or used sandier bricks. So people got increasingly caught up in things and in the care and management of things. One thing just seemed to lead to another, as new solutions were found which themselves depended on getting more things. For example, in order to get the wooden posts that helped stabilize houses, people had to travel to upland areas away from the lowland settled villages. And they needed polished axes to cut the trees down. So they also had to travel to sources of ground stone to make the axes. Everything seemed to be getting much more complicated, entangled.

We see this increased entanglement with human-made things most clearly in the domestication of plants and animals. Once domesticated, wheat and barley plants can no longer shatter and disperse themselves naturally. The domesticated seeds stay attached to the stems of the plants. So if humans wanted to depend on domesticated cereals, they had to invent ways of processing the plants so that they could get the seeds off the stalks. In contrast to the hunter-gatherers who collected wild plants, the early farmers had to thresh and winnow cereals before they could eat them. They also had to plant the grains to obtain a new crop. The cereals

had trapped humans into harder work and into getting more equipment (threshing floors and implements, sieves and screens for winnowing).

And much the same was true of domestic sheep and cattle. Domestic animals are smaller and less aggressive than their wild counterparts because humans select for more docile and manageable animals. But in order to protect the domestic flocks from the wild gene pool, they had to be watched, herded, and their breeding controlled. So humans were trapped into the care of domestic flocks; they needed to shepherd them, provide stalls for the winter, build corrals in order to keep males from females at certain times of the year. And the entanglement only increased when sheep were used for wool and cattle for milk. We know that from very early on domestic cattle were used to produce milk, but since humans at this stage were largely lactose intolerant, the milk had to be cooked and processed into by-products such as yoghurt and cheese. Indeed, some of the earliest pots in the Middle East were used to process milk. And so the domestication of cattle had entangled humans and pots into a set of dependencies in which humans got increasingly entrapped.

In all these examples we see increasing amounts of human-made stuff at the time of the first farmers in the Middle East, but we also see increasing entrapment as humans get drawn into more work and labor. There is also an interaction between these two processes. As we fix one thing, so we get drawn into another thing. As we fix the slumping house by building a wooden frame within it, so we need to go farther and obtain large timbers from upland areas and make axes that will cut down trees. We depend more on cattle so we need to find a way of consuming milk; in fixing that problem by heating milk, we make pots that themselves require fuel to be fired. More stuff requires more investment by humans in more stuff.

There seems to be a directionality in this process. Above I defined stuff as things made by humans. Natural things have their own life-cycles of death and birth. But things made by humans, man-made things, cannot reproduce on their own. In addition they need each other to function; milk needs a container to be heated in, and a pottery container needs fuel to fire it. So if humans are to depend on things, they have to get involved in the lives of things, to look after them, repair them, replace them, manage them. But in order to do this, humans need yet more things. And so there is a gradual relentless inflation, a gradual drive towards more and more stuff and more and more entanglement in stuff. Things made by humans are unstable. If we are to rely on them, we end up responding to them; we are drawn along by them in the direction of greater entanglement with more stuff.

Plotting the amount of stuff in human lives over the last 70,000 years shows a clear exponential upward curve. This upward curve accelerates during the agricultural revolutions around the world. But the most marked rate of increase has occurred in the time since the industrial revolution. Today we live in a world in which the amount of stuff on a small living-room table makes up only a tiny fraction of all the things in a house or owned by one adult person, and a minute fraction of all the material resources mobilized to produce consumer goods, houses, cities, nation states and global communications. As will be discussed in Chapter 6, constructing the Hadron Collider, the largest single machine in the world, involved collaboration with over 10,000 scientists and engineers from over 100 countries, as well as

hundreds of universities and laboratories. Its computer network infrastructure connected 170 computing centers in 36 countries. Electricity costs to run the machine amounted to $23.4 million annually. In the small beginning in the Middle East 10,000 years ago was set a pattern of growth which continues today.

Unlike 70,000 or 10,000 years ago, the increased amounts of entangled stuff within which we live our lives are difficult to conceive of, never mind control. They are drawing us in the direction of greater entanglements that now include environmental change and global warming. Of course we will try and fix these problems as we always have done, by tinkering and finding solutions. But the lesson from archaeology is that these fixings often make the problem worse, because they involve using yet more technology, more things, new materials. The inflationary direction of increased human-thing entanglement moves forward relentlessly.

The evolutionary direction of entanglement: path dependency

The stickiness of human-thing entrapments has another implication: entanglements gradually increase in complexity and scale, and it becomes more and more difficult to turn back. We saw that the Neolithic Revolution at the end of the last Ice Age and the start of the Holocene was characterized by a step-change in the amount of human-made stuff. But it was also a time that humans became entrapped in the greater labor of dealing with cereals that, once domesticated, demanded human care and engagement. Humans became dependent on domestic cattle and sheep that demanded herding, protection, milking, shearing and all the associated labor costs. In evolutionary terms, these Neolithic changes have resulted in a great success story for cereals, cattle and other domesticates. These species have proliferated at an exponential rate. There are now about 1.5 billion cows and bulls worldwide. Humans have become very dependent on cattle and it would be very difficult to sustain the planet's current human population levels without them. The entanglements too have proliferated. A cow or bull on average releases between 70 and 120 kg of methane per year. Methane is a greenhouse gas. All ruminants in the world emit about two billion metric tons of CO2-equivalents per year. In addition, clearing of tropical forests and rain forests to get more grazing land and farm land is responsible for an extra 2.8 billion metric tons of CO2 emission per year. According to the Food and Agriculture Organization of the United Nations (FAO) agriculture is responsible for 18% of the total release of greenhouse gases world-wide. We recognize and compute the problem; but it would be difficult to go back and manage without domesticated animals and plants – it would be difficult to decrease human population levels sufficiently so that we could return to collecting wild plants and hunting wild sheep and cattle. In much the same way, in the Neolithic, once sedentary life had started and humans had invested in domesticated plants and animals it would have been difficult to dismantle villages, decrease population levels, give up pots and grinding stones and return to a hunter-gatherer way of life. Once humans had invested in things they had become trapped in maintaining that investment and the benefits that it produced.

There is a long-term trend towards greater human-thing entanglement that is a product of the fact that human 'being' depends on things, and of the fact that things depend on other

things and on humans. Things are unstable and finite so that change within entanglements is continually produced. Technological, social and cultural solutions need to be found. Humans thus get increasingly drawn into the care of human-made things. Human evolution is thus fundamentally different from biological evolution. As John Maynard Smith (1993) recognized, a random change in one part of an organism will often be compensated for by adaptive changes in other parts. But random change in one part of a machine often means that humans are drawn into finding technological solutions that often involve greater inputs and expenditures and on-costs. Entanglement thus tends to increase. Becoming disentangled is possible but in most cases a local disentanglement (the collapse of the Maya or the British Empire) is better interpreted as a transformation and change in scale and nature of entanglements. In fact it is very difficult for humans to become less entangled because of the costs that have been invested in existing technologies and material and social worlds, and because unraveling one part of an entanglement often involves disentangling too many other parts. The directionality of entanglement is a by-product of (a) the instability and finite nature of things, (b) the dependence of things on other things and on humans, and (c) the difficulty of going back, of disentangling. Fixing or improving one part of the machine often leads to the need to improve or fix other parts; soon the fixes themselves need fixing, thus proliferating change. The increased rate and entrapment of entanglement may also be a product of the gradual decrease in the 'external' environment. Over the course of human evolution, the expansion of entanglements has meant that all aspects of the environment have become human artifacts. There is less and less outside the human that can 'take care of itself'. The whole environment (in the Anthropocene) is itself an artifact needing care, fixing and manipulation. There is more potential for unpredictable change and human response within complex unbounded artificial systems.

Conclusion

I have tried in this chapter to retreat from an entirely relational treatment of matter, to rediscover the object nature of things. The thingly relations of things include object relations; materials provide affordances or potentialities to humans. The brute matter of things has effects on us that influence social meaning. We cannot reduce things solely to the relational, to a semiotics of things. To do so undermines the power of things to entrap, and particularly to trap the more vulnerable, whether these be the victims of the AIDs virus, the work gang bound by chains, the women bound by child rearing, the populations bound by global agricultural systems.

In the modern world, we have come to see that we need to use things sustainably and responsibly, to care for things. But this care and sustainability themselves too frequently involve further management and control, of animals, plants, landscapes, resources and humans. So things have once again trumped us, entrapped us into their care. Whatever different detailed paths we have taken since we emerged as humans, we have as a species become more and more entangled in things. Ever since the first tool and the first fire, ever since we took the path of being dependent on things, we have been caught up in their lives. Historians have detailed the specific paths that have been taken within this broad movement. We have focused on the

origins of agriculture and the emergence of property, or industrialization and the emergence of the nation state, or on the emergence of new global technologies (Anderson 1983; Castells 2011; Hobsbawm 1996; Marx and Engels 1846; Rousseau 1775). We have explored how some societies became entangled in guns, germs and steel so that they spread over the Americas, or we have explained why, ultimately for geographic reasons, spurts of activity occurred in the west rather than in the east (Diamond 1997; Morris 2010).

There is much to be done in terms of understanding the different paths we have taken as humans, caught up in our varied ways with things. But the big picture is clear. Since a dependence on made things became an evolutionary pathway, there has been one long movement, initially slow, but speeding up exponentially as the strands of human-thing entanglement lengthened and intensified.

We recognize the dangers, but always with a short-term view. We talk today of sustainable use of the environment, of renewable resources, of green energy, of maintaining biodiversity, of resilient alliances, of recognizing that small is beautiful. We try all these paths but they all have the same effects of increasing input, regulating access, managing and increasing entanglements. These short-term solutions do not look at the big picture, that as humans we are involved in a dance with things that cannot be stopped, since we are only human through things. Perhaps there is a future in expanding our dependence on things into the oceans and into space, although both are increasingly cluttered with our detritus and both would involve vast new inputs and colossal entanglements.

Recognition of the long-term increase in entanglement raises the stakes in our ethical consideration of the paths we should consider taking as a species. It seems right that we do what we can to save forests, decrease carbon emissions, protect endangered species. It seems right that we individually use less fuel in our cars and put solar panels on our roofs. All these attempts at fixing problems such as global warming conform with the ways in which we as a species have always dealt with problems. It is in our nature to try and fix our problems now by fiddling and fixing and so becoming more entangled in things and technologies. It is in our very being to devour things. Our bodies incorporate minerals and energies that we gain from things; the electro-chemical activity in our brains depends on food from the world around it; our societies are built on and through things. The environment is not just a backdrop within which we fix problems; rather it is actively involved in our being as a species. And this co-dependence, as we have seen, leads ineluctably to dependency and more entanglement. So to fiddle and fix, as we always have done, seems to be the only solution (Latour 2009). The 2015 Paris Agreement on climate change relies heavily on future technological advances and interventions. But we have perhaps come close to the end of the sustainability of this human impulse. Perhaps we need to face the possibility that fixing our technologies of co-dependency only increases rather than resolves the problem. The long term perspective of increased entanglement offered by archaeology and human evolution suggests the need to look deep inside ourselves and into what it means to be human. The moral choice is substantial, to change what it is to be human, to become something other than ourselves.

Chapter 3

From Process to Practical Entanglement: Shifting the Scales of Inquiry

Identifying the causes of the Neolithic transformation to agriculture and settled life is not the same thing as explaining why it happened. Why is this? Although archaeologists have increasingly adopted practice-based approaches, traditional approaches to such 'big questions' have tended to identify the causes of sedentism and domestication as, for example, climate change, population increase, feasting and prestige competition. The reason these causal explanations remain inadequate is that they leave open further questions such as why people did not respond differently to climate change, why population increased, and why competitive feasting was allowed to spiral. To answer these more complex questions, multiple interacting causalities are often proposed. For example, it can be argued that people did not respond differently to climate change because population had increased. Archaeologists have used various types of system models to describe these interactions.

The argument of this chapter is that such types of explanation still fail to explain why the Neolithic transformation happened because they remain at too abstract and general a level. It remains possible always to ask why things did not turn out differently. For example, during climatic amelioration after the Younger Dryas why did people not dampen population increase, reduce competitive feasting and inhibit technological intensification? In order to answer these more searching questions it seems necessary to be less abstract in the quest to explain why the Neolithic transformation happened and to explore the specific events that were involved. There is a need to shift from abstract theoretical models to practical everyday events. And there is a need to explore the entangled 'lock-in' – why people could not have responded differently (Fig. 3.1).

I have referred (2012, 159) to the statement by Harold Macmillan, Prime Minister in Britain in the late 1950s and 1960s, that it was 'events' that caused governments to change, rather than abstract ideas and decontextualized policies. Many approaches in the social sciences and humanities in recent decades have focused on micro-histories, the *histoire événementielle* of the Annales School (Braudel 1995). In archaeology there has long been an

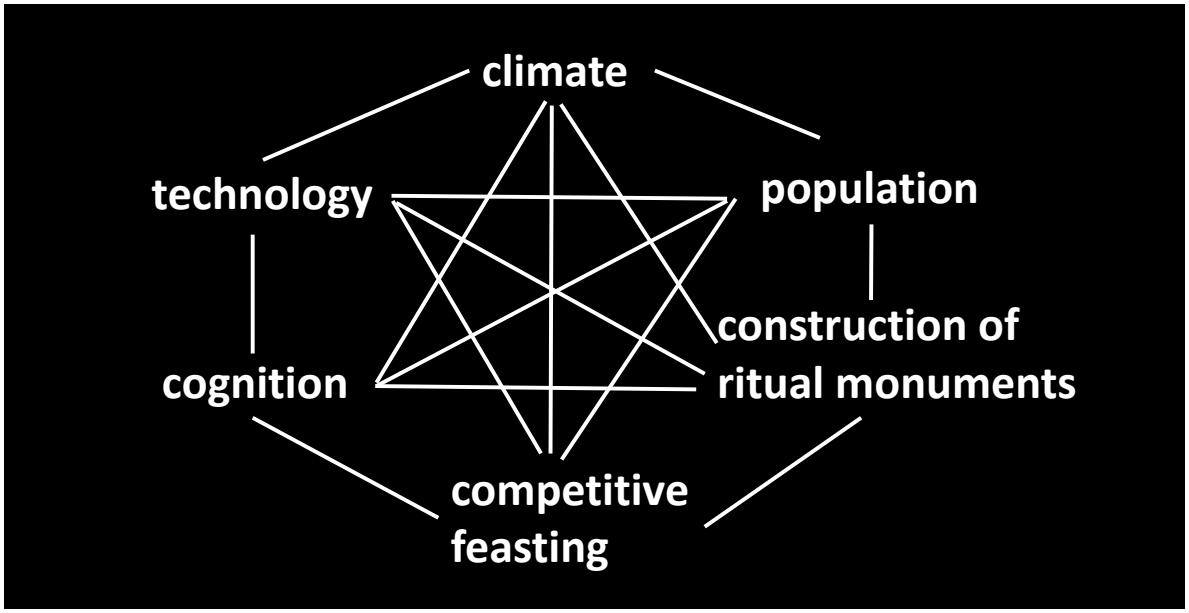

Figure 3.1. *The interactions between the factors often considered as relevant in discussing the origins of agriculture and sedentism in the Middle East.*

understanding that 'small things forgotten' can have major social impact (Deetz 1977), and this focus on the details of material action has been reinforced by social theories that explore daily practice and the reproduction of social forms through practice (De Certeau et al. 1998). Bourdieu's (1977) theory of practice is an important example because of its impact in archaeology, but his emphasis on the reproduction of structure differs from the argument presented in this chapter. The perspective used here is that humans and things are caught up in each other such that change is continually being generated. To describe structural forms and their reproduction is again to remain at too abstract a level. Instead we need to examine the messy and uncertain interactions within Macmillan's world of events.

In this chapter I will examine the practical solutions that humans at Çatalhöyük tried out in order to deal with mudbrick architecture (Fig. 3.2). These solutions responded to events such as the continued collapse and slumping of walls, but the solutions also increasingly drew humans into greater investments of labor (Hodder 2012, 67). New research at the site has allowed further clarification and understanding of this process of ever greater entanglement between humans and things at Çatalhöyük. These new results have been summarized by Hodder and Doherty (2014).

The bricks used to build houses in the earliest levels of Çatalhöyük had a high organic content, the clays having been obtained from back-swamp deposits near the site (Love 2013). These long thin bricks were unstable and there is much evidence of slumping, at times leading to wall collapse. One solution was to bond the bricks with very thick layers of marl mortar. We see this in the lower levels, especially in South K (Mellaart's Level IX) (See Table 3.1). But the marl clay provided insufficient plasticity and bonding and by Level VII there is wider

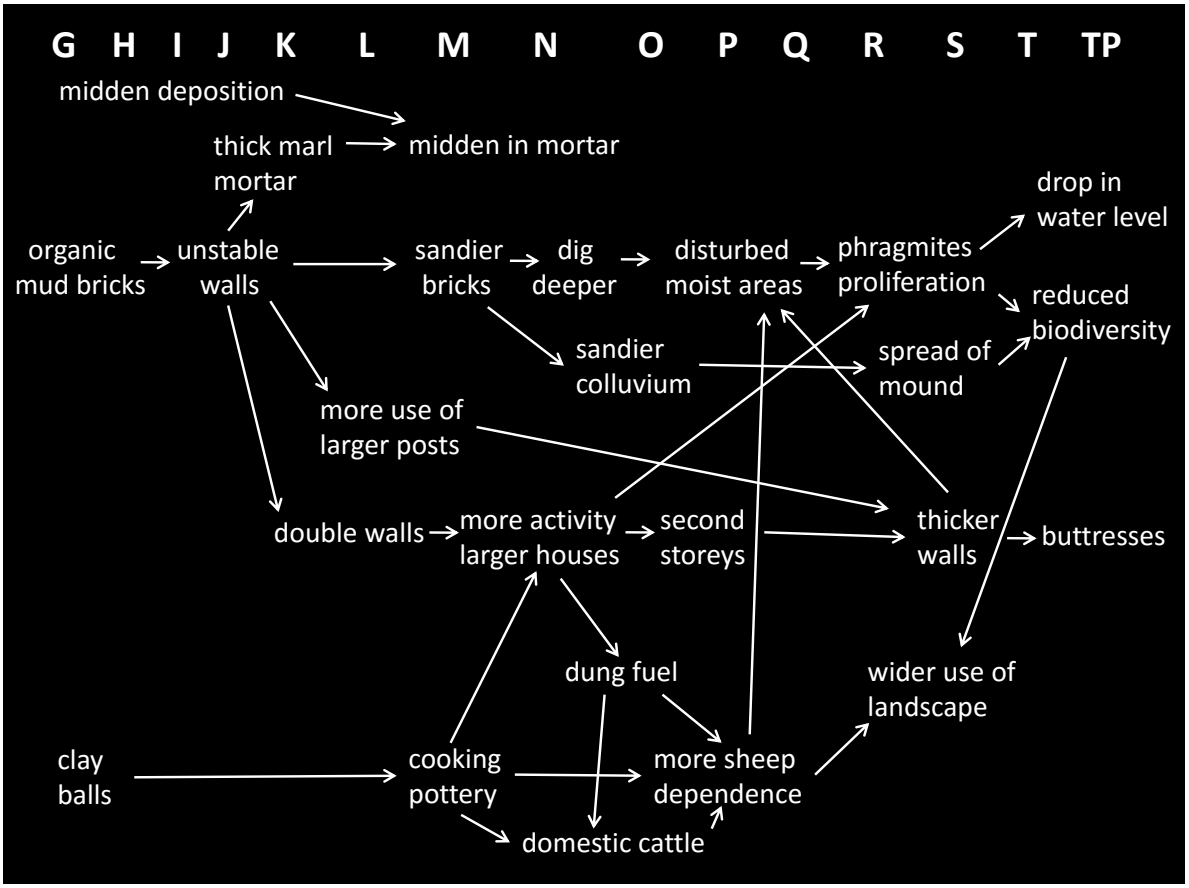

Figure 3.2. *Entanglements related to the maintenance of mudbrick house walls at Çatalhöyük through the sequence of occupation in the South Area of the site (Levels South G to TP).*

use mortar made from midden mixed with clay. This mortar material continued to be used throughout the sites' sequence. Another solution was to add a frame of wooden posts set inside the walls and helping to support them. These wooden frames were not common or substantial in the earliest buildings so far uncovered but they had become common by Level South L. Made of oak and juniper obtained from upland areas, it is often assumed these posts held up the main timbers that spanned the roof. But in fact they were rarely placed in pairs on either side of the main rooms, and they do not occur in side rooms. Rather, their function was to hold up a horizontal beam that went around the inside of the main room, above which the upper part of the wall was inset (Fig. 3.3). The beams for the roof or upper story floor then rested on the inset upper wall. In the upper levels after South P, there is less use of wooden posts to hold up the walls as this again proved less than successful at preventing slumping and collapse. In the later levels symbolic brick posts remained as residual reminders of the early posts, but the main strategy in the upper levels was to build thicker walls and by the time of TP to build brick buttresses.

Another solution to the problem of slumping and collapsing walls (Fig. 3.4) was to build separate houses, tightly packed up against each other. In the earliest levels, up to South K and L, there are many examples of houses that shared walls. In one case a pair of houses was built on the same foundation raft. This type of construction saves energy during construction as only one wall has to be built between neighboring houses. But it also meant that collapsing or leaning walls affected more than one house or building. It meant that if one house needed to be rebuilt, coordination was needed with all other attached buildings. And so after South K and L, the typical Çatalhöyük settlement pattern emerges of buildings built up against each other but each with its own walls. In this way each building could be rebuilt independently. Much has been written of the 'clustered neighborhood' settlement pattern at Çatalhöyük and other sites in central Anatolia (Düring and Marciniak 2005). This closely knit clustering can be seen as a practical solution to the problem of collapsing walls. Each house could be rebuilt independently while at the same time leaning up against and supported by neighboring buildings. Any thin gaps between walls were filled in so that each building protected its neighbor from rain and weather. In this way the expansion and contraction of the smectitic clays in the bricks was minimized.

Levels		Date
Mellaart	**South-North**	
0,I,II	*TP and TPC*	*6400-6000 BC*
	South T – North J	
	South S – North J	
	South R – North I	
	South Q – North H	
(V)	*South P – North H*	
VIA	*South O – North G*	*6500-6400 BC*
VIB	*South N – North G*	
VII	*South M – North F*	*6700-6500 BC*
VIII	*South L – North F*	
IX	*South K*	*7300-6800 BC*
X	*South J*	
XI	*South I*	
XII	*South H*	
Pre-XII	*South G1,G2,G3,G4*	

Table 3.1. *Relationships between excavation levels and absolute dates at Çatalhöyük.*

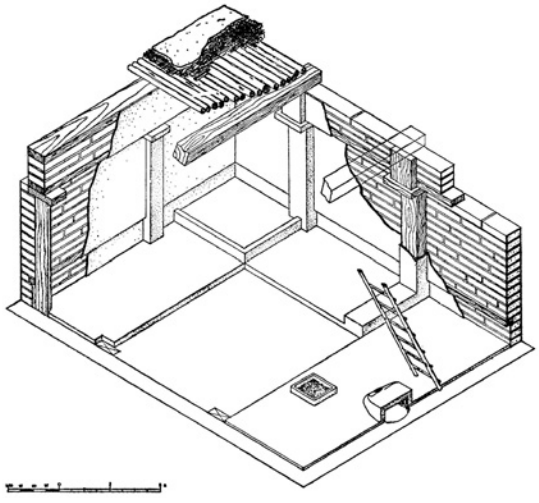

Figure 3.3. *The construction of a typical Çatalhöyük house in Levels South N and O (source: Mellaart 1967).*

But the need to have separate walls for each building also created the possibility for greater independence of house units. Buildings in the clustered neighborhoods could be rebuilt according to their own needs and schedules. There is an overall trend at Çatalhöyük for buildings to get larger, more internally differentiated, and for more activities to take place inside them. This trend is found over large parts of the Middle East from the Natufian, through the PPNA and PPNB (Byrd 1994; Kuijt 2000). There was an overall process whereby the collective sharing that characterized the construction

Figure 3.4. *A collapsed wall in the earlier levels at Çatalhöyük (photo: Jason Quinlan).*

of PPNA monuments, the collective storage seen at 'Dhra (Kuijt and Finlayson 2009), and the collective use of communal space were gradually taken over by individual households. Burial, storage and much productive activity were brought into the house. Rather than seeing this as an inexorable evolutionary process, individuation can be seen at Çatalhöyük as a practical result of, for example, collapsing walls and, as we shall see below, ways of cooking food.

Whatever the contributing factors, as more activities were brought into the house, buildings got larger and there were more internal divisions. By Level South O at Çatalhöyük there were two-story houses, as had occurred by the PPNB in the Levant and northern Mesopotamia. All these changes at Çatalhöyük added to the need to have more stable walls. As already noted, the solutions found included thicker walls and brick buttresses.

But the main response to the instability of house walls at Çatalhöyük seems to have been a gradual switch to the use of clay with higher sand content. Serena Love (2013) has documented the gradual increase in sand content of bricks through the sequence. The main visual change occurs between Levels South K and M when the dark organic bricks of the early levels change to redder, sandier bricks, often held together with mortar containing midden material. Doherty (2013) argues that these sandier clays were obtained by digging down deeper around the mound to reach through alluvium and marl to reach to Pleistocene sands. Through time this digging downwards would have increased as walls got thicker with an ever higher sand content.

Recent research reconstructing the landscape around Çatalhöyük has demonstrated that it consisted of a diversity of wetter and drier micro-habitats that were seasonally variable

(Charles et al. 2014). Earlier research discovered quarry pits around the mound for the extraction of clays and sands (Roberts et al. 1999). The increasing disturbance of moist areas around site as the inhabitants dug further down to obtain Pleistocene sands for brick manufacture created an ideal environment for the proliferation of the reed *Phragmites australis* and there is a marked increase in the phytoliths of this reed in the upper levels, from South P onwards (Ryan 2013). *Phragmites* is an invasive species that would have decreased biodiversity in the local flora and lowered the local water table. In order to maintain plant diversity the inhabitants of the site would have been drawn in to management and cutting back of the reeds. The reeds were also used extensively on site for matting and roofing, and the demands would have increased through time as houses became larger and multi-story.

The local environment of the site would also have been altered over time by the gradual spreading of the mound. The sandier bricks were used in the exposed upper storys of buildings and the weathering and erosion of the walls, as well as of the walls of abandoned houses, contributed to a circulation of clay material that became eroded off the mound, mixed with pottery and organic midden material, and recycled as new brick material (Hodder and Doherty 2014). The colluvium skirt around the mound would have altered the local landscape, smothering and reducing the diversity of local habitats. We have much evidence for a wider use of the Konya Plain during the upper levels of occupation at Çatalhöyük (Hodder 2014c; Sadvari et al. 2015a). This occurred for a number of reasons, but one of these may have been the decreased biodiversity around the site itself.

Another strand of the entanglements that unfold at Çatalhöyük is the shift from cooking with clay balls to cooking with pottery. In the earliest levels at the site there is little to no pottery, and the pottery that exists is organic tempered, thick, and inappropriate for cooking on a hearth. Rather, in these early levels, cooking occurred by heating clay balls, probably in the oven, and then placing them in the hearth or in wooden or basket and skin containers in order to heat and cook food (Atalay 2005). The main shift from cooking with clay balls to cooking with pottery occurs in Levels South L and M, at the same time as the main shift from more organic to more sandy bricks. Whether these two shifts are related, made possible by the digging down to obtain deeper Pleistocene sands, is unclear.

The reasons for the change from clay balls to pottery will be discussed in Chapter 8. Atalay (2005) has argued that while cooking with clay balls is very efficient, it demands much time and attention from the cook as the balls are rotated in and out from the heat source. The great advantage of the fired clay pot is that the pot can be placed directly on the hearth where it acts as a 'delegate' of the cook. Cooking with pots affords more possibilities for the cook to do other tasks while the food is cooking. As noted above, more and more activities, from the more ritual and social to the more productive and economic, were increasingly brought into the house. Task-saving devices such as pottery held a premium in such contexts. The use of pottery thus contributed to the growth of activities inside houses and to their increased size.

But the use of cooking pottery also afforded other changes. Residue analysis has confirmed that while some pots were used for preparing milk products, the great majority were used to process sheep carcasses (Pitter et al. 2013). This evidence is supported by the analysis

of sheep bones from the site that show much evidence of intensive processing to allow the extraction of marrow, grease and fats. While some cattle meat and bone was processed in similar ways, many of the cattle carcasses were processed for larger scale public consumption (Russell et al. 2013). Level South P sees a marked increase in the exploitation of sheep at Çatalhöyük (Russell et al. 2013). The ability to process large amounts of sheep products depended to some degree on the availability of appropriate cooking technologies. This processing took place to a great extent in the home, but it allowed the expansion of sheep herd sizes, resulting in the expansion of grazing over a wider range of environments. Work on sheep isotopes has demonstrated the wider use of the Konya Plain landscape over time (Pearson 2013). But it is also clear that some sheep were kept close to the site (Charles et al. 2014). These, and the domestic cattle that were adopted by Level South O, would have added considerable to the disturbance of the moist areas near the site, and so to the proliferation of the reed *Phragmites*.

We see in all these ways how different activities were tied up with each other in a complex, unfolding entanglement. One further strand that can be added at this stage concerns the role played by animal dung used as fuel. There is much evidence from archaeobotanical and chemical analysis of middens that dung was brought on site, particularly associated with external fire spots and hearths in middens and yards rather than with internal hearths and ovens (Bogaard et al. 2014; Shillito et al. 2013). While wood was also used as a fuel (Asouti 2013), there was a heavy dependence on fuel dung. Dung thus contributed to the increasing array of activities that were undertaken by household units (both inside and outside houses), but it also was related to the increased dependence on sheep and domestic cattle. Matthews and co-workers (2014) have argued indeed that the need for dung fuel may have been a factor in the developments of closer relationships between humans and animals.

It must be emphasized that the Figure 3.2 presents only a very partial view of a much more complex set of entanglements. There are many further strands that could be included. For example, I have not fully or adequately accounted for the gradual increase in the number of activities that took place in houses rather than in open areas. In my view this is mainly linked to the ways in which humans got caught up in forms of intensive food processing that necessitated being close to hearths and in close proximity to stores and utensils such as grinding stones that had multiple functions. To explore all these additional factors takes us well beyond Figure 3.2. Similarly I have not explored all the entanglements involved in the adoption of domestic cattle and in the greater dependence on domestic sheep. My aim here has not been to provide a comprehensive account, but rather to show some of the strands of entanglement in order to demonstrate that many of the large-scale evolutionary processes often associated with the Neolithic can in fact be seen as by-products of local practical entanglements.

Abstracting process from the practical entanglements

We can move on to consider the entanglements at the level of the abstractions about process that are usually used in archaeological explanations. For example, within the practical entanglements as described above there are numerous points at which calls were made on human labor (Fig. 3.5). Digging down deeper into the Pleistocene sands would have required greater

labor, as would travel to the uplands to obtain oak and juniper. The timbers would have to be transported to the site, perhaps making use of the river systems of the Çarşamba and May, split and trimmed. The thicker walls of houses required greater inputs of labor as did the construction of second storys in houses. The increased use of domestic sheep and the adoption of domestic cattle would have required increased labor to tend and manage herds, to process animal products and to milk. The proliferation of *Phragmites* would have been managed by cutting back the reeds, and transporting some to the site for roofing and flooring. There would have been responses to the reduction in biodiversity caused by the *Phragmites* invasion. One response was to make use of resources farther away from the site and there is much evidence from isotopic analysis that sheep were increasingly herded and other animals were increasingly obtained from locations farther away from the site (Pearson 2013).

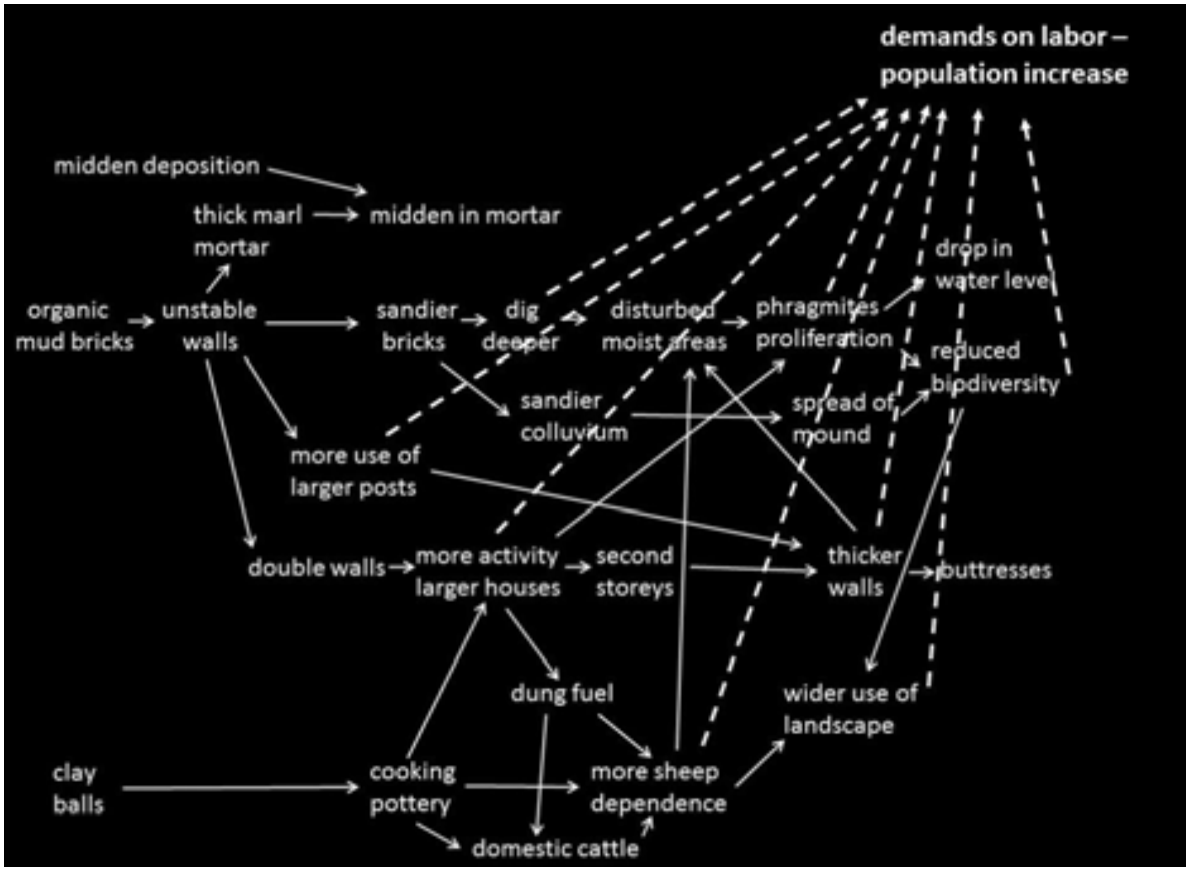

Figure 3.5. *The demands made on human labor by the unfolding entanglements at Çatalhöyük.*

Many of these demands on labor increase in the middle levels South M to P. This is when there is most evidence of increased workload, physical stresses and illness as indicated by the prevalence of osteoperiostitis and osteoarthritis (Hillson et al. 2013). It is also at this time that the population and density of the site appear to reach their apogee (Hodder 2014c). Study of

the age distribution of human skeletal remains suggests that this was a time of heightened fertility (Hillson et al. 2013). It seems reasonable to suggest, therefore, that the main response to demands on labor at Çatalhöyük was to increase population. After Level South P the population at the site itself seems to have declined, but there is also a dispersal of population to new areas of the site and increasingly across the landscape. For example, a herding camp has been excavated in the shelter of Pınarbaşı, 24.5 km to the southeast (Baird 2007a; Baird et al. 2011). In the Konya Plain it seems likely that populations continued to expand in the later 7th millennium BC and into the early Chalcolithic at the start of the 6th millennium.

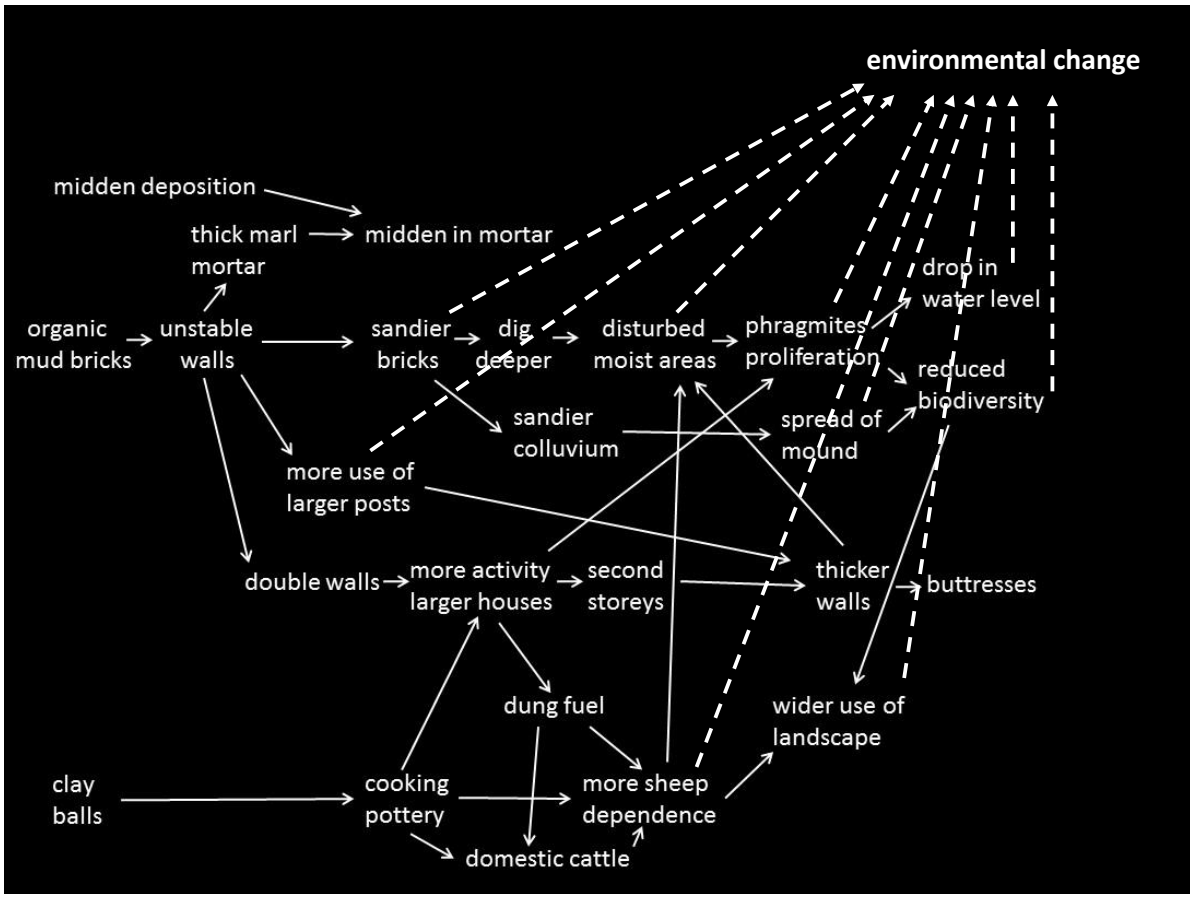

Figure 3.6. *Environmental changes linked to the unfolding entanglements at Çatalhöyük.*

In this account we see population increase not as the cause of change but as itself produced from within the practical entanglements. Similarly with environmental change (Fig. 3.6). There were certainly large-scale regional climatic trends that had impact at Çatalhöyük. The site is in an area that today is marginal for rain-fed agriculture, but in the 7th millennium there is some evidence of wetter conditions (Charles et al. 2014), and there have been some claims for some impact from the 6.2k climatic oscillation (Asouti 2009). But the environmental shifts during the occupation of the site were often the result of human activity. For exam-

ple, after the earliest levels of occupation there is good evidence for a decline in the presence of wetland plants and local freshwater fish (Hodder 2014c). The later growth of a sandy skirt of colluvium around the mound and the proliferation of *Phragmites* would have contributed to such drying locally. The sourcing of oak and juniper timbers from uplands away from the mound along the Çarşamba River may have contributed to deforestation and soil erosion although Asouti (2013) argues against negative impacts on the woodlands nearer the site. The impact of the herding of sheep and cattle across wider swathes of the Konya Plain (Pearson 2013) would have had an impact on vegetation distribution. In all these ways we can explore environmental change not as an independent variable but as produced within the practical entanglements.

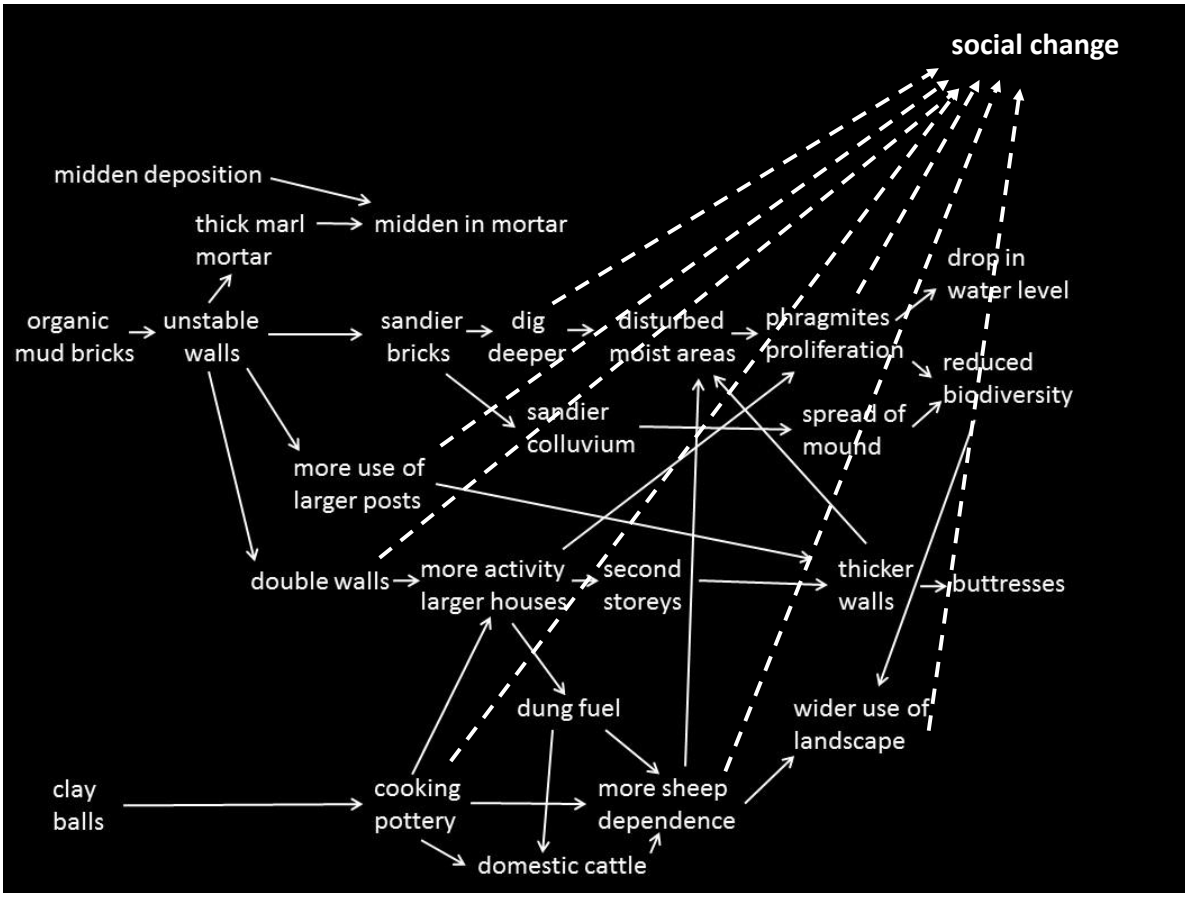

Figure 3.7. *Social changes associated with the unfolding entanglements at Çatalhöyük.*

Similarly with social change (Fig. 3.7). The digging down deeper to obtain sandier deposits with which to make bricks may have resulted in larger work gangs and more cooperation, but it also seems to have been associated with greater conformity in brick production. The early bricks are very long, thin and uneven and may possibly have been laid wet on the walls. Later there is clear evidence of the use of molds and the drying of bricks prior to construction (the wet bricks were initially laid on straw and grasses to dry, leaving impressions on

one side of the bricks). Given the numbers of bricks needed for any one house, this manufacture must have happened off site, implying a high degree of organization. The cutting back of *Phragmites* may also be assumed to have involved joint labor, or at least coordination of labor.

Other social changes are associated with the sourcing of materials from greater distances, a trend that is manifest in the later levels of occupation with regard to many categories of material (Hodder 2014c). The grazing of sheep over wider landscapes, and the obtaining of timbers from upland areas must have involved collaboration and coordination, and may well have involved negotiation and exchange with other communities. There is also evidence from obsidian and groundstone sourcing of increasing travel or exchange over wider areas.

Perhaps the most fundamental social change so far identified during the occupation of Çatalhöyük concerns the breakdown of the clustered neighborhood pattern in favor of the greater size and productive output of individual houses. As already noted, this shift can be seen as already occurring as houses tried to resolve the problem that if they shared house walls with neighboring houses they were tied into the rebuilding schedules of neighbors as their houses slumped and collapsed. One solution was to build with separate walls but as close as possible to neighbors so that the walls protected each other from the elements. This individuation allowed house units to follow their own schedules. The introduction of cooking pottery also allowed individual house units to be undertake more tasks inside houses. Through time the productive potential of individual houses was more fully realized and in the upper levels of occupation houses begin to appropriate adjacent midden and external space. The houses became more like separate farms rather than clustered homogeneous blocks of housing. The wider use of the landscape to herd sheep seems to have been associated with the emergence of separate herds managed by individual houses or groups of houses (Hodder 2014c; Russell et al. 2013).

As noted above, the account presented here is partial; it does not pretend to describe all the relevant entanglements. My concern is only to demonstrate by exploring a subset of entanglements the ways in which processes such as population increase, environmental and social change are produced within practical entanglements. By identifying a set of social changes I do not imply that a separate sphere called 'the social' can be identified at Çatalhöyük. Quite the opposite. All the 'social' changes identified are abstractions and simplifications drawn out of a complex set of messy entanglements. In practice the social emerges from within the entanglements themselves.

And the same can be said of what archaeologists term 'ritual' (Fig. 3.8). A wide range of practices were directed towards helping to hold up the walls of houses at Çatalhöyük. These included the making of sandier bricks but they extended to practices that had a more religious nature (see Chapter 7 for a discussion of religion and entanglement). Such practices took place both at the abandonment and founding of houses, although these two processes often blended into each other seamlessly. In some cases, the construction of a house was marked by the burial of children or notable individuals. In other cases large amounts of ground stone items such as querns were broken and left on house floors or placed beneath platforms. In other cases there is evidence of feasting. The increased use of large timbers to hold up walls was also

embedded within special practices such as the placing of a human skull at the base of a post in Building 17 (Hodder 2006). Here the ancestors were enlisted to help hold up the house. Indeed we increasingly have evidence that sequences of houses were rebuilt on top of clusters of burials; the house starts with a cemetery. Perhaps the whole focus at Çatalhöyük on burial within houses is a product of the practical need for ancestors to protect the house (as much as the house protecting the ancestors).

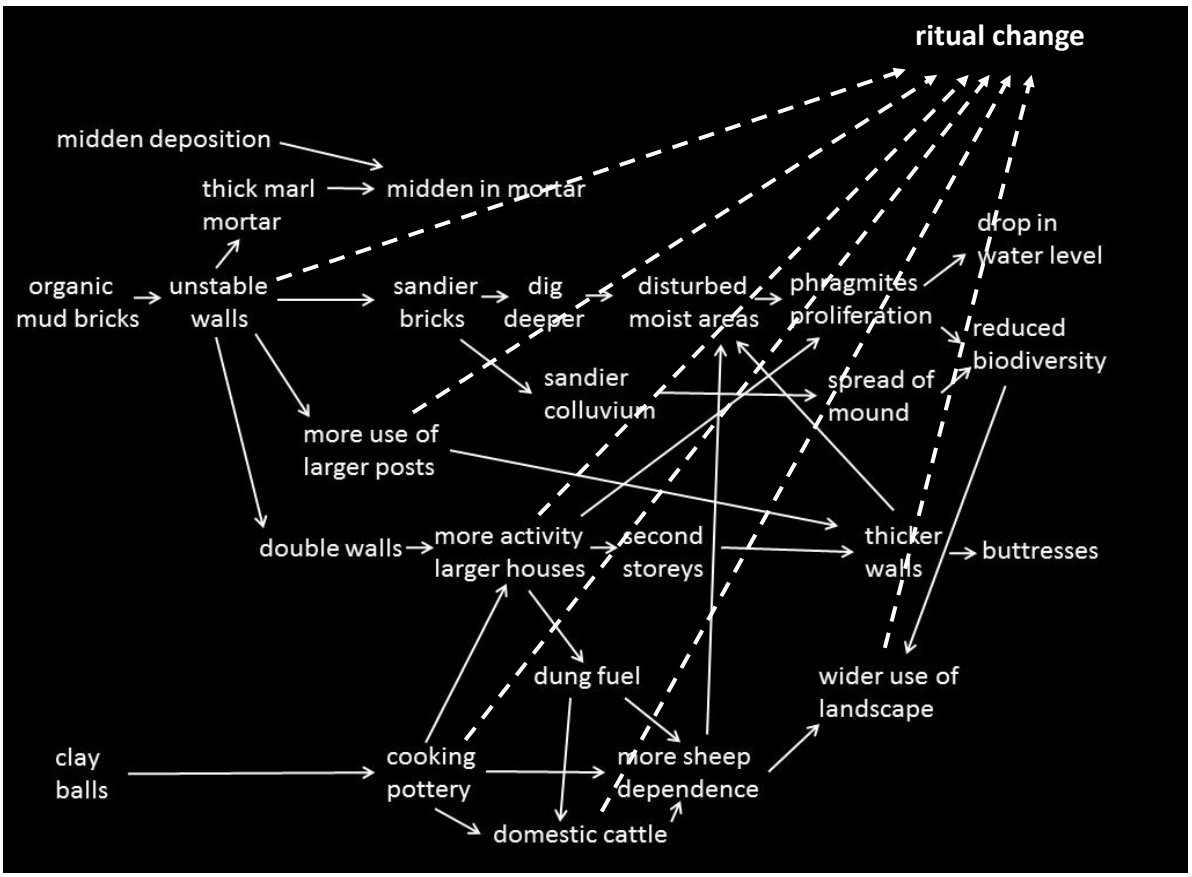

Figure 3.8. *Changes in ritual associated with the unfolding entanglements at Çatalhöyük.*

As with the other abstract terms considered here, it is difficult to separate out ritual from the overall entanglement of human-thing practices. Certainly the increase in the amount of activities in houses through time has much to do with burial and symbolism. As population densities and stress increased in the middle levels so too did the numbers of burials in houses and the numbers of bull horn and other installations. The placing of burials and animal heads (themselves the product of feasting events) in houses seems to have been key to the establishment of sodalities that cut across houses and house groups at Çatalhöyük. But after Level South P there is a greater focus on individual house production; gradually through time into TP and TPC (the latest levels on the East Mound) burial in houses declines as do the numbers of bull and other animal installations. Wild cattle are less common in the levels

after South P so there is less opportunity for ritual use, and in practice there was less focus on cross-cutting sodalities and more on the productive potential of individual houses. These shifts in the amount and intensity of ritual are entirely embedded in the practices of daily life.

There are other aspects of the entanglement that have ritual dimensions. The cooking pottery introduced at Çatalhöyük was initially burnished but otherwise undecorated. This lack of decoration fits into a wider set of practices that distinguish the plain 'dirty' southern areas of main rooms from the northern 'clean' and ritually marked and decorated areas (Hodder and Cessford 2004). This division of practices between southern production, hearth and oven, storage and food preparation areas and northern burial, symbolic installation and perhaps sleeping areas is often marked with platform edges and floor ridges. This site-wide code in the way that houses were organized was an important mechanism in the regulation of this largely egalitarian society. Social codes were embedded within the practices of everyday life and the repetition of those practices reproduced the social order. But the spatial code was itself embedded in practical considerations. The prevailing winds are from the north and so by having ovens on the south side of main rooms, with entry holes in the roofs above them, smoke would have been sucked away from the room itself. The light from the entry and from the oven and hearth would have been most consistent in the southern part of main rooms, so it made sense to focus most production and food preparation activities in this area. Equally it made sense to concentrate such activities near the hearth and oven. In the southern area of the main room it was often necessary to dig small holes into the floor (for example to store stones or to build hearth guards) and the walls quickly became dark with soot. It thus made sense to place most burials (at least of adults) and wall paintings in the northern cleaner parts of rooms. However much the north-south separation became embedded in social and ritual meanings and restrictions, however much it became a set of practices in its own right, the division can be seen as embedded within a set of practical considerations in which fire and smoke and obsidian and burials were entangled with each other.

Cattle can be taken as a final example of the ways in which ritual at Çatalhöyük was entangled in daily practice. It remains unclear whether the domestic cattle that appeared at the site from Levels South M to O were domesticated locally or introduced from elsewhere, although the latter seems most likely (Russell et al. 2013). Arbuckle (2013) suggests that the late adoption at Çatalhöyük in comparison to other areas of Anatolia may have occurred because wild cattle had an important symbolic and social role at the site. While this may be the case, it is also possible that the killing of and feasting on wild cattle were such an important part of the social framework at Çatalhöyük in the early and middle levels of occupation that humans and wild cattle developed very close relationships. Especially as the frequency of cattle-based installations increased in the Levels South M to O, there may have been a need to manage 'wild cattle' more closely, so that there was sufficient provision for killing and feasting. Certainly the appearance of domestic cattle is associated with a decline of installations in the upper levels and indeed there is much evidence of transformation and re-aligning of practices after Level South O, perhaps linked to the tending of domestic cattle and the loss of the symbolic and ritual potential of wild bulls.

Conclusion

It seems possible, then, to mine human-thing entanglements in order to extract whatever specific dimension is of greatest interest to us. We have seen that it is possible to explore entanglements to discover population increase, environmental change, social and ritual processes. One could do the same with cognitive change, behavioral trends, feasting, technological innovation, trade and exchange, the economy. One can always extract what one wants and then study the inter-relation of variables. In the case being discussed here, one can extract the variables shown in Figure 3.9.

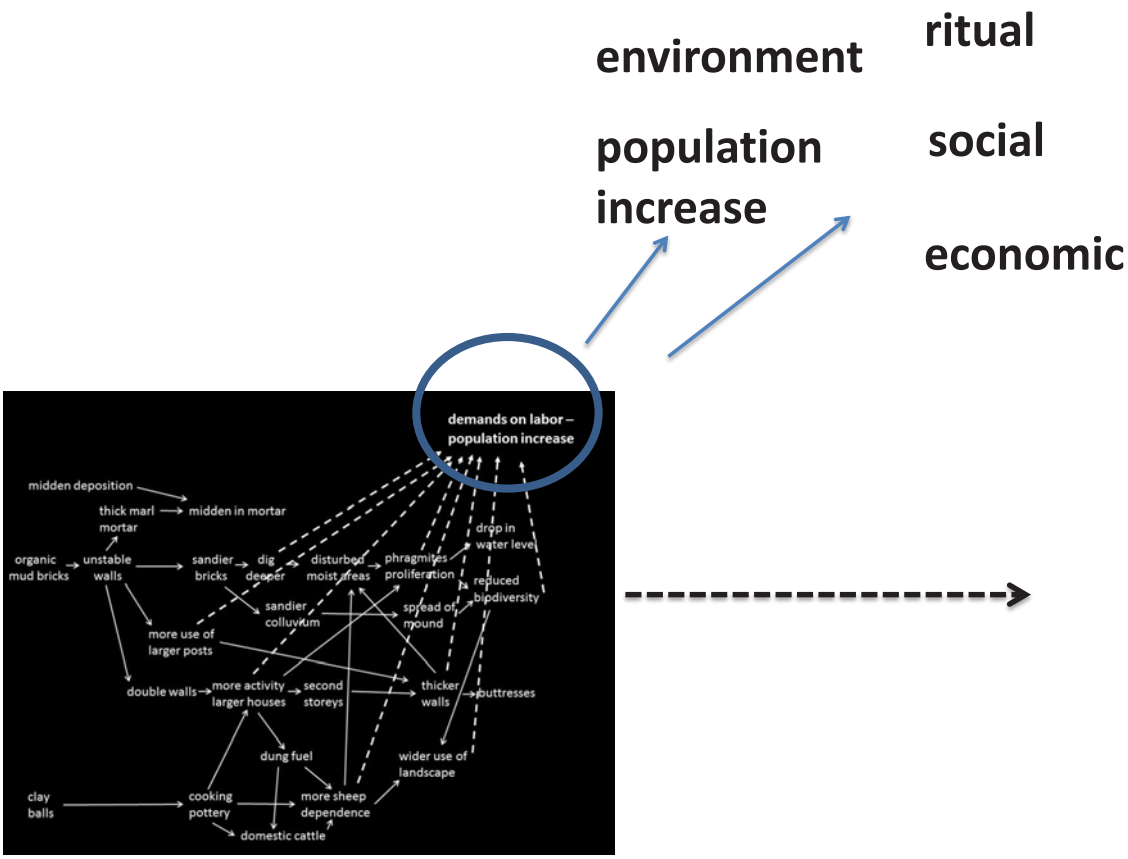

Figure 3.9. *The extraction of abstract processes from the unfolding entanglements at Çatalhöyük.*

One can then get absorbed in questions such as which variable is the prime mover. Archaeologists routinely argue that, with reference to a question such as the origins of agriculture or settled life or urbanism, population increase drives settlement agglomeration that drives technological and social change. Or they argue that competitive feasting in the socio-economic realm leads to a need for increased production and thus to agricultural intensification. Or they argue that increased trade leads to social differentiation and specialization, and so on. In all these cases the variables (population increase, increased production, feasting)

are abstract concepts disentangled from the human-thing practices in which they are embedded. There is always an awkward moment when someone asks – but what causes population increase, or what causes competitive feasting, or what causes increased trade? Analysis proceeds as if systems were closed when in fact they are open ended. Everything is entangled with everything else and so it is not possible to have one variable (e.g. population increase) independent of the others.

The extraction and abstraction become compounded when it comes to explaining the origins of agriculture, settled life or urbanism (Fig. 3.10). Here the debate has shifted so far from daily practical entanglements that there is little possibility of testing hypotheses or examining arguments. It is not possible to answer these 'big questions' in this way. The origins of agriculture and other major transformations are simply the unintended consequences of the daily unfolding of human-thing entanglements. Human-thing entanglements find themselves moving down particular pathways, but whether these pathways lead to 'the origins of agriculture' is coincidental and dependent on how one defines terms (such as 'origin' and 'agriculture'). The only way adequately to understand the larger scale and more abstract questions is to tease apart the complex entanglements in all their specificity, to engage in the everydayness and practicality of human-thing dependencies.

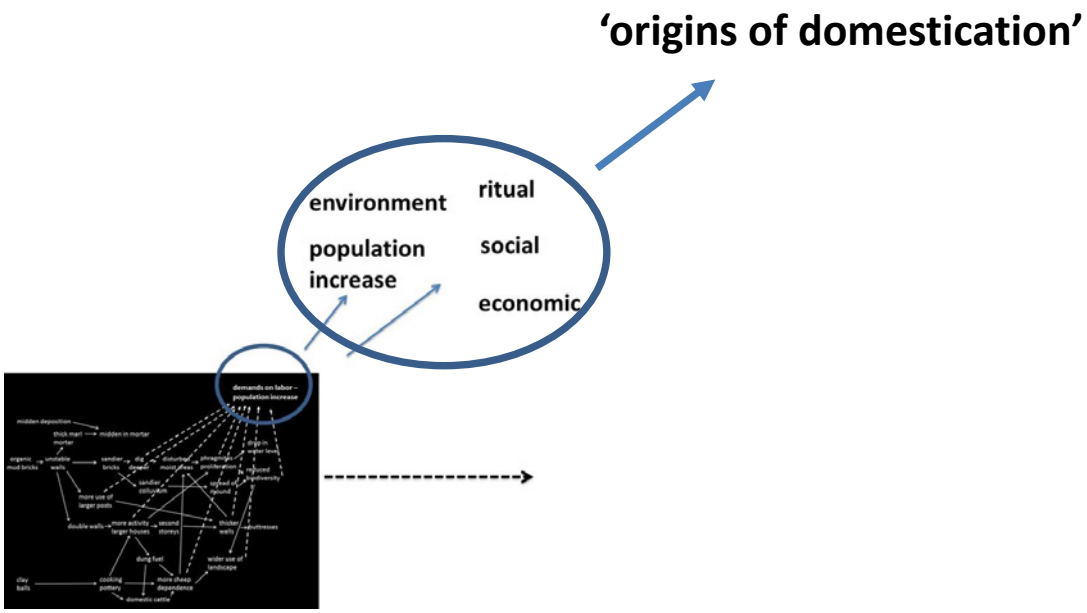

Figure 3.10. *Explaining the origins of domestication by reference to abstract concepts.*

In this way there is no independent and abstract variable. Population change is produced within entanglements; it is a product of their unfolding. Similarly social, ritual, and one might add economic or cognitive change are only produced within entanglements and they can only be separated out by distancing the analyst from the integrated workings of the practical caught-up-ness that is entanglement.

We also see that once a particular pathway has been embarked upon it becomes very difficult to turn back and to respond by lowering population levels, reversing social and ritual changes. This is partly because of the very many inter-connected (and here one might say interlocked) components in the entanglements. So much gets caught up in the changes that reversals involve too many constituent parts. We can take the example of the adoption of domestic cattle. I have argued above that one effect of this adoption was a decline in the centrality of rituals centered on wild bulls. These rituals were key to the establishment of memories and sodalities that tied the social community together. The decline of wild bull rituals is linked to the increased focus on the independent production of individual larger houses in the upper levels of occupation. The care and herding of domestic cattle and sheep involved increases of labor, a wider use of the landscape and contributions to the proliferation of reeds around the site. To reverse this trend and give up domestic cattle in favor of hunting wild cattle may have been difficult given overall increases of population in the Konya Plain, although we have no evidence that wild cattle had been 'hunted out' at this time (the late 7th millennium BC). But to replenish wild stocks would have taken time and may have been difficult given other calls on the plain, such as the large expansion in sheep populations and wider sheep grazing that had occurred. Such a reversal would have meant that houses had once more to give up their independence and return to a greater focus on shared rituals and sodalities. House size would have had to decrease. If populations were made to decline significantly, the labor needed to dig deeper to obtain sandy material for bricks may not have been available. And so on. Questions about why communities did not respond differently thus turn on an understanding of the particular entanglements and on how humans got drawn into particular pathways that were difficult to reverse.

At a larger scale, one possible example of such a process that would bear scrutiny from an entanglement perspective is the impact of the Younger Dryas climatic oscillation on Natufian populations in the Levant in the 13th to 11th millennia BP (see Table 4.1 in Chapter 4 for chronological chart). Natufian sites in the Levant were occupied by hunter-gatherers but there is considerable evidence of larger and more sedentary sites than in earlier periods. In contrast to preceding Epipalaeolithic sites there is more burial, more groundstone, bone tools and decorative objects. Sickle blades were probably used for harvesting wild cereals and there is evidence of an increasingly intensive use of wild resources such as acorns and lentils and gazelle (for evidence of intensive resource exploitation in the Natufian see Munro 2004). It can be argued, then, that these complex hunter-gatherers were well on the pathway towards fully settled agricultural life. The climatic episode of the Younger Dryas (approximately 11,000-10,200 years ago) created cold and dry conditions in the Levant. It seems likely that the yields of wild cereals decreased, 'a development that could have motivated the Late Natufians to cultivate wild cereals' (Belfer-Cohen and Bar-Yosef 2000, 25). There is evidence of increased mobility in the Late and Final Natufian. More burials are secondary, suggesting that increasingly mobile groups returned to earlier sites and used these settlements as cemeteries. It is as if the Early Natufian settled sedentary base camp sites remained as focal points in the landscape, but primarily for burial. In the following PPNA (Pre-Pottery Neolithic A) from 10,300 BP, in the aftermath of the Younger Dryas, settlements are again larger, sedentary and

long-term, for example in the Jordan Valley. House construction is more substantial and there are massive monumental constructions at Jericho, to rival those in northern Mesopotamia at Göbekli Tepe (Schmidt 2006). The subsistence economy remains based on wild plants and animals, incorporating the intensive collection or cultivation of wild cereals and legumes.

In this case we see that the climatic deterioration caused by the Younger Dryas does interrupt the process of increased sedentary life: Belfer-Cohen and Bar-Yosef (2000) call it a 'bumpy ride'. In the Late Natufian there is a reversal, or return to greater mobility, but not to the full way of life associated with earlier Epipalaeolithic hunter-gatherer groups. Late Natufian people remained attached to their earlier settlements, even if only for burial and associated rituals. While there has been no detailed analysis of the entanglements of Natufian societies in the way outlined in this chapter, it seems possible that during the Early Natufian period new practices emerged that involved long-term association with sites, stable points in the landscape, and active memory construction. Archaeologists talk of 'sedentism' but a wide range of social, economic and ritual practices were involved. People became entangled in longer-term, delayed return systems. When the climatic deterioration occurred, forcing a return to more mobile life-styles, the Late Natufians found creative ways of retaining the commitment to place, memory construction and history making. They did not return to an Epipalaeolithic way of life. And when warmer and wetter conditions returned in the early Holocene, after the Younger Dryas, there was a quick return to large sedentary sites, and a reinforcement of memory and history making through burial practices, house replacement and collective monument construction. Humans had become locked into long-term social and ritual practices during the Early Natufian and did not reject them even when forced into greater mobility in the Late Natufian. The type of analysis described in this chapter would allow a fuller understanding of the ways in which Natufian populations became caught up in ways of life that would ultimately lead to full sedentism and agriculture.

As another example, Arbuckle (2015) asks why it is that sedentism in the Middle East did not lead immediately to the domestication of animals. After all it has been widely noted that sedentism tends to lead to resource depletion as larger concentrations of stable inhabitants 'hunt out' local wild fauna. Arbuckle finds that depletion of large game is not a precursor to domestication of animals in most parts of the Middle East. He argues that wild animals were extremely important socially and ritually in pre-agricultural societies, essential components in for example marriage and social feasting. Humans reacted to sedentism by continuing, even enhancing, hunting of wild game in early sedentary villages. They had become 'locked in' to the social benefits of hunting so that the economic benefits of shifting to the herding of domestic animals took 3,000 years to dominate. More work would be needed to explore the full entanglements of this social focus on the hunting of wild animals, the feasting, the taboos, the equipment, the schedules, and how they became transformed into the domestication of animals. Exploring these ideas further is the task of the following chapter.

For the moment my aim in this chapter has been to show that adequate understanding of large-scale change in societies involves detailed examination of the micro-scale dependencies of humans and things. Rather than exploring abstracted system processes, it is necessary to

delve into the messy and complex practical worlds within which humans and things entangle each other. This chapter has involved much detailed description of small events at a specific site. But it is out of these specific interactions that the larger processes emerge. The large-scale processes are produced out of the daily struggle to fix practical problems. We have been enticed by the lure of big questions and have tended to seek simple reductive accounts; in doing so we have worked at a level of abstraction far removed from the daily grind of humans struggling to deal with the uncertainty of events, the instability of things and the complexities of interactions. In the following chapter the larger-scale processes of the adoption of agriculture are discussed in terms of the specific entanglements of hunting.

Chapter 4

Adopting Agriculture in Order to Hunt Better: An Example of Entrapment and Path Dependency

This chapter asks whether theories of entanglement can help in understanding why sedentism (despite the difficulties in defining the term) in the Middle East did not immediately lead to the domestication of plants and animals. Why was there, by some measures, a 3,000 year delay? The answer to this question ends up contributing to the wider issue of why plants and animals were domesticated at all. It is argued that the slow adoption of farming is tied up in the entanglements of hunting. Perhaps counter-intuitively, people adopted farming so that they could hunt better.

It has often been argued that population growth and increased sedentism in the Late Epipalaeolithic and early Neolithic in the Middle East led to pressure on resources. As a result of such pressure, humans increasingly focused on smaller, lower ranked resources. This 'broad spectrum revolution' involved a decrease in foraging efficiency as large game declined and humans had to concentrate on animals and plants that were more costly to exploit (Flannery 1969; McCorriston and Hole 1991; Munro 2004; Tchernov 1991; for a critical evaluation see Zeder 2012). In the Middle East it is argued that the increased exploitation of birds, tortoises and hares rather than gazelle or deer, and the increased hunting of juvenile gazelle (with lower meat yields), indicate resource pressure. More generally, diet-breadth models expect a shift from high-ranked resources to lower-ranked resources wherever humans or climate negatively impact high-ranked resources and this process has been documented in many parts of the world (e.g. Winterhalder and Smith 2000). In the Middle East it is argued that these pressures ultimately led to the domestication of plants and animals in the 9th millennium BC.

Certainly, there is much evidence that sedentism can lead to a pressure on resources around settlements with large populations (Cannon 2000). In the American Southwest, increased exploitation of small game has been recorded in such instances (Speth and Scott 1989). Recently this hypothesis has been tested for the Middle East by Ben Arbuckle (2015). Arbuckle explores whether there is any evidence for resource depression in the exploitation of large game in the PPNA, just prior to the appearance of domestic animals (Zeder 2008). He

bases his study on a large number of faunal assemblages from sites from the Palaeolithic to the Neolithic. He uses an ungulate index "which measures the frequency of ungulates compared to small vertebrates in archaeofaunal assemblages" (2015, 219). He also uses a caprine index which compares the frequency of sheep and goats against all other ungulates, given that it is sheep and goats that were the first animals domesticated in the Middle East. And he calculates a small game index that measures the ratio of 'fast' game (such as hares and edible birds) to 'slow' game (such as tortoises); high frequencies of fast small game are supposed to indicate more intensive sedentism since they are more costly to hunt. Arbuckle also looked at mortality profiles to see if there was any evidence for increasingly selective culling of caprines as a result of hunting pressure.

The results obtained for the ungulate index are shown in Figure 4.1. For all the indices, the data "do not support the idea that depression of big game resources was the causal factor behind the domestication of livestock" in the Middle East (Arbuckle 2015, 227). While there is evidence for big game depression in the southern Levant (Fig. 4.1), in the areas that played a more direct role in the domestication of caprines such as northern Levant and the Zagros, there is no evidence of resource depletion in the PPNA prior to the emergence of domestic stock in the PPNB. PPNA subsistence strategies remained very similar to those in the Epipalaeolithic.

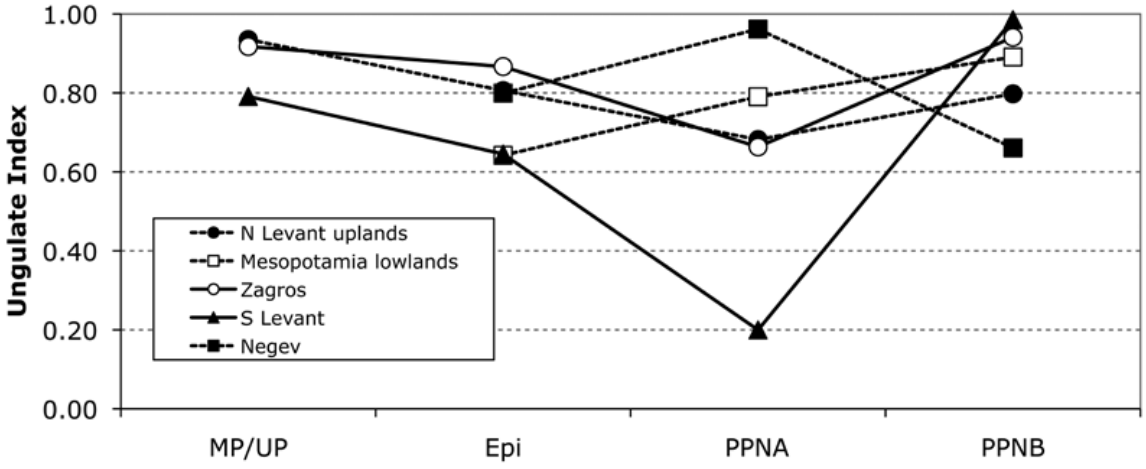

Figure 4.1. *Mean ungulate index values calculated for five geographic regions in the Middle East through time (source: Arbuckle 2015, 225).*

There is an undoubted economic value of having herds of domestic animals available for use in settled villages. There are the entanglement costs of all the extra labor needed to tend, feed, manage, control animals, as well as provide pens, build fences, regulate breeding and so on. But for many sedentary communities there is an advantage in switching to raising domestic flocks. Reduced human mobility benefits from having animals whose movements and dispersal are controlled and managed. There is also a contradiction between the entanglements of farmers and hunters. In order to get their prey hunters have to be mobile, but

mobility hampers farming which often needs constant supervision. There are great difficulties in measuring the degree of sedentism at Epipalaeolithic sites in the Middle East but some degree of sedentism is usually accepted by at least the Natufian and the late Epipalaeolithic. Why, then, do these sedentary communities not domestic animals for at least 3,000 years between the 12th and 9th millennia BC?

Arbuckle suggests that a factor may be the social value of wild animals in intensive hunter-gatherer sedentary societies. Arbuckle suggests that elaborate hunting rituals "may have pushed the social value of hunting so high that it stifled any attempts at innovation in the form of managing and domesticating animals" (2015, 232). My aim in this paper is to extend this argument and show that all the entanglements of hunting amongst sedentary foragers in the Middle East resulted in a continuing commitment to hunting and a reluctance to shift to the tending of domestic flocks.

Epipalaeolithic	22,000 – 10,000 BC
Natufian	12,500 – 10,000 BC
Pre-Pottery Neolithic A (PPNA)	10,000 – 8600 BC
Pre-Pottery Neolithic B and C (PPNB – PPNC)	8600 – 7000 BC
Pottery Neolithic (PN)	7000 – 6000 BC
Start of Chalcolithic	6000 BC

Table 4.1. *Simplified chronological chart for the Middle East.*

Even when domestic crops and animals were adopted in the PPNB in the 9th and 8th millennia BC in the Middle East and Anatolia (Table 4.1), hunting initially remained important. Even at the highly sedentary mega-site of Çatalhöyük domestic cattle were not introduced until 6500 BC and domestic pigs were never adopted (Arbuckle and Makarewicz 2009; Arbuckle 2013). The continuation of hunting in early farming societies might be seen as a hangover from pre-agricultural traditions. It might be argued that tradition, habitus or inertia meant that early sedentary foragers and farmers carried on hunting. It might be argued that one way of life can only slowly give way to another. There are two problems with such a scenario. The first is that this tradition hung on for a very long time – perhaps 6,000 years from the first sedentary communities in the Middle East to the adoption of cattle at Çatalhöyük. This seems rather too long to argue that habituated ways of doing things impeded change. The second problem is that, as we shall see, there is some evidence of an increased emphasis on hunting elaboration and symbolism amongst Neolithic farmers. An alternative approach that explores the entanglements of hunting in sedentary forager and farmer societies provides solutions to these two problems and explains the long resistance to the herding of domestic animals as well as the ultimate adoption.

In this chapter I will first consider some of the ethnographic evidence for the social and ritual aspects of hunting amongst complex sedentary hunter-gatherer societies, before assessing how such evidence can contribute to understanding of Late Epipalaeolithic and

Early Neolithic (PPNA) sedentary foragers in the Middle East. I will then turn to the evidence for continued hunting in PPNB and later agricultural villages and the reasons for this continuation. I will argue that hunting continued and indeed its social importance increased not simply as a hangover, a continuation of a traditional habit, but because it had become so entangled in so many domains that it played a continued and active role. I will also argue that it is possible that the ultimate adoption of farming may have taken place to enhance social and ritual strategies centered on hunting.

Ethnographic evidence for the roles of hunting in delayed-return foraging societies

Woodburn made the important distinction between hunter-gatherer groups that have immediate and delayed returns for their labor. In immediate return systems, meat is quickly shared and there are few long-term dependencies between people. In delayed return systems, people invest in the clearing of land or the building of boats and nets and returns for this labor may be spread out over long periods of time. There is the introduction of ownership and various forms of property relations with respect to land and tools and equipment. The core shift is the development of corporate households (Barnard and Woodburn 1988, 28) of clans, lineages or some other form of social grouping in which people have long-term obligations to each other. It is this latter type of entangled entrapment that is most relevant to the hunter-gatherer societies of the Middle East prior to farming. My aim in this section is to explore some of the broader entanglements of hunting amongst delayed return foragers.

Barnard and Woodburn (1988, 12) note that in immediate return societies hunters "are expected to deprecate their own success and may even choose to give up hunting for a while lest they be suspected of attempting to build up their status". Amongst the San of the Kalahari, people "belittle individuals' success in hunting since the accumulation of goods, be it meat or anything else, can create potential inequality" (Kent 1989, 4). Even within these constraints, the high value given to hunted meat amongst the San has been attributed to the status of men and a rigid division of labor (ibid.). For simple hunters such as the Ache of Paraguay, Hawkes (1991) observed that large game hunting, while unpredictable in success rate, conferred social prestige on hunters and was associated with a degree of reproductive success. At the other end of the scale, American Northwest Coast groups have complex sociopolitical organization with hereditary chiefs, potlatches and full-time specialists, but here too "people spend a relatively large amount of time procuring meat with much effort in terms of time and preparation while receiving a relatively low return for their endeavor compared to the gathering" of fish, shellfish and other resources (Kent 1989, 5). Specific animals such as whales are the foci of ritual, myth, art and status. Hunted resources have a much higher social prestige than gathered resources.

The hunter often had ritual status. Sharp (1988) argues that for the Chipewyan in the North American Subarctic every encounter between man and prey is a sacrificial event. Russell (2012, 168-9) describes how in many foraging societies hunter and prey are in some ways seen as equal. She and Ingold (1994) note that animals are often thought to offer themselves

to the hunter, and in return the hunter treats the animals properly and respectfully, shares out the meat correctly, disposes of the bones appropriately. In many societies an animal must consent to its own death for a hunter to be successful (Kent 1989, 12). Hamilakis (2003) summarizes a range of ethnographic evidence for hunter-gatherers in which hunters are seen as having special ritual powers (as shamans for example) who can mediate between the wild outside and the domesticated inside. Lewis-Williams (1988) has long argued that in Bushman rock art there are associations between hunting and trance and between eland and medicine men.

Hunting is usually entangled in sex and gender relations. Young men may need to show themselves effective as hunters before they can marry (Russell 2012, 159), and hunting often has strong sexual imagery (ibid., 160). Killing a wild animal may be seen as related to sexual intercourse, with women as metaphors for animals. Men often express their control over women through the killing of animals. Barnard and Woodburn (1988, 28) argue that in the shift from immediate to delayed return foragers an important component is often "the intensification of control by men of rights over women who are to be given in marriage". With the emergence of corporate households nested within lineages and clans, the long-term control of and handing down of resources as well as the need to control domestic labor lead to men, especially middle-aged men, controlling women and young men (for example, the labor of sons-in-law). The control of women's destination in marriage becomes key, leading to a severe decrease in the autonomy experienced by women in immediate-return systems.

Flannery and Marcus (2012) summarize much evidence for the emergence of ritual or men's houses in delayed return hunter-gatherer and early farming societies. For example, in the highly complex delayed return hunter gatherers on the Northwest coast of North America, amongst the Nootka ritual buildings were dedicated to successful whale hunters. The buildings contained wooden statues of successful harpooners and large numbers of skulls of deceased ancestors. The large feasts given by chiefs in the Nootka and Tlingit in the American Northwest were key to the status of chiefly families, enhancing reputation and creating debt relationships. These buildings were often linked to totemic animals that were key to social groupings such as clans. For example, Flannery and Marcus (2012) describe the totemic animals of the Tlingit on the Northwest Pacific coast as bears, sea lions and whales. These and other totemic animals were key to the property of chiefs and were handed down from ancestors. The totems were integral to the social structure, part of the intellectual property of chiefly families.

More generally, anthropologists have long discussed the definitions of totems, especially inspired by the theories of Lévi-Strauss that discontinuities between species function as a mental model for organizing social segmentation among humans. This notion that 'animals are good to think' has been transformed by recent research that argues that different human societies may relate to animals and the world around them in fundamentally different ways, embracing different ontologies. The perspectivism examined by Viveiros de Castro (1998) in Amazonia is of significance here, as is the more comparative writing of Philippe Descola (1994). In moving away from the Cartesian distinction between nature and culture, Descola

situates the nature-culture division as just one (he calls it naturalism) among four types of ontology, the others being animism, totemism and analogism. An example of the last is the medieval and Renaissance Great Chain of Being. For the time frame considered in this chapter the most relevant ontologies are animism and totemism. Animism according to Descola is common in South and North America, in Siberia and in some parts of South-East Asia where people endow plants, animals and materials with a subjectivity and set up personal relations with them. The animals and spirits live in villages, exchange, follow kinship rules and indeed have a culture similar to humans. There is always the same idea that vitality, energy and fecundity constantly circulate between organisms thanks to the capture, the exchange and the consuming of flesh. Totemism is to some degree about classification, but Descola sees it more as an ontology that is best represented in Aboriginal Australia. There, the main totem of a group of humans, and all the human and non-human beings that are affiliated to it, are thought to share certain attributes (e.g. of physical appearance or temperament) by virtue of having a common origin in a place in the land. Many societies in fact have mixtures and blends of these ontologies that can exist side by side, and there is no simple relation with mode of production – thus pastoral groups with domestic animals may sustain a totemic ontology regarding wild animals. It is in my view extremely difficult to discern which ontologies were current at different moments during the Epipalaeolithic and Neolithic in the Middle East. But we do see in the work of De Castro and Descola that animals enter into human experience in fundamental ways (Alberti and Marshall 2009). Amongst many hunter-gatherer societies and in farming societies that place an emphasis on hunting, origin myths describe humans and animals as indistinct and part of the same society. Humans and animals are seen as closely related in many ontologies; animals may look after humans and vice versa.

These different ontologies also have an impact on the ways in which complex hunter-gatherers interact with the environment (Descola 1994). The complex worlds of animistic beings and totems within which complex foragers and farmers often live entangle the forest or jungle with social and symbolic valences. Turning these social beings into dominated resources would often have caused ruptures. Especially if we conceive of the environment as lived in according to a series of different tasks (Ingold 2000), rather than as something contemplated and thought about, it is clear that herding and tending fields promote changing ways of living within and engaging with the landscape.

In considering the entanglements of hunting amongst complex foragers in the Middle East it is clear that we need to consider much more than hunting strategies and their nutritional benefits. In this brief review, we have seen that hunting in complex delayed-return societies may be caught up in corporate households, clans, lineages, social hierarchies, prestige, sex and gender relations, marriage, the control of labor, the organization of ritual, the construction of ritual and men's houses, categorization, exchange, relations with the environment, fundamental notions of being, ancestors, property, debt, reputation. It is in this context that we can consider the social and ritual roles of hunting amongst sedentary, delayed return foragers in the Middle East.

Hunting amongst sedentary foragers in the Middle East

The first domestic plants and animals predominate in the Middle East in the PPNB (see Table 4.1). It is clear that earlier, in the Late Epipalaeolithic and PPNA, the continued focus on large game in faunal assemblages (Fig. 4.1) is matched by a range of other social and ritual values assigned to wild animals. There is less symbolism devoted to plants and the domestic realm (for example, sickle blades set into ornamented bone handles in the Natufian: Belfer-Cohen 1991), and it could be argued that the overall symbolic focus of society was wild animals, even though during this time large settled villages were forming and stable settlement established.

New findings from the 12,000-year-old Natufian cave site, Hilazon Tachtit (Israel), have revealed the burial of an elderly woman with animals including wild boar, eagle, wild cattle, leopard, and marten, as well as a complete human foot (Grosman et al. 2008). At the pre-Neolithic Natufian site of Nahal Oren in the Levant, Noy (1991) found carved stones with incised decoration, and animal heads carved on bone handles. Carved bone, bone fragments and bone sickle hafts representing animals (deer, horse) were also found in Kebara Cave (Garrod 1957). The sickle shafts from El Wad and Kebara are in the form of deer and goat heads (Henry 1989). Fox (*Vulpes sp.*) teeth are widely used as raw materials for pendants (Goring-Morris and Belfer-Cohen 2002, 70). In the Natufian we see a marked rise in the numbers of raptor talons (ibid., 71) and pendants of bone and canine teeth (Henry 1989).

Much of the symbolism and ritual surrounding wild animals during this period is concentrated in special or ritual or men's buildings. We have seen that foraging societies may build hunting shrines in order to ensure the success of future hunts (Russell 2012), or in order to build status, provide feasts or establish relations of debt and exchange. Interpretation of these special buildings in the late Epipalaeolithic and PPNA of the Middle East is difficult. Finlayson (2014), in a review of the debates about such buildings, argues that we should not discard various alternative interpretations of these structures. Alternatives such as "men's houses, *diwan* or *madhafa* … or the combination of performative and celebratory action associated with practical work, such as the harvest processing we have very tentatively suggested for WF16 …. should figure more largely within our discussions" (ibid., 134). Already at Hallan Çemi in Turkey in the 11th millennium BC there is an aurochs skull on a wall of a 'public building', a row of three wild sheep skulls in a public space, and there is a snake carved from bone (Rosenberg and Redding 2000). Russell (2012) interprets the public building as a hunting shrine.

On the other hand, the very elaborate enclosures at Göbekli Tepe have been interpreted as temples (Schmidt 2006), houses (Banning 2011) or men's houses (Flannery and Marcus 2012). Peters and Schmidt (2004) look at the representation of animals on the stele at Göbekli Tepe in comparison to the faunal assemblage from the site. At the time of writing, the animal depictions on the T-shaped pillars in enclosures A to D were dominated by snakes, with in descending order of importance fox, bear, crane, aurochs, wild sheep, wild ass, gazelle, leopard/lion, bear. The faunal assemblage is dominated by ungulates (especially gazelle), fox, and birds. In terms of meat consumption, aurochs provided 50%. Clearly the depictions are not an

accurate reflection of the economic importance of the animals to people at the site. Instead, Peters and Schmidt suggest that the enclosures may have played a role in hunting symbolism, totemism and shamanism.

During the PPNA, wild cattle imagery is found throughout the southeast Turkey-north Levantine region (Goring-Morris and Belfer-Cohen 2002). At Tell 'Abr 3 in Syria, a series of stone slabs line the bench around the walls (Yartah 2005) in building B2. These are polished and decorated with wild animals — gazelle, panther, aurochs — as well as with geometric designs. The panthers are spotted and highly stylized and look rather like lizards. Bucrania are deposited within a bench, but there are also bucrania on view in smaller buildings, interpreted as houses, at the site. Investigators at Jerf el Ahmar also found a building with four cattle bucrania probably suspended on the interior walls (Stordeur 2000; Yartah 2005). Two impressive stelae some two meters high in one building seem to represent birds, possibly raptors (Stordeur et al. 2000, 40). At Jerf el Ahmar there is also serpent decoration on the stone slabs of the benches of the large circular buildings (Stordeur 2000), along with a separate depiction of a vulture (for parallel symbolism at Hallan Çemi and Nemrik 9 see Rosenberg and Redding 2000; Kozlowski 1992).

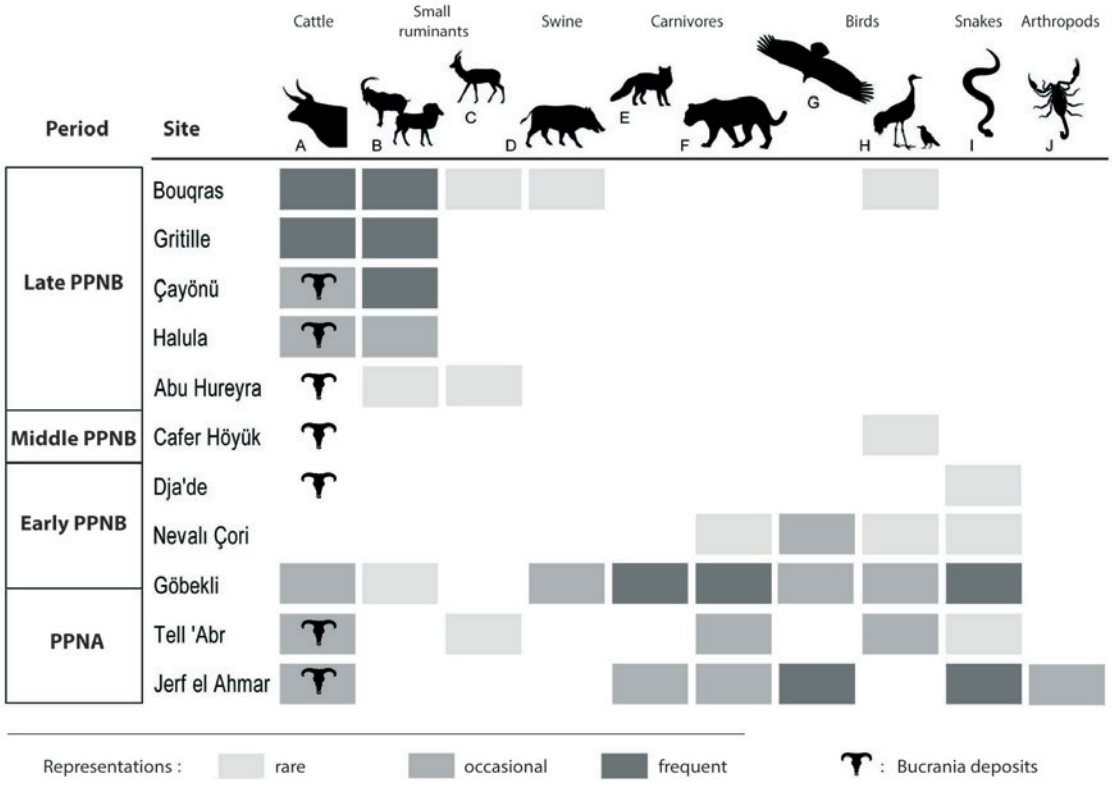

Figure 4.2. *Frequencies of animal representations in the northern Levant and southeast Turkey between the 10th and 7th millennia BC. A: aurochs/cow; B: sheep/goat; C: gazelle; D: boar/pig; E: canids (fox); F: cats (panther); G: diurnal birds of prey (vulture/eagle); H: various birds (crane, duck, other); I: snakes; J: scorpions/insects (source: Helmer et al. 2004).*

According to Helmer et al. (2004, 144) the available data indicate, for northern Syria and southeast Turkey, "a veritable explosion of animal symbolism at the end of the PPNA horizon (9500-8700 cal BC), prior to the appearance of the first domestic animals. At this period, the recurrent themes in the iconography are bulls, felines (panther), canines (fox), diurnal birds of prey (vulture) and snakes; these do not at all correspond to the species which were commonly consumed". They demonstrate (Fig. 4.2) an overall shift from a focus on a wide range of carnivores and distinctive animals and birds etc. that might be thought to have totemic, animistic or other symbolic values. Many of these creatures are good to think with but do not provide much nutritional value. It is only in the later phases that the symbolic focus shifts to ungulates and pigs that are meat-bearing and are domesticatable. We shall see below that the perspective offered by Figure 4.2 needs to be set against the 7th millennium evidence from Çatalhöyük for continued use of snakes, birds and panthers. Nevertheless there is a shift in emphasis through time towards meat-bearing wild animals in social and ritual contexts of feasting and memory making.

There is also a strong male emphasis in the symbolism associated with these PPNA public buildings. Most of the animals depicted on the stelae at Göbekli Tepe are identifiably male, and a headless human with erect penis is also shown. Hodder and Meskell (2011) summarize the evidence for phallocentric imagery from across the Middle East, including the ithyphallic statues from Yeni Mahalle and Adiyaman-Kilisik. The evidence may be interpreted in terms of the importance of hunting for male identity, but the specific associations with public buildings perhaps indicates more male attempts to assert public control.

We have seen that symbolism associated with wild animals increases into the late Epipalaeolithic and PPNA. Much of this may be interpreted as having totemic or animistic connotations, associated with animals and birds that were rarely consumed. However, through time there is an increased focus on wild cattle and other animals that could be used in feasting. Both types of symbolism are especially associated with various types of public buildings. The degree of diversity in cultural practices throughout the Middle East at this time is considerable and it is perhaps dangerous to identify overall trends and to draw generalizations. But we have seen that there is enough evidence to support Arbuckle's claim that the social value of hunting was high. The 'social value' needs to be understood in terms of the numerous roles and values in which wild animals were involved. Wild animals and hunting seem to have been involved in gender relations, social categorization, the establishment of public buildings, the use of houses, feasting, body decoration and burial practices. Hunting and wild animals had become part of so many aspects of life, in particular the focal ritual centers, that it may have been difficult for domestic animals to be integrated into the social system. As we have seen, domestic animals make alternative and often contradictory demands on labor. They constrain the mobility of the hunter, they demand different tasks in the landscape, and they have less potential to be seen as vital agents equivalent to humans. Domestic animals draw humans into different sets of entanglements and it is perhaps for this reason that they were resisted, despite increased sedentism.

Hunting among farmers

Why then were plants and animals domesticated? Can this discussion of the entanglements of hunting contribute to this long-established debate?

Although the processing and storage of plants were parts of the activities in the 'public' ritual buildings in the PPNA and PPNB in Anatolia and the Middle East, the overall symbolic focus on wild animals continues well into PPNB during the widespread adoption of domesticated plants and animals. There is much ethnographic evidence for a similar pattern. Kent (1989) describes the ethnographic evidence for the role of hunting and hunted meat amongst semi-sedentary and sedentary horticulturalists. In all the groups discussed hunting is considered the most important subsistence practice 'while actually providing a smaller proportion to the diet than domestic and wild plants' (ibid., 6). A good hunter has higher status than a poor one, and a chief is often one of the group's best hunters, or occupies a special position in the settlement layout. Hunting confers male identity and status. Successful hunters may be more successful in marriage and reproduction, and the sharing of their meat throughout the community can lead to social distinction.

Although wild animals and feasting may be key to the establishment of clans and lineages (Flannery and Marcus 2012), hunting can also play rather different social roles. Mills (2014) argues that in the US Southwest pueblos there were sodalities that cross-cut the nested communities and brought together non-kin, non-residential groups. These latter sodalities consisted of medicine and hunting societies. While they had integrative functions they could also be used as the basis for creating divisive power distinctions. The curing and hunting sodalities placed a great emphasis on wild animals. "At Zuni, the medicine societies revolve around specific wild animals called the 'beast gods'… Each society has different principles of recruitment, its own fetishes, leadership, and rituals… Illustrations of sodality rooms at Zuni in the late nineteenth century show animals painted on walls, including rattlesnakes, mountain lions, bears, badgers, wolves, eagles, and moles" (Mills 2014, 171).

Ethnographic evidence for the different ways in which wild and domestic animals are treated in such societies varies. In some cases the adoption of domestic herds leads to an objectification of an animal as a resource, thus losing some of the aspects of the symbolic significance of the wild animal. Kent (1989, 15) suggests that "once animals become domesticated, they tend no longer to be categorized as animals *per se* - sapient, sentient beings like their wild counterparts … Domesticated animals become socially, ritually, politically, and economically valuable in a way different from wild animals – and they become analogous to objects. I suggest that the status of domesticated, in contrast to undomesticated, pigs changes to that of object as they become more important as stores of wealth. For instance, domesticated pigs are seen as objects when used for bridewealth or when Big Men use them to validate their sociopolitical status through feasts and ceremonies".

In other cases, the domestication of animals leads to a closer identification between humans and animals such that domestic animals are yet more closely likened to humans. For example, in agricultural villages in Thailand, Tambiah (1969) noted that clear distinctions were

made between domestic and wild animals. The domestic animals included ox and buffalo that worked closely with humans in tilling the fields and were kept beneath the house at night. This close association between humans and buffalo and ox resulted in ritual restrictions on killing and consumption, more so than in the case of the wild versions of those same animals. In consuming the domestic counterparts, the preference is to obtain animals by exchange from other villages. It was the domestic animals that were most protected and most closely associated with humans.

Given such diversity it is important to attempt to understand the sequence in the Middle East in its own terms. Domesticated crops are well established throughout the Middle East by the start of the PPNB although there is much variation in regional sequences (Colledge et al. 2004; Fuller et al. 2011). The first domestic sheep and goat, cattle and pigs have appeared in the northern Levant/Mesopotamian area by at least 8000 BC (Arbuckle et al. 2014). Both domestic crops and animals appear at sites that continue to place a symbolic focus on wild animals. For example, there are domestic crops and sheep and goat at Nevalı Çori but also a cult building associated with a vulture-like bird sculpture, and with a sculpture of a head with snake. Animal figurines made of stone are found representing "lions, panthers, wild boars, wild horses, bears and vultures" (Hauptmann 1999, 77) although clay figurines show domesticable animals. At Çayönü, in the PPNB levels an oval pit with aurochs skulls was found in the Skull Building (Erim-Özdoğan 2011, 201), and "the presence of an aurochs skull with horns … on the wall facing the courtyard is an indication of a bull cult related to the ancestor cult" (ibid., 209), associated with an increasing reliance on domestic pig, sheep and goat and cultivated plants. The upper levels at Aşıklı Höyük have dense housing and cult buildings associated with domestic plants and the tending of sheep (as seen in age-sex profiles and on-site deposits of dung – Stiner et al. 2014). During the later phases of occupation, the adjacent site of Musular has comparable cult practices but also an enormous deposit of the slaughtered remains of wild cattle (Duru and Özbaşaran 2005).

Turning to the southern Levant, Goring-Morris and Horwitz (2007) describe a PPNB funeral feast at Kfar HaHoresh in Israel at which eight wild cattle were killed and placed in a pit at the start of a funerary sequence. They suggest that the wild cattle remains would have provided meat for at least 2,500 people. It is of note that the cattle skulls had been removed. Wild cattle (aurochs) "appears to have been a favored taxon for symbolic depictions in statuettes, murals, stone-carvings and bas-reliefs in sites throughout the Near Eastern world …. PPNB clay statuettes depicting aurochs are often recovered from unusual and often ritual localities within settlements. Thus, at 'Ain Ghazal, 24 of the 84 figurines described by McAdam … were recovered from a single cache in a house and form a remarkably consistent corpus in terms of size, shape and style. At 'Ain Ghazal … bovid figurines were found which had been intentionally broken (maimed) or 'killed' by the insertion of flint or obsidian blades that were stuck in their torso. They were commonly located in groups and often in pits. These features have led researchers to suggest that they played a role in hunting rituals in which the animals acted as substitutes for prey that the hunters intended to kill …. At 'Ain Ghazal, from the plaster floor of a circular storage bin, a small clay figurine depicting an aurochs was found underneath three *Bos* metapodials, one of which was incised and may have had a ritual

significance … Cauvin (1994; 2000) has discussed the central role played in Neolithic belief systems by aurochs, the ram and, less commonly, the wild boar as embodiments of the male deity" (Goring-Morris and Horwitz 2007, 915).

Reviewing the PPNB evidence for symbolism and ritual for southeast Anatolia and the southern Levant, Verhoeven (2002, 252) concludes that "early agricultural societies in the Near East people were symbolically attached to the wild ... This can be regarded as a sort of counteraction to the domestication of society, plants and animals. It is as if people were bringing the undomesticated and wild into domestic (and ritual) contexts".

It can be argued that this focus on hunting and the wild in the PPNB was not just that people, animals and things were caught up in a set of hunting and wild entanglements, but that there was an active and increased focus on hunting. This seems particularly clear in the case of changing types of projectile point. Stone tools classified as 'points' occur in the eastern Mediterranean in the Middle Palaeolithic (Shea 2013) although their functions, and whether they were hafted remain unclear. There is a wider diversity of points in Upper Palaeolithic contexts in the Levant, and these were used as the tips of projectile weapons such as hand-thrown spears, spearthrower darts, or arrows. These are made on flakes, blades or bladelets and are not often fully bifacially flaked. The Epipalaeolithic in the Levant included the Kebaran and Natufian. During this period the lithic industries are based on very small blades and microliths, many of which were presumably set into wooden or bone projectiles. There are some lithic points but they are very small, part of the bladelet/microlith repertoire. But it is in the Neolithic, from the 10th millennium BC to the 6th, that one sees the greatest elaboration of a wide range of singular (rather than multi-component) point types. During the PPNA there is a diversity of points mostly made on small blades and bladelets. But among the first fully agricultural villages of the PPNB one sees the appearance of a wide range of elongated points, made on blades, sometimes with pressure-flaking. There is great variation in form, for example in the notching or shape of tangs. These points (e.g. Jericho, Byblos, Amuq points) blur into larger projectile points/knives, often longer than 10 cm, and often made from tabular flint nodules or large obsidian cortical flakes. Among all these large projectile point/knife types, "one finds evidence of invasive parallel flake scars, likely from pressure-flaking, that attest to enormous outlays of effort in tool production that result in little or no measurable effect on tool functional efficiency", suggesting that these "artifacts had a significant symbolic function for their users" (Shea 2013, 269). In the Pottery Neolithic in the Levant, there is a trend towards smaller and shorter projectile points, perhaps indicating the use of a smaller bow, the hunting of smaller game, or the use of poison (Shea 2013). Overall then, most labor is invested in the manufacture of projectile points not by the hunter-gatherers of the Palaeolithic and Epipalaeolithic, but by the sedentary foragers of the PPN.

So why do elongated and bifacially flaked points increase in PPNB just at the time when animals are more fully domesticated within intensive arable farming? Is it to protect the domestic flocks from wild animal predators and from other social groups? Does the increased effort in the production of these prestige objects indicate that a high premium was placed on those who protected the flocks from wild animals? Were the points used in warring rather

than hunting? It is also possible that hunting was retained by farmers as a risk-buffering exercise (Halstead and O'Shea 1989) amongst early agriculturalists. This may be part of the story but it cannot be a full account. Risk buffering does not seem adequate to account for the enormous amount of symbolism surrounding hunting and the wild. So another possibility is to turn the argument round and say that herding and agriculture came in as a buffer for an increased focus on hunting, not just in terms of nutrition but in terms of the vast social world it was caught up in. The continued focus on hunting large animals (see Fig. 4.1) may simply be a product of the increased food supply per unit of land obtained from domestic cereals and plants.

The specific evidence from Çatalhöyük allows some answers to these questions, very late in the PPNB/PN process. It is particularly interesting to examine the role of hunting at a site with fully developed farming and domestication (although domestic cattle were not adopted until the middle of the sequence and domestic pigs were never adopted). Indeed it is possible that 'hunting' in this context was manufactured. Peters and co-workers (2012) have suggested that perhaps the 'wild cattle' at Çatalhöyük may have been managed but intentionally bred with free ranging wild males in order to maintain a highly desired wild phenotype (size, color, horn shape, etc.). It is of interest that large parts of whole carcasses seem to be present at the site; this would be surprising if the cattle were a traditionally hunted large game resource. Even if managed in some way, it is clear that the 'wild' and 'hunted' aspects of bulls were valued (see further below).

Returning to Figure 4.2, it does seem that some of the same focus on a wide variety of diverse and often inedible or highly taboo animals continues at Çatalhöyük. There are depictions of snakes, and also felines which do not seem to have been eaten on site (Hodder 2006). And we can now say a bit more about the social role of such animals. The continuity of leopards in two levels of Mellaart's 'Shrine 44' suggests that they had some role in distinguishing houses and this was carried through time (ibid.). Bears, foxes and weasels may have played similar roles as they are used as symbols and are rarely eaten. But there is greater focus at Çatalhöyük on animals that could be consumed in feasts, such as deer, cattle, pig, sheep and goat. These animals do not seem to have the same roles as the wider range of animals described by Helmer and co-workers (2004). At Çatalhöyük they are more the focus of consumption, feasting, and social and symbolic display. They do not seem like symbolic, totemic markers of houses or social groups. They occur in all houses although there are differences in the quantities of installations in houses. There is a focus on killing wild animals, feasting on them and then putting their heads, teeth or horns into houses as memorials and symbols of display. In addition, Martin and Meskell (2012, 415) have discussed the figurine corpus from Çatalhöyük and find that 'the majority of figurines probably represent wild animals, with the most being wild cattle, so we might say that 'wildness' was prized or marked in some way', but it should be noted that these figurines are mainly found discarded in middens, rarely in special caches below floors in houses. They seem part of everyday life rather than special categorical markers.

Thus at Çatalhöyük one can envisage at least two ways in which wild animals were entangled in social practices. On the one hand there are markers of groups or sodalities that are based in certain houses and are reproduced through time. The animals used in such contexts are rare, including the leopard and the bear, and are rarely consumed, at least in the settlement. Vultures, foxes, weasels, frogs and snakes may be related categories. These animals are used to create social groups that may cut across house-based descent groups although they are anchored in such units. On the other hand there are the meat-bearing, accessible animals, herbivores and pigs that are used as part of feasting and exchange and in the amassing of house-based resources and histories. There were probably also social rules based on age about the consumption of wild meat. In a study of human and animal isotopes from Çatalhöyük, Pearson and Meskell (2014, 239) find that "the carbon isotope values of the younger adults are significantly different from both the middle-aged and older adult individuals, while the values of middle-aged and older adults were not significantly different. No significant difference was observed in nitrogen isotope values in any age group". Given isotope data from animals at the site they interpret the data to suggest "that younger adults consumed more wild meat than the middle-aged and older adults did from domestic animals" (ibid., 240).

Further insight into the social and ritual roles of hunting at Çatalhöyük can be gained by turning again to projectile points. Sadvari and co-workers (2015b) argue that the bifacially flaked obsidian points found at Çatalhöyük were used as projectile points. Lemorini has found use wear evidence that they were often multi-purpose tools, but certainly one function is likely to have been as projectiles used in hunting and/or fighting. Sadvari et al. argue that they were used as launched projectiles in two ways, one with bow and arrow and the other with hand-held spear. The two types of points are distinguished on the basis of thickness and other measurements. It is found that the spear points predominate in the middle phases of occupation (Levels South M-O), whereas the arrowheads predominate in the upper levels (South P-T) (for an explanation of the levels at the site see Table 3.1). It is of note that the hunting scenes in the wall paintings are all in these upper levels and they have images of bows and arrows, with only one possible spear-bearer depicted (Sadvari et al. 2015b, 69). This shift from spear-throwing to bows and arrows is found to correlate with the prevalence of bone stress on changing parts of male (but not female) bodies, indicating a male association for these activities. Killing fast-moving prey is more efficient with a bow and arrow, but killing with a spear may have advantages with large animals, creating a more serious wound immediately and bringing the large animals down more quickly, and it involves more danger in that the hunter has to get very close to the prey; spears may have been used in conjunction with other hunter strategies such as snares, bolas, ambushes near trails and watering holes, concealed pits, and groups 'beating' fields/forests to drive prey into nets. As noted above, it is also possible that the 'wild' cattle were to some degree managed.

It is of interest that the spear is used most at the height of the provision of wild cattle installations inside houses in Levels South M-O. It is at this point that gaining prestige through killing and feasting on large wild animals reaches its height. Some houses show clear evidence of aggrandizement using these practices. For example, Building 52 starts as normal-sized and at one point a very small bench is set with wild goat horns. Later this feature is

turned into a large bench set with massive bull horns, while a full cattle skull is placed in a nearby niche and 13 wild bull horns are stacked on top (Fig. 4.3). Through time, too, burials are added (Haddow et al. 2016) in this house and the house itself is extended to include a large number of rooms. This seems to be a case of a house increasing its status and importance through mechanisms including killing and feasting on and memorializing 'wild and hunted' animals.

Figure 4.3. *13 bull horns stacked in a niche in Building 52 at Çatalhöyük (photo: Jason Quinlan).*

There are other aspects of the entanglements around elongated points. The sourcing of lithic material that had sufficient quality to be finely flaked into long blades and into bifacial points required long-distance travel or exchange (Nazaroff et al. 2013). Understanding of this process has been increased by research at Çatalhöyük where much effort has been put into sourcing large numbers of obsidian artifacts. Carter and Milić (2013a) show that the blanks used to make projectiles were all products of specialist workshops 160 km away in Cappadocia, either Kaletepe bifaces or large opposed platform blades from Nenezi Dağ. Once on site, the bifaces were buried in caches below the floors in the southern parts of main rooms of houses. Later they would be retrieved, thinned and retouched in the house in order to produce projectile points. These weapons thus had multiple authorship spread over space and time from Cappadocia to individual houses at Çatalhöyük.

The projectile points could thus be used to build up individual histories and identities. The clearest example of distinct identities associated with obsidian tools at Çatalhöyük is the scratching of distinctive marks on Canhasan III points (ibid.). But more generally, "one also notes the stylistic and scalar variability of the projectiles, both diachronically and synchronically; differences that we do not consider to be related to functionality alone. On the basis of ethnographic parallels, we argue that the wielding and use of these weapons was closely related to the creation, maintenance and expression of social identities, such as age grade status, kin group and ethnicity" (Carter 2011, 10).

The burial and retrieval of caches of obsidian were also linked to the process of construction and abandonment of houses at Çatalhöyük. In the earliest phase of use of Building 60, "there was a cluster of thinning flakes from a Kaletepe biface which had been swept up and included in a nearby bench, *prior* to the associated biface then being buried in a hoard" (Carter and Milić 2013a, 504). There is much evidence from other buildings of projectile manufacture at the time of house construction. Equally, the abandonment and dismantling of houses was also associated with projectile point deposition, especially the placing of used or broken points in post-retrieval pits, or in abandoned bins or on platforms. In numerous ways, then, projectile points used in hunting or warfare were inter-related with people, houses and their identities and histories.

Figure 4.4. *Examples of projectile points from Çatalhöyük (photo: Jason Quinlan).*

As noted above, the larger points are particularly associated with Levels South M-O which is the period at the site with highest population density and fertility. It could be argued that they were used in warfare. However, despite the fact that over 800 bodies have been excavated below the floors of buildings at Çatalhöyük, there has been no case of such a point embedded in skeletons. There is some skeletal evidence of blunt force trauma that did not lead to death, but the only artifact that has been found sticking into human bone as a weapon was made of animal bone. So it seems important to interpret the elaborate points as hunting weapons. They occur in the period in which most of the 'classic' traits of Çatalhöyük are most prevalent, such as bucrania on walls and benches and below-floor burial. Feasting deposits are dominated by wild bulls. So the preponderance of elaborate projectile points seems to fit into core concerns about building house-based histories and status. Hunting wild bulls in particular, but also other wild animals, seems at the core of the house-based social system. Houses vie with each other in the killing of animals and the giving of feasts and in the amassing of bull horns. When the dead are buried they are surrounded by, seemingly protected by, bull horns (as in Building 77). So it seems inadequate to conceive of hunting at Çatalhöyük as a supplement to agriculture. While hunting may be a supplement in nutritional terms, in overall terms hunting is so entangled in the social fabric that it contributes to the core of the social system. In these terms, it is more that agriculture is a supplement to a hunting/ritual/social house-based system. It is important to note that domestic sheep and goat and domestic plants play little role in the ritual and symbolic worlds of 'classic' Çatalhöyük. They remain un-marked. The core was the ability of house-based groups to build alliances through the circulation of the dead and through hunting and providing feasts. It might be argued that the domestication of plants and animals came into play only insofar as it allowed these interests to be more effectively pursued.

It is clear that these same processes continue into the upper levels of occupation Çatalhöyük, from Level South P onwards. This is the time of the impressive wall paintings that show large numbers of people, often men, engaged in hunting with bows and arrows or teasing and baiting wild animals with a variety of instruments. Another interpretation of some of the paintings is that they depict humans interacting with dead animals. There is undoubtedly dancing, and some individuals have more elaborate costumes than others (Fig. 4.5). This is large group but organized activity that could only have taken place away from the densely packed settlement. So, earlier practices continue, but there is also increasing evidence for change. Projectile points become smaller (as they do elsewhere in the PN), and there is a decrease in the scale of communal consumption (Demirergi et al. 2014). There is a decrease in the placement of wild bull horns in installations in houses and an increasing use of domestic cattle in feasting contexts. Houses become larger and more independent with greater emphasis on storage. It is at this point in the later 7th millennium at Çatalhöyük that we finally see domestic animals and plants being used as the primary basis for building households and community relations.

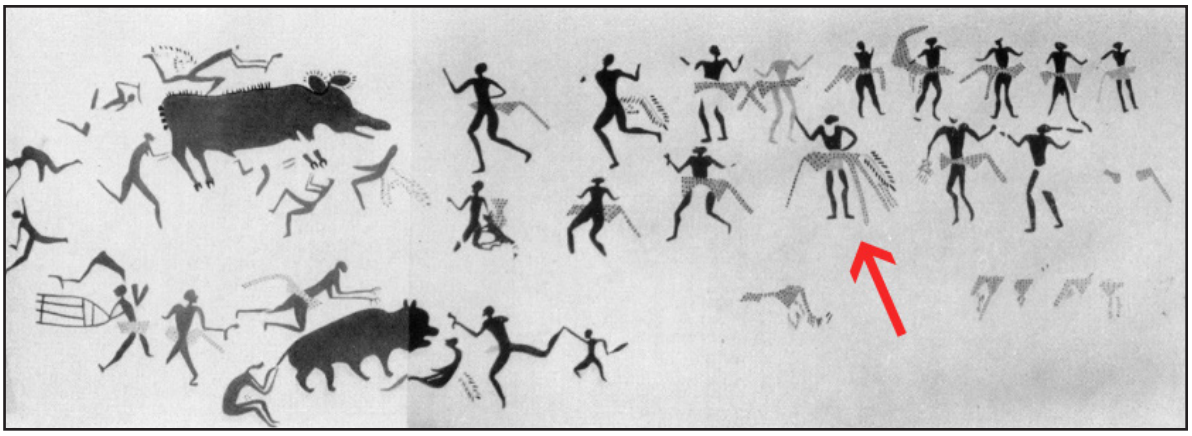

Figure 4.5. *Copy of painting from building F.V. I at Çatalhöyük discovered by James Mellaart, with individual with more elaborate costume identified.*

Conclusion

The argument of this chapter is that a consideration of the entanglements of hunting and wild animals through the late Pleistocene and early Holocene indicates that the hunt served far more than nutritional needs (see also Speth 2012 for a more general argument). For these increasingly complex and sedentary hunter-gatherers, wild animals played a key role in social categorization, identity and status. Both in the home, but especially in public buildings, wild animals, their meat and their symbolic attributes were used to build social alliances in a diversity of ways. In some cases the focus was on feasting and meat distribution, in others on cross-cutting sodalities based around key animal attributes.

Hunting and wild animals were thus the core of economic, social and ritual life in the sedentary villages of the PPNA and PPNB in the Levant, Anatolia and northern Mesopotamia. This is not to argue that gathered plants and domestic plants and animals did not play important economic and other roles, or that people did not spend much of their time in tasks related to these resources. Plants were used in feasting and other collective activities and they were key to domestic production. But it is very clear that, from the start right up until Çatalhöyük, plants and domestic animals were not highly marked symbolically. Indeed even at the late site of Çatalhöyük, plant storage is hidden in back areas in houses while wild bull horns are openly displayed in main rooms (Bogaard et al. 2009). People's attention seems directed to hunting and the wild and it is through them that social and ritual strategies are built. It is also possible that there were gender and age components to the differences between hunting and gathering, although at Çatalhöyük there is no evidence that men and women had different diets (Pearson 2013); it is important not to jump to the conclusion that women's work with plants was hidden and un-marked in contrast with male involvement in hunting. The real situation seems to have been much more complex and varied.

This chapter has argued that all the complex entanglements of hunting resulted in the continuation of a focus on wild animals long after the emergence of sedentary life. Arbuckle

argued that the social and ritual roles of hunting inhibited the adoption of domesticates; in this chapter the focus has rather been on the numerous entanglements of hunting such that to give up hunting would have been very disruptive, undermining many aspects of social and ritual life.

Why then, in the end, were domestic plants and animals adopted? This chapter contributes to this question by arguing that farming may have allowed an increased focus on social and ritual strategies based on hunting. This is not just a matter of increased prestige through feasting (Bender 1978; Hayden 1990), but a broader pursuit of a wide range of strategies within houses and communities. It is remarkable that, after millennia of projectile point production, the most elaborate and time-consuming production occurs not at the high point of hunting and gathering economies, but at the time of the first domesticated plants and animals in the PPNB. Is it possible, then, that the domestication of plants and animals occurred because people wanted to hunt more? As investment in hunting rituals of various types increased, dependence on domestic sources of food would have supported larger-scale events associated with hunting. Hunts could become more risky and elaborate if the buffer of domestic cereals and sheep and goats existed. Domestic resources were a steady presence in the background, allowing a focus on amassing prestige through hunting, killing and feasting, as well as through circulation of the dead.

Everything suggests that these early farmers were very caught up in complex social and symbolic worlds that centered on hunting and the wild. The building of community and house were based on success in these areas. From the Palaeolithic and Epipalaeolithic into the Neolithic, social lives were primarily entangled in the multiple dimensions of hunting and wild animals. This entanglement was so caught up in so many areas of life that it continued on through the PPNA and PPNB and, at places like Çatalhöyük, into the early PN. Intensification of the exploitation of plants and animals can thus be seen as an offshoot of this primary focus. The build-up of domestic resources provided a safety net that allowed greater elaboration and intensification of hunting as a social and ritual process. Aggrandizement focused on these latter areas of life.

In some ways the use of domesticated resources and the continuing hunting of wild resources may have complemented each other. It may have been possible to fit the mobility required of hunters into the mobility needed for grazing domestic flocks, and the flocks may have attracted predators that could be hunted. But on the other hand there were tensions, particularly in the relation between crops and wild animals. The increased labor demanded by domestic crops and herds must have constrained hunting activities and, as we have seen, by the time of Çatalhöyük the 'hunting' of 'wild' animals may have been managed. In the end the focus on hunting declined in the Pottery Neolithic as the entanglements of farming became increasingly demanding.

Over the ensuing millennia, hunting and wild animals played a diversity of roles in the establishment of elites, in the pursuit of male identities, in the management of landscapes. Still today hunting trophies adorn the walls of stately homes, and game parks attract global tourism. Through the course of time, hunting and the wild have been given a diversity of new

meanings. But, as we have found with the Neolithic case, it is wrong to see such activities as simply a hangover from our hunter-gatherer selves. Rather hunting has found new roles through time linked to different forms of entanglement.

Chapter 5

Power and the Poverty Trap

This chapter is about the situatedness of power and inequality. I want to start with Paul Willis' 1977 *Learning to Labor: How Working Class Kids Get Working Class Jobs*. The book looked at 12 boys – the 'lads' – in their last two years at a school in the West Midlands in England in the 1970s, at a time when unemployment was not particularly high. The book attempts to get inside the thought processes of these young boys as they made the decisions that would set them on one path or other in their lives. The boys were creative, defiant, thoughtful, belligerent, and very aware of the decisions they were making, articulate and humorous. They were undoubtedly strong and masterful agents. They were powerful young men. And yet they made decisions that recreated their working class category. They reproduced their own subordination. In reacting against the establishment, they made choices, such as not doing well in school, spending time in the pub, that made sense to them but which ensured the reproduction of their own conditions of existence. Paul Willis' book did not blame the boys or the working class more generally. Rather it pointed out that the boys had few alternatives; it gave the sense of their being stuck or entrapped.

What can entanglement contribute to our understanding of different forms of power relationship? As humans we have evolved a particular way of dealing with the world that depends on technologies. We are successful and productive as a species at least partly because we came to use tools to achieve our ends. Tools are productive of human life. But as soon as the first tool was invented, we started to be constrained and limited by our dependence on tools, their procurement, manufacture, maintenance, discard.

Take the effect of the invention of the wheel. This invention in Eurasia in the 4th millennium BC led to carts, chariots, water wheels, potters wheels, and later cars, trains, buses, planes. The modern world is entirely dependent on wheeled vehicles. I ask you to try and imagine how long you would survive if you could not use a wheel. How would you get to the supermarket? How would you get food after the supermarket lorries had stopped running? Where would you find land to grow crops and how would you get there? Where would you find the seed to grow crops … and so on and so on. Modern society is entirely dependent on the wheel. But this dependence also involves dependency in that we become constrained by

the vast networks of debts and relations that go into making a car, we are constrained and entrapped by our resulting dependence on oil, and we are constrained by the effects of carbon fuel emissions on global warming. We would like to solve the increase in global warming but we cannot get rid of the car – we have become too dependent on it. Our economic and social systems, our livelihoods, would collapse without the car or wheel.

The tension between dependence and dependency produces continual movement and change. We keep searching for solutions to the entanglements and entrapments we find ourselves in. Human 'being' involves us in things, but things are unruly, have their own lives and needs. They are us but not us, and we continually devise new things to manage the entanglements and entrapments. We invent hybrid cars, electric cars, we use public transport – but these solutions only lead to further entanglements and entrapments. There is a continual movement produced by the unity of opposites that is humans and things. But what is the relationship between this type of human-thing entrapment and the entrapments of power described by Willis?

Power and entanglement

What is the relationship between entanglement and power? Certainly both entanglement and power describe situations of limitation and constraint – both describe a situation of entrapment (Baehr 2001). So, is entanglement a form of, or the same as, power? I will explore this question in the rest of this chapter. But one can perhaps already see that our entrapment in cars differs in some respects from the entrapments of power. Of course there are powerful interests that get profits from cars and control petrol supply. But superficially, and this is something that needs unpacking, the entrapment produced by dominant groups seems to differ from our entanglement in wheels and cars; we seem entrapped in cars whether elites are involved or not. I want to argue in this chapter that entanglement produces entrapment and constraint that is different from the workings of power, even though it might produce or be produced by power.

We have tended to see power as something that is top-down, wielded by dominant groups that have 'power over'. We tend to relate power to inequality, the rise of complex societies and dominant elites that control the means of production, exchange relations, specialized knowledge, prestige goods and so on. But archaeologists have recognized for some time that there is also 'power to', that is the ability to mobilize resources in one's interests or to achieve one's goals (Miller and Tilley 1984).

Another lesson we learned from discussions of power in archaeology was that different forms of power are produced in different historical contexts (ibid.). From Marx to Foucault we learned that in different social conditions, whether feudal systems or capitalist states, different forms of power and domination were possible; and that in the nineteenth century in Europe new formations of power and knowledge arose in which bodies were surveilled and administered in prisons, hospitals, schools, all informed by the ideas and practices of the panopticon.

This type of surveillance society creates a situation in which individuals are entrapped within discourses and regimes of power/knowledge.

The focus on entanglement is close to that of regimes of power/knowledge in that it posits a specific historical context within which entrapment of a particular type is produced. But entanglement focuses less on discourse and power/knowledge and more on the practical messes, the everyday constraints and restrictions that people find themselves caught in. For Foucault, power was everywhere. Entanglement focuses on the ways in which people are entrapped, whether they are elites or non-elites. Entanglement allows us to explore how both dominant and non-dominant groups are entangled. It allows us to look at how elites also are entrapped, even if less so, or differently, than non-elites. It allows us to argue that there is more to inequality than domination and power.

In order to explain what I mean I would like to describe some archaeological examples that deal with the continued use of sites after they have been abandoned by elites amongst the Maya (McAnany et al. 2015; see also McAnany and Yoffee 2009). In a number of the case studies, as elites left or abandoned a site or region, non-elites remained and had to find a way to cope. It seemed that elites were not very entangled in a place; they could abandon a locale. They had the resources, knowledge, connections etc. to move away. But non-elites were entangled in place, tied up in local crops and skills and knowledge. They had given meaning to local places and invested them with memories. They could less easily uproot.

We see this in the case of Minanha in Belize (Lamoureux St-Hilaire and Iannone 2011). The royal court at Minanha was abandoned around 810 CE (McAnany et al. 2015) with a slower decrease in the surrounding population over the next four centuries. The royal residential courtyard was carefully filled in and buried. This reverential process suggests a "local sentiment that valued this symbol of local grandeur and authority" (ibid., 269). Surrounding agrarian households continued to be occupied and non-royal burials were placed in the abandoned architecture of the ancient royal core. The burials created links to the ancestors and bound the community together even when the elites had abandoned the site. On the one hand it seems tragic that local people were so invested in a site abandoned by those that had dominated them; but on the other hand the investment created community ties in the present and helped to sustain the community after the elite abandonment.

Another example is discussed by Olivia C. Navarro-Farr at the Maya site of El Perú-Waka'. She looks at the main civic-ceremonial shrine at the site that had a lot of material deposited by non-elites in the Late-Terminal Classic at the time of the decline of the site's royal court. There is also a lot of re-setting of stones and stele in new juxtapositions. The aim of all this was to improve agricultural potential and restore sacred balance in the community and in the land, long after the decline of the royal court – and such rituals have gone on to the present. As McAnany et al. (2015, 267) describe it, "At Waká, the sustaining population carried on after the royal court was abandoned. On the flanks of monumental architecture, ritual specialists – who pretty clearly were not royalty – left behind broken artifacts and evidence of expedient constructions (Navarro-Farr et al. 2008). Arguably, at Waká, we are witnessing the

materialization of an effort to "hold the center" – and to dialogue with deities in the absence of a royal mediator".

In these examples we see that elites might 'own' and 'control' a place, but that the people that are owned and controlled may become most invested in place and need it most – they are the ones that become habituated and entangled, whereas the owners can move away. "The extreme localness of the sustaining population of farmers and artisans stood in stark contrast to the regional connectivity of royalty who moved among allied cities, witnessing anniversaries and coronations and negotiating alliances through offspring of marriageable age" (McAnany 2015, 271). With the nodes emptied, remaining residents lacked access to the benefits of participating in a network of effective alliances that included various forms of protection, support and assistance when needed.

We can of course say that the reasons non-elites stick to places is just habituation and habitus. Bourdieu (2013) in his discussion of class distinction focuses on our dispositions that recreate and transform the larger social field. We could say that these examples from the Maya show that people get stuck in certain dispositions; and similarly for the working class kids in England. But my argument is not based on habituation. Rather, I argue that non-elites get entangled so that they are trapped in particular investments and networks of resources such that they have little choice to change. People make choices that are practical and pragmatic; non-elites may simply not have the choice, resources, networks, skills, knowledge to move away. It may make practical sense to stay put. In these Maya examples, non-elites remain entrapped even when elites leave. Their entrapment and lack of choice derive from something other than 'power over'. Even centuries after elites have abandoned a place, non-elites remain tied, entangled and entrapped. All this suggests that power and entanglement may be rather different, producing different forms of entrapment.

I do not want to deny that people get caught by despots into appalling entrapments. But I do want to argue that there is a dimension of entrapment that is not reducible to control by dominant groups. I want to argue that there are practical entanglements in which people find themselves and which it may be in their best interests to sustain. People are not solely entrapped in social groups or classes because they have become disposed to act in a certain way. Rather, they get entrapped because they have little choice in terms of their material and knowledge resources.

If the entrapments of power can be separated from the entrapments of what I have called entanglement, we can then ask the question, who is most entangled, elites or commoners? While we are most used to think of non-elites as entrapped and powerless, the entanglement perspective allows us to explore the ways in which elites too are entrapped. They may have more resources at their disposal, but these very resources create entanglements and entrapments. For example, elites may depend on access to prestigious or rare goods, they may take on loans and debts, they may depend on their control of armies. In all these ways they have a lot to lose and may suffer or lose power as a consequence. On the other hand, they are more likely to have the resources to find their way out of trouble, to relocate, or re-negotiate terms.

Non-elites seem more circumscribed. Indeed I would argue that they are often doubly entrapped. The first type of entrapment is the type I have been focusing on in this volume, that is the practical and everyday process of being caught up in human-thing dependencies. These are the strategic decisions of the boys in a working class school and neighborhood in the West Midlands, and the practical engagements of local Maya communities when those living in elite residences leave. Dealt a certain set of cards, we are positioned and situated, and we work within these parameters as best we can.

And yet on top of this there is a second type of entrapment experienced by non-elites, that is the 'power over' wielded by elites. To varying degrees in different societies and contexts, elites can manipulate the entrapments of entanglement, add to them, exploit them, to exacerbate entrapment. The chains of slavery, of abject poverty, of ignorance, of lack of rights can be imposed by elites, causing new realms and levels of entrapment. This human to human entrapment is often based on the control of things, resources and labor. But the human to human entrapment is often possible because the two types of entrapment reinforce each other. It becomes possible for elites to exploit non-elites precisely because non-elites are entrapped in entanglements which afford them very little and give them little room to maneuver.

Ultimately this is why it seems to me to be important to separate entanglement from power. It is not enough to deal with power if one does not deal with the deprivation, lack of education, lack of resources that people find themselves caught within. It is important to recognize and address the double bind of dominated groups and classes. It is important too to recognize that elites may hold on to power at least partly because of the entanglements they find themselves within – they have too much to lose. It seems to me to be wrong or at least unhelpful to say that humans have a basic 'will to power' that surfaces wherever and whenever it can. Rather, power over other humans is produced in particular entanglements; it is the study of those entanglements that leads to a deeper understanding of the intractability of power.

Poverty traps

The discussion so far in this chapter has described the double bind experienced by dominated groups, entrapped both by human exploitation (power over) and by the social-material conditions of daily life. In historical eras at least, this double entrapment of the dominated is often associated with poor conditions and poverty. The notion of poverty traps has been widely discussed in relation to recent and contemporary economic conditions. The argument is that low-income groups are not just poor. If they were 'just poor' then presumably they could pull themselves out of poverty. The fact that poverty seems to reproduce itself through generations suggests that pulling oneself out of poverty is difficult. Many people seem trapped in poverty. Can discussion of entanglement contribute to the understanding of these poverty traps?

The poverty trap takes many forms, but the term is usually used to describe some form of feedback or spiraling mechanism whereby people cannot get out of poverty, often because of a lack of sufficient resources. If people lack capital it may be difficult to acquire it, in a self-reinforcing negative cycle. In addition, tax laws and income-related social security bene-

fits are often structured so that if people earn more they have to pay higher taxes and gain less benefits so that their disposable income decreases and they cannot escape welfare dependency.

Gore (2003, 2) defines the poverty trap as "a situation in which poverty has effects which act as causes of poverty. There are thus vicious circles, processes of circular and cumulative causation, in which poverty outcomes reinforce themselves". He argues that poverty traps exist at different scales from the household and community to the nation and to the global. At the international level there are debt traps, and traps caused by trade agreements. Gore describes the poverty trap as stemming from the fact that escape from poverty is linked to economic growth, but economic growth is restrained by poverty. If a majority of the population in a country has very low income, a major part of GDP has to be devoted to gaining the necessities of life. There are few resources available to allow public funding on education, health, administration, law and order. Low incomes lead to low savings; low savings lead to low investment; low investment leads to low productivity. Poverty also leads to environmental degradation as, for example, people cut down forests to gain a livelihood. The situation is made worse by international trade and finance agreements. In some cases development aid ends up being used to pay off international debts.

Often, even if large sums are provided, people become dependent on the aid so that there is not a sustainable escape from poverty and the trap becomes deeper and more severe (Moyo 2009). At the global scale, poverty traps of these types are compounded by entanglements with other processes such as environmental degradation, poor health, war and insecurity, corruption, lack of infrastructure, poor education, lack of skills and training. Dealing with one part of the entanglement (for example by providing loans) may lead to problems in other areas. There is a need to deal with the entanglements as a whole. An example of the complex entanglements is provided by Bonds and co-workers (2010) who show the intersections of poverty and disease. Higher income affords some level of protection against infectious diseases, via nutrition and better sanitary conditions. So disease prevalence falls as income rises. However, human health is required for economic productivity, so productivity falls as disease prevalence rises. There is thus a trap making escape from poverty difficult, unless a major amelioration in health or income can be achieved.

As noted above, the poverty trap implies that large amounts of development aid may be needed on several fronts in order to provide the potential for escaping poverty. This is why development projects are so difficult and so often fail. An example of how disastrously things can go wrong is the groundnut scheme, a development project of the British government between 1946 and 1951 in the southern province of what is today Tanzania (Rizzo 2006; Wood 1950). The reasons for the abject failure of this example of colonial intervention have been much discussed; my purpose here is to explore the deeply embedded connections and contexts that made it so difficult for the region to move out of poverty.

How did the groundnut scheme come about? After World War II, the US declared that it would end financial aid to allies. Britain had a large balance of payments deficit and could not afford the high prices demanded for vegetable oils and fats in international markets. It was therefore decided to mount large-scale production of oil-producing plants on African soil. The

British government undertook to produce groundnuts in vast swathes of southern Tanzania. Since population in the region was low, it was decided to mechanize the process of production as far as possible.

When the project was shut down in 1951 it had cost 36 million pounds of British public money, with limited groundnut production. Rizzo (2006) discusses the problems that were encountered. The initial evaluation of the region had not realized that at least in parts of the area there was insufficient rainfall to cultivate groundnuts. The clay content of the soils meant that agricultural operations were impossible in the dry season. The soils also damaged the machines that were brought in; bulldozer blades were ruined by the ground roots. The machines had not been tested in tropical conditions and there were few spare parts and inexperienced drivers and mechanics. The supply of machines was impeded by the blockage of the ports in Mombasa and Dar es Salaam. There was a very inadequate road system (German and then British colonial powers had not invested in this because they thought the agricultural potential of the area was low). There was a single railway line at the start but a flood destroyed the tracks. In any case there were insufficient numbers of machines available in the international market and so World War II tanks were rounded up and converted into bush clearing machines, but this added extra costs. In addition, Rosette disease attacked the groundnuts in parts of the region and there was no known treatment. Harvesting was impeded by the paucity of local labor and the difficulty of finding migrant labor. There was inadequate housing for laborers and poor water quality. The influx of investment "stimulated rampant inflation of both goods and wages, and social unrest, of which the spread of alcoholism, prostitution and theft were the most obvious symptoms" (Rizzo 2006, 211). Thousands of men were drawn from their small farms to work on the scheme, thus depressing local food production and supply. Over time fewer and fewer groundnuts were grown in the area (Hogendorn and Scott 1981).

This example shows the complex heterogeneous mix of processes that are involved in development projects; in practice there are many entangled processes that intersect with each other and spread out into numerous domains. If large scale interventions are made, sometimes the situation is made worse and the trap just deepens. Even where, unlike the groundnut scheme which aimed at an exploitative development, the main purpose is aid, similar problems may be encountered. Indeed, the difficulties have led some commentators to suggest that all aid should be halted (Moyo 2009).

An alternative and more hopeful view is that it is indeed possible to escape the poverty trap by following structural investment strategies (as the Chinese have been doing in Africa – see Moyo 2009) or making small-scale interventions. For example, Moran and co-workers (2003) argue that a focus on families and on the education of children can have positive outcomes in terms of some mobility out of poverty. Their study of how to break the intergenerational transmission of poverty in South America places an emphasis on families and family relations rather than just income. While such interventions are welcome, it is clear from the work of Moran and co-workers that providing opportunities for children can only successfully lead to transitions from poverty if a whole series of other variables are dealt with,

such as parental involvement, higher incomes for families, health management, government intervention, provision of education and social services.

Similar comments are relevant to the use of microfinance schemes to alleviate poverty. Microlending involves providing small sums to a member of a small group of, for example, traders in a rural village. If the loan plus interest is repaid then a further small loan is made to another member of the group and so on. It is in the interests of all members of the group to support each other in repaying the loans and schemes of this type have been very successful worldwide. Hermes and Lensink (2011) review evidence for the effectiveness of microfinance lending and whether it relieves poverty. The results are very mixed and many argue that the schemes are not effective in reaching the very poor. Despite examples of success in poverty alleviation after disasters, and in the empowering of women, much seems to depend on a range of other cultural and social factors. For example, Ahlin and co-workers (2011) show that the success of microfinance institutions depends on the country-level context, in particular macroeconomic and macro-institutional features. They find that microfinance institutions are more likely to cover costs when growth is stronger and where there is more manufacturing and higher workforce participation. Van Rooyen and co-workers (2012) show that the ability of microfinancing to alleviate poverty depends on population density, attitudes to debt, group-cohesion, enterprise development, financial literacy, and financial service provision. The region or country context and environment affect whether microfinancing schemes are sustainable. Globally many microfinance institutions are dependent on donor funds and are not sustainable long term. In many parts of Africa the schemes remain largely unavailable. All this suggests that a lot more is needed than just lending money to the poor. A lot else has to be in place to allow the schemes to work in lifting people out of poverty. When considering a broad range of factors including income, savings, expenditure, and the accumulation of assets, as well as non-financial outcomes including health, nutrition, food security, education, child labor, women's empowerment, housing, job creation, and social cohesion, van Rooyen and co-workers (2012, 2249) find that for sub-Saharan Africa "the available evidence shows that microfinance does harm, as well as good, to the livelihoods of the poor". In India many people have become over-indebted, businesses have failed and suicide rates have risen (ibid.). "Microfinance can, in some cases, increase poverty, reduce levels of children's education and disempower women" (ibid., 2259). Reducing poverty through individual or small-group agency is very much entangled with a wide range of factors and networks that often conspire to trap people in poverty despite carefully designed and well-intentioned intervention.

The notion of the poverty trap reinforces the view that dominated groups get caught in a double bind, constrained and exploited by dominant powers (as in the groundnut case) and at the same time entrapped in a mesh of practical problems, debts and disadvantages. The entanglement perspective draws attention to the multiple intersecting processes that conspire to compound and lock in the trap. And yet, much archaeology of poverty and inequality has appeared to focus on the strivings of individual agents. Symonds (2011) describes how historical archaeologists have documented the lives of those living in slums and in poverty, and describes how such studies often seek to demonstrate the agency of the poor, despite their conditions. He worries that such accounts give the impression that hard work and sheer

tenacity can overcome adversity, and that individuals can strive to ameliorate their positions. The studies, he fears, appear to endorse the view that in neo-liberal democracies inequalities should level out. There should be a trickle down as the prosperity of the wealthy spreads through society as a whole. The play of the market should allow entrepreneurial initiative and the overall growth in the economy. The view presented in this chapter, however, is that for some people things just do not work out that way. There are huge global differences in wealth, and within many western nations there are increasing gaps between the super-rich and the very poor. Symonds points out that there are many aspects of poverty – including hunger, lack of shelter, illness and lack of access to medical care, lack of education, lack of employment and representation. The argument in this chapter is that this totality of entangled intersecting factors makes escape from the poverty trap extremely difficult, hence the low values for upward mobility in many developed countries.

The 'origins' of inequality

What does this focus on the entrapments of dominated groups imply for archaeological discussions of the origins of inequality? First, as was discussed in Chapter 3, the search for origins is problematic as it is always possible to search for the origins of origins in an infinite regress. In the case of inequality, all human (and indeed many or all animal) societies have some form of inequality. We can confine our search to inequality that cross-cuts age and sex, but even then there is much evidence of special, elaborate and rich burials from very early in the Palaeolithic of Europe. Inequality has deep roots and finding its origin takes us into deep time and into studies of animal and primate behavior. Second, archaeologists have tried to explain increases in inequality by dragooning in an army of possible causal factors (Bender 1978; Hayden 1990; Kuijt and Goring-Morris 2002; Price and Feinman 1995). In particular it is argued that the intensification of production leads to the ability to produce surpluses which can be controlled and underpin social differentiation. Specialized craft production or restricted resources provide the opportunity for elites to emerge. Elites manage to assert power through the control of prestige exchange, ritual or feasting. This is all fine but it leaves open the sorts of follow-on questions discussed at the start of Chapter 3 – why does intensification occur, why do people let specialization take place and the restriction of resources, why are people allowed to control prestige goods or to convert status gained through giving feasts into political power? Answering these questions leads to an understanding of the radical dispersal of causality through the long extended threads of heterogeneous entanglements. To explore these threads in their specificity involves exploring daily practice and the particular intersection of processes as in the examples given in Chapter 3.

From such a perspective, inequality and differential power are produced within entanglements. Flannery and Marcus (2012) in their book-length treatment of the origin of inequality take the neo-liberal line; that inequality is created by through clever manipulation by aggrandizing individuals. The approach taken in this chapter is very different. We can return to the arguments in Chapter 3. The diagram shown in Figure 5.1 indicates some of the ways that the complex unfolding practical problems at Çatalhöyük created the potential for in-

creased inequality. The diagram does not capture the full range of factors leading to increased inequality at the site; its aim is simply to illustrate examples of a more general process by which everyday problems and the fixing of those problems produces emergent qualities such as inequality. In reality many other entanglements need to be considered to fully account for the emergence of inequality at Çatalhöyük.

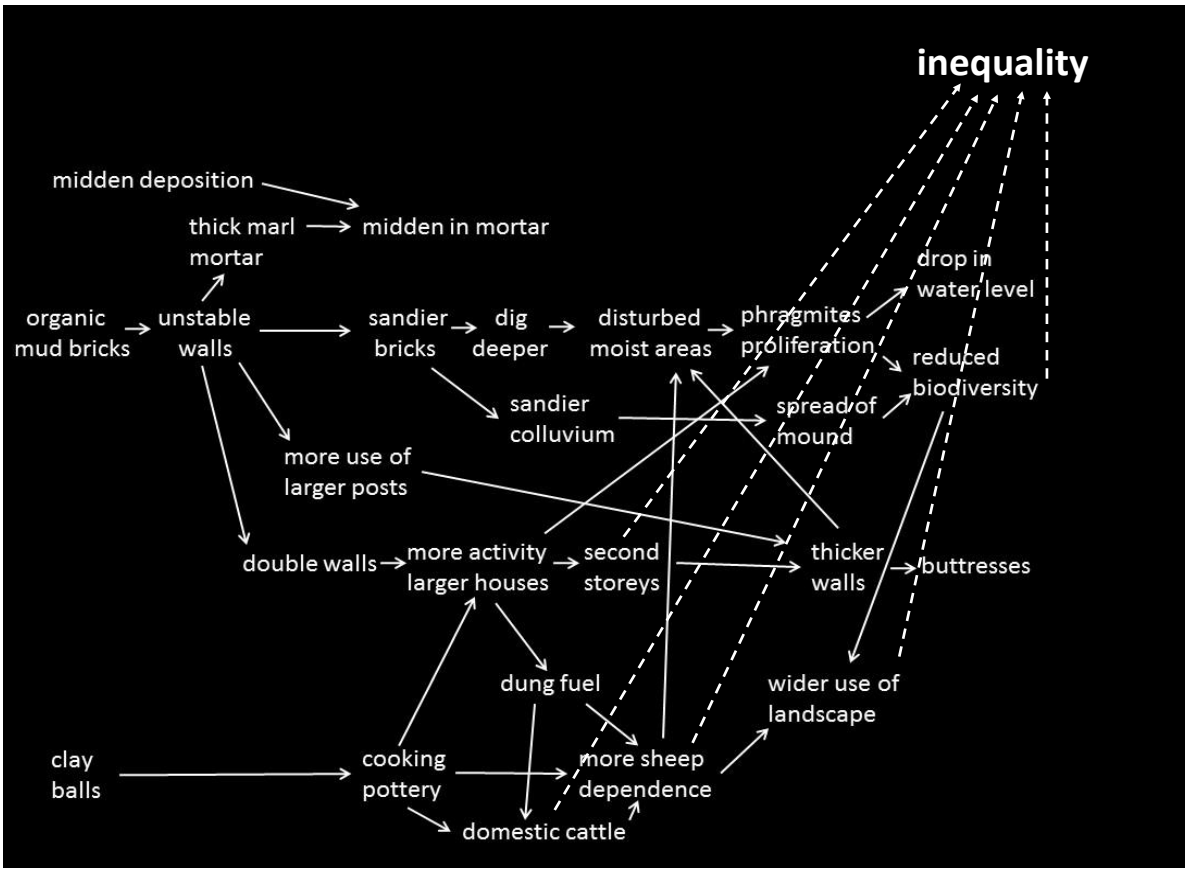

Figure 5.1*. Potential factors leading to increased inequality at Çatalhöyük.*

Up until about 6500 BC, Çatalhöyük can be described as an aggressively egalitarian society (Hodder 2006, 2014c). However, this does not mean there was no inequality. There is some evidence of age differentiation (Pearson and Meskell 2014), but the main differences were between houses (termed history houses) that had many burials and animal installations and endured over time, and other houses that had less of these characteristics. Düring (2006) has shown very clearly that through time in the lower phases of occupation up to 6500 BC certain houses came to dominate in terms of numbers of burials and ritual installations. These houses were central in the social and ritual spheres, but they seemed unable to translate this social and ritual distinction into the control of storage and production. There is no evidence that such houses contained more storage or controlled production (Hodder 2014c). There were obviously strong leveling mechanisms that prevented ritual centrality being translated

into economic advantage. But around 6500 BC (at the end of Levels South O and North G) there is much evidence of disruption. Many buildings are burned and the continuity in house rebuilding is broken. In the upper levels of occupation, larger elaborate buildings emerge such as F.V.1, A.III.1, A.II.1 that had rich paintings on internal wall surfaces as well as large amounts of storage space. These later buildings do manage to link symbolic and economic aspects of power. They are part of a larger process of increased independence of houses in the upper levels, with greater differences emerging between smaller and larger houses. By the end of the Chalcolithic West Mound in the mid-6th millennium BC, Building 25 stands out as a very large building containing a large central room and numerous ancillary rooms.

Figure 5.1 identifies some of the practical interactions that made this transformation possible, as discussed in Chapter 3. The problems caused by digging around the mound, disturbing local habitats and proliferating reeds all had to be managed. As outlined in Chapter 3, there is evidence that in the upper levels of occupation houses started to manage their own herds and 'houses' became more like independent farms. The collective ethos that had dominated in the lower levels of occupation was perhaps unable to cope with the numerous interacting problems as they emerged. Houses found the burden of building ever more social ties difficult and they started becoming larger and more independent; including building second stories. In addition the greater investment in herding domestic sheep and the adoption of domestic cattle allowed individual houses to build up individual wealth. The care of domestic cattle in particular both depended on labor investment and provided wealth on the hoof. The wider use of the landscape, in very practical terms, meant that surveillance and collective control were increasingly difficult.

As noted in Chapter 3, the period just before 6500 BC in Levels South N and O show evidence of high population density, increased fertility, increased trauma and disease. The increased numbers of burials in some houses suggest that social ties were being made through the location of burials in certain houses; similarly social ties were built by the increased installation of bull horns and other ritual objects in certain houses. As densities rose people built more and more social ties in order to buffer periods of economic hardship; the system depended on social ties for support since house-based storage was small in scale. Managing and provisioning all these social ties and debts must have become increasingly difficult. The solution that was found after 6500 BC was greater house independence. Houses were able to build their own resources, control their own herds and build up larger amounts of storage. Rather than investing in numerous cross-cutting social ties, houses became more self-sufficient economically, owning their own cattle and investing in sheep herding. But these shifts opened the door to economic differentiation and inequality. The social focus was no longer on collective sharing. While the collective ethos had been in place it was not possible for individual houses to build up their own resources; the system depended on every house pooling resources. But given the build-up of problems towards 6500 BC a solution had to be found that allowed more individual house independence. As a result social, ritual and economic differentiation could emerge, leading to inequality.

It might be thought that houses that already had a dominant position in terms of ritual and symbolism would be best placed to take a dominant position in the new system after 6500 BC. They already had an advantage and could use this to attain a dominant position in terms of economic production. But in fact the evidence suggests otherwise. Very few buildings have been excavated across the 6500 BC divide. This is largely because there seems to have been much disruption at this time. But there is some evidence that the dominant history houses prior to 6500 BC did not continue as major central buildings in the upper levels of occupation. For example, Building 1 and Building 52 were both replaced by smaller buildings. Düring (2006) has shown that the buildings that become central buildings in the ritual and symbolic system up to 6500 BC had little elaboration and few burials in the upper levels. The major buildings with much art and burial and with much storage in the upper levels appear to be new foundations. In this case, unlike the Mayan examples given earlier, it seems that it is the dominant groups that had become entrapped. As is discussed in Chapter 4, Arbuckle (2013) has argued that domestic cattle were adopted late at Çatalhöyük and in central Anatolia because societies were deeply embedded in rituals associated with wild cattle. The ritual elites that had emerged in the history houses at Çatalhöyük seem to have become entangled in a range of practices such that they were resistant to change. After 6500 BC it was other houses that were most able to adopt changed lifeways based on domestic cattle and sheep and increased house-based production and storage. In this case it was the dominant groups in the older system that were less able to adapt to change.

Conclusion

In this last example from Çatalhöyük, it is argued that inequality is an emergent property of unfolding entanglements. Inequality is not a result of a small number of identifiable causes, and it is not just the result of creative aggrandizing individuals. Rather, it emerges as a result of numerous small changes within entanglements that produce unexpected problems that need fixing. Inequality may emerge as one of those fixes. But the way that it emerges is highly contingent on the specific entanglements. In the Çatalhöyük case, it is dominant groups that seem unable to change and transform ritual centrality into economic inequality; non-dominant groups, however, can take advantage of the larger changes in entanglements to create new forms of power. In the Maya cases considered earlier, on the other hand, it is the elites that seem most able to transform while non-elites appear caught in a type of poverty trap, tied to land, place and community. Perhaps the same can be said of the working-class lads from the West Midlands.

I have discussed the poverty trap as an example of the entrapments of entanglement. In historic and recent times people get caught in traps that make escaping from poverty extremely difficult. Subordinate groups are caught in a double bind, dominated by powerful groups and individuals and entrapped in numerous overlapping entanglements including low income, poor health, limited education and bureaucratic barriers. What entanglement emphasizes is that these traps involve the compounding of heterogeneous processes and practices. Poverty has many dimensions that conspire together. It is thus hard for individuals to move out of

poverty. Large-scale interventions are, as a result, often called for, but the complexities of the entanglements make such development projects dangerous with many unexpected and unintended outcomes. The entanglements are multiple and they extend out in long interconnected threads. Intervening in such entanglements often leads to failure and to calls for an end to aid. But precisely because we are now so globally connected it seems morally unacceptable to do nothing. We seem, therefore, to ourselves be caught in the trap of endlessly trying to fix things in order to end inequality, and then trying to clean up the mess. This indeed is the process of entanglement.

Chapter 6

Creativity and Disentanglement: The Origin of Darwin's *Origin*

Early humans such as *Homo erectus* made stone tools called handaxes. They made them for about 1.5 million years! The handaxes vary, especially in later millennia, but for long stretches of time they looked very similar. Simple in form but by no means easy to make, they are often described as having a symmetry, as being aesthetic (Depaepe 2009). Does this enormous stability mean that these early humans were less creative and had less agency than we do today? Does the overall slow rate of change in deep prehistory mean that these humans could copy but not make things anew? In the Upper Palaeolithic, *Homo sapiens* is associated with very slow change in tool types over millennia. Such humans made spectacular art on cave walls but it is remarkable how little stylistic change there is over great expanses of time. In France, from the paintings in Chauvet at around 30,000 BC to the later Magdalenian representations, Depaepe (2009, 143) estimates 1,000 generations. It is difficult, if not impossible, to tell the early and late paintings apart. Even in the Neolithic, the rate of change seems stuck in a quagmire. The excavators at the tell site of Aşıklı Höyük have exposed a section through most of the sequence of occupation. The numerous layers over 1,800 years (from perhaps 9000 BC to 7200 BC Stiner et al. 2014) show a staggering continuity not only in the location of buildings rebuilt over each other, but also in the exact locations of hearths and other internal features. Does such repetitive behavior mean that these people were less creative, innovative agents than we are?

Why do we ask this question? Why have social scientists become so interested in agency and creativity over recent decades (Dobres and Robb 2000; Mithen 2005)? Perhaps the answer is that modern post-industrial capitalism puts such a premium on start-ups and innovative technologies, as the near sanctification of the memory of Steve Jobs demonstrates. Or perhaps the focus on creativity is a romantic nostalgic response to the repetitive character of much modern life, its reproductive mass sameness. Or is it that in our digital virtual worlds in the clouds we have become so far removed from material skills and practices that we have become fascinated with how people use their hands to make things? Or is it that modern worlds have become so large and interconnected that we have lost a sense of individual agency? Ben-

nett (2010) and Latour (2005) describe ways in which we live in an increasingly entangled world, in which the modern self feels biotechnologically, medically, virally, pharmacologically entangled with non-human nature.

For whatever reason, we have come to want to find creative agents in the past. As one small but telling example of this trending of creativity, a book that might earlier have been called the origin or evolution of social inequality is today called 'The Creation of Inequality' (Flannery and Marcus 2013). In much archaeological and social theory we assume creative agents who impose their ideas on the world. In their book Flannery and Marcus describe powerful agents who manipulate societies in their own interests to create inequality, monarchy, slavery and empire.

In a series of writings, Tim Ingold too has turned his attention to creativity. But his approach is very different from Flannery and Marcus. He sees such work as dogged by the separation made by Aristotle between form and matter. Instead Ingold (2010) suggests that creativity emerges within the flows and transformations of material. Creativity is "an improvisatory joining in with formative processes" (2010, 3). In his book about 'making', Ingold (2013) explores processes in which maker and material work *with* each other, rather than the maker studying or imposing on the material. For Ingold (2010, 44-5), making is "not the imposition of preconceived form on raw material substance, but the drawing out or bringing forth of potentials immanent in a world of becoming". Similarly archaeologists such as Malafouris (2013) have successfully demonstrated ways in which humans and things co-produce each other. As a human makes a pot he or she responds to the material affordances of the clay in the improvised moment of production.

Artistic endeavor is a special type of creativity, as will be argued below, but here too there are differences in perspective about whether creativity is an imposition of form on matter or a co-production. There are those artists such as Andy Goldsworthy who take a more processual, embedded approach. Goldsworthy's (2015) ephemeral art is integrated into fields, frost and rain; it is very immediate, transient and improvised. Goldsworthy contrasts his approach to the artist facing a blank canvas. Goldsworthy's and much performance art seem close to Ingold's (2010, 2013) account of artist and material co-production. "The role of the artist is not to reproduce a preconceived idea, novel or not, but to join with and follow the forces and flows of material that bring the form of the work into being" (Ingold 2010, 10). On the other hand there are conceptual artists, for whom abstract ideas are the starting point. From Marcel Duchamp's *Fountain* to Yoko Ono's and Tracy Emin's beds, concepts were seen as most important in contrast to aesthetic considerations. The idea determines the art and the making of the art piece is seen as secondary and of limited importance. For such artists it seems difficult to argue that creativity is embedded within the making and within the flows of productive activity.

The verb 'to create' has numerous meanings and inflections of meanings. We might distinguish three overlapping meanings particularly relevant to this chapter:

- to make, produce, cause to come into being (from the Latin *creare* – to produce or make)
- to cause something new to exist, to innovate, do something new or original
- to produce with artistic effort, to do something creative.

Throughout this chapter I will elide these three meanings because I wish to argue that creativity is a constituent process within everyday life and is not confined to great artistic, scientific or technological innovations. For the moment I wish to argue that the different forms of creativity all involve the same component parts. These parts include:

- interpretation – before making something there has to be a process of making sense, of reading the situation, of understanding the materials and the players involved; this is a creative process of working things out
- whatever understanding has been arrived at, creativity also involves a forward-looking imagination, including imagining or finding a solution
- competence or skill at bringing things together in new ways that work
- for something to be seen as creative it has to be recognized or made sense of in its time. Darwin, Picasso or Beethoven were not possible in the 13th century; such creators would not have been seen as fitting at that time. People may be thought later to be very creative, even though (like the poet John Keats) they die in obscurity
- power/knowledge – a work is more likely to be recognized as creative if made by an academic or professional, or by someone central to the networks of power and knowledge at any one time.

However, definitions of creativity and understanding its constituent parts are difficult, especially as the term blurs into many others. The term 'innovation' is often associated with technology and depends on uptake, whether the thing made is seen as fitting or useful in its time. 'Originality' refers to the emphasis on newness in the definitions above, but there is not a necessary inclusion of skill or competence. A child's scribbles might be greeted by parents as a sign of hidden talents. The scribbles may be new and original but they are not creative or innovative in the sense of understanding, fittingness, uptake. The term 'agency' has already been used interchangeably with creativity, and the two concepts are very close. Agency is perhaps a broader term referring to all doing rather than making, but it has the same components of understanding, thinking forward, being competent and appropriate and depending on flows of power/knowledge. The term creativity often seems opposed in meaning to 'production', if the latter is associated with the repetitive processes of Fordism and mass production. But in many instances production and making are key components of creativity. Another opposing term is 'copying', or repeating. But even here it can be argued that copying or mimesis always involves creative assessment of whether it is the right context in which to copy something, and to copy well involves great skill and judgement.

The distinction between creativity as the imposition of form on matter and creativity as a working with matter may be related to the different constituent parts of creativity as described above. In the first two steps there may be more of an envisaging of form, a project to be undertaken, whereas in the third step human and matter work together in the process of skilled making. However, it is not my intention in this chapter to resolve the question of whether creativity is imposed or co-produced. In my view both are different responses to the creativity trend in contemporary societies, the one emphasizing active agents, the other nostalgically remembering the crafting of things. Rather I wish to argue that the main limitation of both these perspectives is that they remain overly focused on the maker and the material. Conceptual artists seem to impose form on matter, whereas Goldsworthy works embedded in, soaked by, his material. It is not possible to understand this difference by focusing only on the process by which Tracy Emin made her bed or Andy Goldsworthy made a pile of rocks. In order to understand the creative processes employed by these two artists it is necessary to look beyond the relationship between the artist and the material, to look at the wider context that produced their different aims and responses to each other.

Both types of artist, from the more processual to the more conceptual, are embedded in or caught in their moments. Both are differently embedded in ideas and practices of their times. Both produce works that would have had no discernible 'artistic' value in medieval Europe for example. So, while Ingold's or Malafouris' focus on situating creativity within the framework of making is important, the continued focus on the immediate processes of art making remains problematic. While Flannery and Marcus' amassing of data about the creation of inequality is impressive, they do not ask what it is that allows their agents to impose new forms on the world. To answer such a question would necessitate looking beyond the agency itself to explore the factors that make the intentions possible. Different forms of art, as different forms of making and doing, have to be situated within their wider entanglements (cf. Gell 1998), that is their broader material dependencies, tensions and entrapments.

There may seem to be a logical contradiction in focusing on entanglement, entrapment and path dependency on the one hand and creativity and agency on the other. Innovators in the arts or sciences often talk of moments of inspiration when ideas seem to come out of nowhere. Latour (2005, 59-60) describes a puppeteer who says that a puppet seems to act on its own. Authors of novels often say that the characters in their books have lives of their own, and seem to write the book for them. Jazz pianists improvising on the piano will often look down at their fingers and wonder who is playing the piano. In all such cases the author, puppeteer or piano player is presumably so in tune with the moment, so skilled, that he or she is creating automatically. One has to be in the moment, in the context, to know what is appropriate. But on the other hand, one has to be so involved that the rest of the world gets tuned out. There is a moment of freedom or disentanglement that allows the creativity, the novelty. Creativity often seems to involve emptying one's mind, being blank, engaging in free association. All this anecdotal experience suggests that moments of disentanglement are necessary in order to find solutions 'out of the box'. Creativity involves being in and out at the same time, entangled and disentangled together.

Much creativity, in technology and research as much as in art, seems to involve moments of free association when usually unlinked things are brought together in new combinations. As a result all creativity is historical, embedded in the possibilities afforded by particular situations. Creativity is embedded in entanglements and in the horizons of possibility they produce. As a result, it cannot be adequate to focus on the maker and the process of making itself, whether one sees that process as the imposition on matter or as a co-production.

Creativity is dispersed into entanglements, but it is not only this dispersal that needs to be considered. Creativity often seems to involve struggle. It is often not easy to make connections that have not been made before. The energy that drives creativity often comes from attempts to resolve the messiness, contradictions and entrapments of entanglements. The world around us is made of apparent entities that are both things and objects. They connect us and make life possible, but they are also against us – stubbornly mute and unresponsive, falling apart, unstable. We identify with things but yet they are always separate. We own them but never completely. We depend on them and see them as stable, but they also entrap us. We get caught going down pathways that contradict other pathways or conflict with other intentions and demands. All creativity, agency, and indeed all life, involves skillfully finding solutions to these demands and contradictions. Entanglement provides much of the impetus for creativity. It causes problems that demand resolution, the opening up, the moment of disentangling.

Taken in this general sense, creativity is an ever-present component of daily life, indeed of all life. Ingold (2010) makes a move from agency to the generative capacities of life. Yet more broadly we could say that even the non-organic physical universe includes similar processes. Consider a river that has for millennia passed down a particular channel that then gets blocked by a mud slide from a neighboring steep slope. The river has to find a new way down to the sea. The water spreads out and overflows but gradually finds a path of least resistance and starts to form a new channel. The river has found a new solution, created a new path. The system produces creativity. We could just say that all systems are self-organizing, and in that sense they have creativity within them. We could agree with Ingold that creativity is just the generative capacity of life and the universe. Certainly such a perspective takes us away from the creative maker of things and focuses on the wider entanglements that produce creativity, although there is a danger that the struggle of creativity, the challenges, tensions and contradictions are not adequately explored.

So were people less creative in the Palaeolithic? Hunting and gathering require much initiative and renewed daily responses to changing conditions such as prey availability. Archaeologists have become very adept at evaluating the costs and benefits of different choices in resource procurement (e.g. Winterhalder 1998). Palaeolithic humans found ways of organizing socially and of dealing with the unknown, as perhaps seen in the flowering of art in the Franco-Cantabrian caves. In any case, if creativity is just part of life then it is difficult to argue that humans at any moment in time were less creative. In the smallest of movements humans have to adapt to the world, finding a solution, placing their hands and feet in ways that fit with the world around them. Walking down a path, the step and gait have to respond

to undulations in the surface of the ground, to differences in vegetation, and as they do so, however unconsciously, they find a creative solution. They place their feet in a particular way.

So it is not that people were less creative in the Palaeolithic or Neolithic. One difference today may be the way that creativity is valued. In Silicon Valley at least, creativity is how people make money, investors are continually on the search for new ideas. There is now an economy of creativity. Creativity is highly valued and aggressively sought after. But in a more objective sense, this greater emphasis on creativity may itself be produced by a larger process of increased entanglement. The problems that now have to be solved are enormous in scope, involving large research teams, enormous facilities and massive resources, as in the cases of the invention of the atomic bomb or getting humans to the moon. The construction of the Hadron Collider, the largest single machine in the world, involved collaboration with over 10,000 scientists and engineers from over 100 countries, as well as hundreds of universities and laboratories. Its computer network infrastructure connects 170 computing centers in 36 countries. Electricity costs to run the machine amount to $23.4 million annually. The total cost of the creative discovery of the Higgs boson is estimated by Forbes at $13.25 billion.

The entanglements are so large, the problems we are trying to solve so complex, that creativity nowadays often involves more than the single human mind, or even multiple human minds, can manage. Vast global resources are needed, and machines do a lot of the work for us. The more we explore things, the more we realize what we do not know and so we keep pushing farther asking new questions and demanding more creativity. Put yet more generally, the more we get entangled in things, the more we discover the need to go down the ever receding but never ending threads of entanglements, finding yet smaller particles, going yet farther distances. And as we go down these pathways we get involved in yet further entanglements, even larger machines, larger networks, enormous resources. We need to be ever more creative to manage these huge systems. One might say that things have entrapped us into valuing creativity and innovation. Our increased entanglement with things has forced us to be highly creative and to put a great emphasis on innovation. So it is not that humans are more creative than they were in the Palaeolithic but that the scale and rate of creativity and perhaps the value we place on it have changed.

Darwin: creating evolution

As an illustration of the points made so far in this chapter, I wish to consider Charles Darwin and the theory of evolution. Many would agree with the estimation of Peter Bowler (1983, 25) that "we are impressed with Darwin's creative genius". What did this creativity consist of, where did it come from, and can it be used to help understand the relationships between creativity, entanglement and disentanglement? Darwin is often portrayed as a towering intellect who single-handedly countered millennia of religious belief and entrenched dogma to come up with the ideas of gradual evolution and natural selection. The first indication that there is something wrong with such an account is that someone else, Alfred Russel Wallace, came up with a very similar idea at about the same time. So what were the conditions that produced this dual discovery of evolution? Could one say that the entanglements were developing in

such a way that by the mid-19th century someone was bound to discover evolution by natural selection? Did it just happen to be Darwin (or Wallace)? I wish to start by considering the history of ideas that led to *The Origin of the Species* in 1859, and then to consider the wider contexts and entanglements.

History of the ideas of evolution

It is widely recognized that the idea of evolution has a long history before Charles Darwin came onto the scene.

The books of all the Abrahamic religions tell of how God created the world, the heavens and the earth, the plants and animals, and the humans. For example, in the Qur'an "Man hath He created from a moist germ" (Sura 16, Verse 4). In the European tradition, study of the Genesis story led Archbishop Ussher in Dublin in the mid-1600s to argue that the year of creation was 4004 NB. According to religious dogma, all species were created by God as fixed, perfect and immutable. In the world of ancient Greece, Aristotle too argued that species could not change.

For centuries these taken-for-granteds held sway in Western thought, but by the end of the 17th century challenges to the religious account had begun to emerge. Philosophers such as Thomas Hobbes and John Locke had begun to describe the gradual development of social forms, and discovery of the Americas had exposed a troubling diversity of humans, animals and plants. Galileo and Descartes had started to understand the universe in terms of universal laws of development, and mechanistic theories of the earth's origins had emerged (Bowler 1983, 32). In 1691 Leibniz published the *Protagaea* in which he argued that fossils showed that rocks had been formed by natural processes as the earth developed (Bowler 1983, 34). Work on the identification of fossils was greatly enhanced by use of the newly discovered microscope (in the late 16th and early 17th centuries). For example, Robert Hooke in Britain used the microscope to show that fossil wood was very similar to wood in living trees. But these 17th century thinkers saw nature as a machine that worked so wondrously in its complexity that it demonstrated the hand of God. In this way religious orthodoxy about creation and fixed species could be accommodated to the evidence for gradual development and diversity.

During the 18th century, this compromise between religious orthodoxy and a developmental view of the world increasingly came under strain. There was too much diversity and too much geologic change through time to be easily accommodated by Biblical accounts. Some argued that change in the fossil record could be explained in terms of a series of floods that had drowned all terrestrial life, leading to the emergence (the Godly creation) of new species. But there seemed a need for an awful lot of floods. God seemed to have been very busy. And as Europeans increasingly traveled across the globe they ran into other problems. Some of the peoples encountered were perceived to have apelike features. How was this to be explained? Parallels were drawn between ethnographic societies and the 'primitive' past (Daniel and Renfrew 1988). The Comte de Buffon in mid-18th century was already speculating about the evolutionary origins of similar species. He argued (1791) that flint axes discovered in the ground were not thunderbolts, as was widely assumed at the time, but "the first monuments

of human art" (quoted in Bowler 1983, 57). He saw the possibility of human escape from nature through the use of tools. Many Enlightenment writers from Adam Smith to Rousseau to Montesquieu had come to argue that human social forms had gradually evolved through stages and these social theories influenced Buffon's account of the development of species.

In the later part of the 18th century, Linnaeus found that it was possible to order species into a complex hierarchical system consisting of genera, orders and classes. He allowed for some hybridization between species, but his approach largely assumed a pre-arranged, fixed plan. His abstract, formal approach was heavily criticized by Buffon who argued that closely related species must have descended from a common ancestor (Bowler 1983, 77). For example, he proposed that lions, tigers, leopards and domestic cats had all derived from a single ancestral type of cat (Larson 2004, 14).

Georges Cuvier in the late 18th and early 19th centuries rejected de Buffon's ideas of transmutation, but his work is important in collating evidence for the great diversity of species and for developing a more complex and flexible classificatory system based on internal structure (revealed by dissection) rather than external characters (Bowler 1983, 94). He argued that species were fixed, but he did recognize that some had become extinct. He held to the idea of fixed species even as he demonstrated the fact of organic succession.

This contradiction between the fossil record of biological change and the accepted view of fixed species led Cuvier's colleague Lamarck in Paris to a very different hypothesis, that of transmutation. Long-term variation in the climate and environment of a species would guide the development of organisms in a particular direction. Acquired characteristics were heritable, leading to gradual transmutation or evolution. Stretching for higher leaves on trees, giraffe necks gradually extended. In such ways, simple forms of life developed into more diverse and more complex forms. The earliest, simplest forms could have been produced by spontaneous generation – and here Lamarck invoked the generative power of electricity (Bowler 1983, 88). In Britain similar ideas were expressed by Erasmus Darwin, the grandfather of Charles Darwin. Erasmus Darwin argued that species could develop new organs to help them meet challenges in the environment. These new forms gradually emerged and could be inherited.

In Britain in the early 19th century, discoveries of dinosaur fossils by William Buckland and Gideon Mantell, added to the evidence for biological change over great expanses of time. Buckland (in Oxford) envisaged God creating a sequence of species each adapted to its climatic conditions. In Cambridge, Adam Sedgwick also identified a progressive development (fish below reptiles, below humans), and he too saw a pattern of successive creation (Larson 2004, 37). Some British authors such as Robert Grant and Robert Chambers became influenced by Lamarckian ideas of transmutation, while others such as Richard Owen rejected transmutation even if they found more and more evidence of branching sequences of gradual development in the fossil record.

An important influence on Darwin in Britain was Charles Lyell who played a large part in developing the theory of uniformitarian geology – that is the principle that geological processes in the past can be explained in terms of currently observable geologic forces, rather than

in terms of extraordinary catastrophes. It was the notion that over the long term there could be small everyday changes producing large scale change that influenced Darwin, even though Lyell denied the possibility of evolution (Larson 2004, 49).

Darwin's trip to the Galapagos Islands in the 1830s led him to the idea that individual plants and animals that colonized a new island would be isolated from their parent population, and would gradually evolve so that they adapted to the new environmental niche. In studying the mockingbirds of the Galapagos, and exploring the variation in the shapes and functions of finch beaks on the different islands, he showed how variation between individuals could lead ultimately to differentiation into different species. He knew that others such as Lamarck, had proposed theories of organic evolution before, but he proposed a new mechanism.

In developing his ideas about this mechanism, an important influence was the writings of Thomas Malthus who argued that all species, including humans, reproduce at such a high rate that there can never be sufficient food to feed all the offspring. As a result large numbers, especially the weaker individuals, die. Darwin saw that this struggle for existence would lead to weaker members of a species dying out and better adapted or stronger members surviving. Any natural variation between individuals would get selected for if it allowed beneficial adaptation, in a process he called natural selection. Herbert Spencer too, in his 1851 book *Social Statics*, linked a Lamarckian idea of gradual evolutionary change to Malthus' ideas on populations to develop a very Victorian concept of "the survival of the fittest" (Larson 2004, 72).

In this maelstrom of circulating and competing theories about progress, the transmutation of species and long-term change, Darwin delayed the publication of his ideas, worried about their impact, their reception, and their effect on society and on his religiously inclined wide Emma. But in 1858 he received a manuscript from Alfred Russel Wallace whose work in the Malay Peninsula had led him to ideas very similar to Darwin's. He too had observed links between species variation and geographical distribution, and he too had read Lyell and Malthus. Putting all these influences together he concluded that variations would be propagated if they enhanced the chances of survival in the struggle for existence. Worried that the originality of his work would be lost, Darwin quickly published *On the Origin of Species by Means of Natural Selection* in 1859.

In all this we can see the gradual development of an idea, or rather an inter-related set of ideas about gradual change, uniformitarian principles and natural selection. We might draw a line starting with Leibniz (though we could also start with Copernicus, Galileo or Descartes – the starting point seems arbitrary) and continuing through Buffon to Lamarck to Erasmus Darwin to Lyell and Malthus to Charles Darwin. All in their various ways contributed to Darwin's creativity. The origin of his ideas can be traced back in time. There was a gradual 'unfolding' (the Latin origin of the word evolution is *evolvere*, meaning to unroll) as more and more evidence built up that contradicted the Biblical account of divine interventions.

Beyond the history of ideas

But the history of ideas is entwined in the history of material practices. What was it that moved the ideas forward? Why did people keep asking the question of evolution?

An important context is the expansion of empire and colonial conquest. At one level this simply meant that scientists in Europe had access to more data in order to explore the relationships between species. For example, Larson (2004, 6-7) notes that Georges Cuvier was the first naturalist to have a large collection of the world's mammals in order to carry our comparative anatomical studies. Napoleon's armies had plundered the collections of Europe and sent home specimens to Paris from as far away as Russia and Egypt.

Empire also contributed to Darwin. As noted above, his trip on the Beagle that took him to South America and the Galapagos Islands from 1831 to 1836 was key to the development of his ideas about evolution. The Beagle was a British Navy vessel charged with charting the coast of South America and the islands of the Pacific. It was thus a product of Britain's imperial reach and ambitions. Voyages of scientific discovery had become common by this time, and the expeditions brought back large numbers of specimens for study and comparison.

The imperial context was also caught up in the idea of British superiority. When Darwin came across the native communities in Tierra de Fuego, he considered them to be low forms of humanity and noted apparent similarities with primates in the London zoo (Larson 2004, 67). Later, after reading Malthus, Darwin came to see more clearly that human races compete with each other in a fight for existence. "In his mind's eye, Darwin surely saw the forces of British imperialism triumphing across the globe" (Larson 2004, 70). In his *Descent of Man* (1871) Darwin referred to evidence that non-white races had smaller brains and more apelike features. Although he himself was appalled by slavery, the notion that some races were less evolved than others was used to justify slavery in Africa.

Another important context for Darwin's ideas was industrial capitalism. Darwin married a Wedgwood, a family that owned a successful pottery production company founded by Josiah Wedgwood in Stoke-on-Trent in the mid-1700s. The Darwins and Wedgwoods had long been linked and Darwin's wife Emma Wedgwood was his first cousin. The industrial wealth of the combined family meant that Darwin never had to earn a living. He lived in the wonderful secluded environment of Downe House where he could concentrate on his work and manage his nervous anxieties. The importance of this material context is perhaps demonstrated by a comparison with Wallace. Wallace grew up poor and was largely self-educated (Larson 2004, 72). In pursuing his interests in natural history abroad, he had to earn a living by sending back animal skins, pressed insects and dried plants. By no means a wealthy establishment figure like Darwin, he never had the opportunity to conduct long-term research and build a body of substantive work. Thus we remember Darwin who, through his own efforts and through the efforts of privileged scholars such as Thomas Henry Huxley, established himself as the originator of natural selection.

The family funded Darwin so that he could join Captain Fitzroy on the Beagle as a gentleman's companion. Born as he was into a family of successful capitalists, Darwin was very

influenced by *laissez-faire* capitalism, individualism and utilitarianism. He read the works of Adam Smith who argued that individual competition was a driving force of economic progress. Natural selection seemed an appropriate perspective in this competitive economic world. After the publication of *The Origin of Species*, Marx and Engels pointed to the analogy "between natural selection and the competitive ethos of nineteenth-century capitalism" (Bowler 1983, 17), although they welcomed Darwin's theory because of its materialism (Bowler 1983, 101).

Another important factor behind the emergence of the idea of evolution was the changing nature of science. During the 19th century "the modern system of state support for science was established" (Bowler 1983, 106). A recognizable scientific community emerged, with its journals, societies and meetings. In France both Cuvier and Lamarck worked at the Museum of Natural History in Paris, and in London many of the debates concerning Darwin's work took place at the British Association for the Advancement of Science and at the Geological Society of London. In conjunction with the global expansion of European powers, these institutions housed the burgeoning collections of fossils and species on which many of the claims and counter claims regarding evolution and transmutation were based.

The idea of evolution emerged as a struggle against the Biblical account of creation. We can see this as a confrontation between science and myth, with science gradually pulling away the curtains and identifying the truth. Or we can observe that, regardless of debates about the transmutation of species, secularism was on the rise. Certainly there is good reason to suspect that the rise of secularism and atheism played a contributory role in the development of ideas about evolution. The Comte de Buffon in the mid-18th century was attracted to evolutionary ideas perhaps partly because he was an atheist who rejected Christianity and sought materialistic explanations (Larson 2004, 14). By the time Darwin wrote *The Origin of Species* he had largely abandoned religious faith (Bowler (1983, 146).

Larson (2004, 81) writes of a "wave of secular modernity ... sweeping across Western Europe" in the 19th century. Secularization is described by Chadwick (1975, 23) as a process that allows "many religions or no religion in a state, and repudiate[s] any kind of pressure upon the man who rejected the accepted and inherited axioms of society". Chadwick (1975, 22) identifies several interconnected influences on this movement. For example, the notion of liberalism dominated the 19th century, arguing that humans needed more room to think and act than they were allowed by established law and religion. The liberal notion of natural rights was strongly argued by John Locke in the late 17th and early 18th centuries, and the concept of the inalienable rights of individuals was widespread in the 18th century, emboldening people to act and think "as their conscience dictated" rather than as their church, state or society preached. In turn the focus on liberalism can be traced to the ravages of the religious wars that long dogged Europe. The religious wars that concentrated in the period 1540 to 1700 led many to be skeptical of religion and the strongly held but divergent beliefs of warring communities (Hitchcock 1982). Other important influences on increasing secularization were the emergence of centralized states, urbanism, trade and industry (Chadwick 1975, 26). For ex-

ample, during the Industrial Revolution many statistics demonstrate that the larger the town the smaller the percentage of people who attended church on Sundays (Chadwick 1975, 94).

Also important in the rise of secularism in the 19th century was the materialist and then Marxist critique of religion. The phrase the 'opium of the people' was written by Marx in 1843 (Chadwick 1975, 49) but similar phrases had circulated in the 18th century. As early as 1767 the French materialist d'Holbach attacked Christianity by saying 'religion is the art of making men drunk with enthusiasm, to prevent them thinking about the oppressions committed by their rulers' (ibid.).

None of this is to deny that the increase of rational science, from the Copernican Revolution onwards and during the Enlightenment and in the Industrial Revolution, contributed to secularization, although it must be noted that many scientists, then as today, managed to be both religious and scientific. But there is a wider and longer term, larger encompassing process that produced a climate in which questions about the biblical account of creation continued to be asked. The larger secularization context encouraged people to ask questions about why races differed, why some appeared more successful than others and that justified individual competition and the dominance of world powers. This larger context created an opening into which theories of natural selection could enter. The increasingly atheistic Darwin undoubtedly contributed significantly to the religion-science debates in the 19th century and since, but it would be incorrect to argue that the critique of religions was not already in the air.

There were many other contributions to Darwin's creativity, beyond empire, industrial capitalism and secularization. For example, Darwin began *The Origin* by discussing the breeding of horses and hounds, pigeons and the cultivation of hybrid plants. This artificial selection process was seen as an analogy for natural selection in the wild. Darwin wrote incessantly to animal and bird breeders, asking for information about their practical knowledge of creating change in species. Their information can be said to have contributed to his creativity. One could also say that the mockingbirds and finches on the Galapagos contributed too. The archaeological discovery of stone tools in gravel beds in the Somme valley by Boucher des Perthes in the 1840s also played its part, confirming the great antiquity of humans on earth. We have already seen that the invention of the microscope played a part in the early development of evolutionary ideas. In the late 18th and early 19th centuries, experimenters from Benjamin Franklin to Michael Faraday made progress in the understanding of electricity, and as noted above, Lamarck was influenced in his account of the spontaneous generation of simple living forms by the idea of electricity (Bowler 1983, 88). This idea linking electricity and life is the central theme of Mary Shelley's novel Frankenstein written in 1818 at the same time as Lamarck was working.

Entanglement and entrapment

A heterogeneity of strands thus played into the creativity that produced natural selection and *The Origin*. The creativity is radically dispersed through space and time. This is a line of argument that might be made by Actor Network Theorists. For example, Latour (1988) has discussed the discoveries and implementation of the scientific ideas of Louis Pasteur in terms

of a large network of forces such as the public hygiene movement in France, the medical profession, and colonial interests. But the entanglement perspective encourages us to look beyond the dispersed networks at the conflicts and tensions within human-thing dependencies and at the entrapments that ensue.

In the late 18th and early 19th centuries it seemed especially important for established authority in Britain and Europe to cling onto the notion of fixed species that never changed. "Evolutionism became part of the radical campaign to discredit the old worldview which propped up aristocratic privilege. The claim that God had designed a hierarchical universe in which everyone should keep to their allotted place was used to bolster the position of the upper classes. Both the radicals and the less strident middle-class activists saw a universe which changed through time as evidence that human conventions such as the class system could change" (Bowler 1983, 126-7). Charles Lyell, towards the end of his *Principles of Geology*, described a "violent struggle between new opinion and ancient doctrines, sanctioned by the implicit faith of many generations, and supposed to rest on scriptural authority" (quoted in Larson 2004, 62).

On the other hand, the disorder seen in France caused by the French Revolution in 1789 was alarming to the rising middle classes in England. "Notions of biological instability seemed to breed social disorder" (Larson 2004, 17). The growing middle class in Britain included individuals (such as Wedgwood) making fortunes out of the new mechanized industries. Such individuals were pitted against the notion of a social scale preordained by God. But they were fearful of the radical developments seen in the French Revolution. Evolutionary ideas of gradual and orderly change in the natural world supported their own image of orderly gradual change. For example, Lyell was a liberal from a wealthy Scottish family. While he wanted society to be rid of aristocratic privilege, he wanted to safeguard the upward movement of the middle class in an orderly world. Change had to be small-scale and gradual.

There were other contradictions and conflicts for which the theory of evolution provided a solution. The Biblical story struggled to account for the mounting geological and paleontological evidence for gradual transformation of species over enormous expanses of time. Bowler (1983) talks of a logjam as scientists came to accept natural development but lacked any plausible mechanism. "The scientific world was trapped by an inability to explore certain avenues, because earlier speculations had rendered them unpalatable, even though the evidence for some form of natural development was becoming stronger" (ibid., 140). Darwin's discovery of natural selection provided a solution and it broke the logjam in a way that fitted with middle class progressivist aspirations. "The more dangerous aspects of Darwin's theory were temporarily shunted aside" (ibid., 140) and the solution was embraced.

The dangerous aspects of Darwin's theory was the replacement of divine design by natural selection. In the decades after the publication of *The Origin*, the theory of evolution was gradually accepted but there was less acceptance of the theory of natural selection. Even Darwin's 'bulldog', T.H. Huxley was suspicious of it. The theory of evolution supported middle class but non-revolutionary ideas of slow gradual progress and transformation. But the theory

of natural selection remained controversial and was not widely adopted until the acceptance of Mendelian genetics (see below) in the early 20th century.

Thus Darwin's ideas came out of a series of conflicts and unresolved tensions between religion and science, aristocratic and middle class ambitions, and between theories and mounting evidence for species variation and development. For a moment, Darwin disentangled things, provided a solution, resolved the tensions. But immediately other associations and entrapments were made. For example, Herbert Spencer quickly accepted natural selection and it was he that coined the phrase 'survival of the fittest'. He used the ideas to support his view that the state should play little part in protecting the welfare of individuals. In this sense he was a 'social Darwinist', a phrase often used in modern times to describe movements that emerged in Europe, Britain and North America in the 1870s that applied biological concepts of natural selection and survival of the fittest to sociology and politics.

Darwin failed to anticipate Mendel's genetics. He held a traditional view of heredity and reproduction. This seems surprising since Gregor Mendel was conducting experiments on pea varieties between 1856 and 1863 that established a modern understanding of heredity and inheritance. Although his work was published in 1866, his ideas had little impact until the start of the 20th century. Darwin was unaware of Mendel's publication, so that once again we see the importance of context in understanding creativity and its impact. If Mendel is often see as the 'father of modern genetics', it was the linking of Mendelian genetics with Darwin's natural selection that led to the modern synthesis of evolutionary biology. Much as this synthesis has had enormous impact and countless benefits, throughout the 20th century there have also been moral issues raised, especially around the concepts of eugenics and more recently genetic engineering. Notions of genetic transmission have been applied to culture (memes and dual transmission – Dawkins 1976; Boyd and Richerson 1988) Genetic fingerprinting and DNA profiling have become cornerstones of forensic science, central components in police investigations, parent testing and disputes about immigration, identity, heritage and inheritance. It is difficult to argue that we have not become entrapped in a new entanglement with genes that has come to increasingly dominate our lives.

Conclusion

It has not been my purpose in this chapter to decide how much of Darwin's evolutionary ideas derive from the man and how much from his background and context. Historians such as Peter Bowler (1983) have discussed this issue very well. On the one hand, "Darwin's notebooks confirm that the discovery of the selection theory stands as a major example of creative thinking… He drew on an enormous range of influences, scientific and nonscientific" (Bowler 1983, 157) putting things together in new ways to come up with a radical break. On the other hand, Darwin's own verdict on where the creativity came from was clear. While he recognized the originality of his work, he said "I always feel as if my books came half out of Lyell's brains" (quoted by Larson 2004, 62). Bowler (1983, 1) writes that the Darwinian revolution "actually began before Darwin was born". A whole series of precursor writers (such as Edward

Blyth, Patrick Matthew and William Charles Wells) have been claimed by those wishing to undermine Darwin's originality (Bowler 1983, 158).

And it has not been my purpose simply to identify the heterogeneity of the influences on Darwin from ceramics, finches and mockingbirds and pigeons to electricity, geology and paleontology. Latour would have done this very well, as he did for Pasteur. Again, Darwin anticipated the same point. For example, he identified the "species of the Galapagos Archipelago" as a primary source "of all my views" (Larson 2004, 63). Rather, my concern has been to make three claims.

First, the influences on Darwin were both global in extent and deep in terms of time. "The history of modern evolutionary science does not begin with Charles Darwin or even with biology. It begins with breakthroughs in late-eighteenth-century geology and paleontology" (Larson 2004, xv). But we have also seen that we can draw a line of influences that extend back to the 16th century, and we could go farther and argue that it was claims made in the Bible and in Classical Greece that provided the impetus for the debate about the origin of species. Perhaps it is absurd to go yet farther back, but it is nevertheless true that Darwin's work was contributed to by plant and animal breeders who could not have done their work without the initial domestication of plants and animals in various parts of the globe in the early Holocene, starting at least 10,000 years ago. Equally, Darwin's work was made possible by wealth from ceramic production, itself indebted to the first making of fired clay containers in China and the Middle East between 20,000 and 9,000 years ago. Those innovations created the possibility, however remotely, for Darwin's creativity.

Seeking the origin of *The Origin* thus does indeed become an absurd task. Perhaps, then, the problem is the way we think about creativity. Rather than individual genius, perhaps we should think more of the river finding its new banks. Perhaps we should think more of the 'evolving', the rolling out, of the theory of evolution. Over the very long term, certain pathways were made possible and the whole, the whole heterogeneous entanglement, rolls out in a certain way according to the conditions around it. This unrolling takes up the idea of evolution, and indeed Darwin himself, and takes them along with it. Darwin and Wallace independently arrived at the same/similar point at about the same time. But of course they were not independent. They communicated but did not share the idea until 1858. But they had read the same authors and were part of the same imperial and industrial world, even if differently positioned within it. Many others were close to the same discovery, many were moving in the same direction. Someone would have come up with the idea if Darwin hadn't. It is as if the whole material-social-human-cultural-conceptual juggernaut just unrolls and we are caught in it.

But this is much too simplistic. My second claim is that the messy, fragmented, contradictory entanglements themselves generate the need for creativity. I have argued that there is no origin of *The Origin* (for a critique of origins research see Conkey and Williams 1991), just an infinite regress that could take us back to deep prehistory. The total heterogeneous bundle moves forward but it is made up of entangled parts (ideas, technologies, social forms, economies) that are often in conflict or contradiction with each other. Over the long term,

entrapments lead to insoluble problems. In the case considered here, the problems are between religion and science, between established authority and middle class entrepreneurial power, and between earlier knowledge and the build-up of new facts. These issues were hard fought and long struggled over because they concerned changes in deeply held beliefs, new social groups rising to power, new challenges to established authority. The conflicts and contradictions were becoming intolerable. In the decades before Darwin published *The Origin* there was continual debate and lampooning of the different protagonists. After the publication Darwin was subject to ridicule as much as to praise. He had delayed publication because he was worried about the impact. He solved the problem, found a solution. But the solution came from struggle, from the attempt to resolve the deep contradictions that had built up.

My third claim is that creativity involves a momentary disentangling. At the end of *The Origin*, Darwin contemplates an entangled bank. He might have been contemplating his own entangled world of controversy and personal struggle and disappointment. And yet somehow he found an answer, a theory that made sense of all the mess and all the accumulating information. He found an opening, a way through. That opening had been partly made for him, by other scientists, by the rise of liberalism and secularism, and by numerous other changes in knowledge and society, but nevertheless he saw an opening. He disentangled the parts and found a way through. For a moment there was an opening out, a resolution, a release. Very quickly new messy entanglements emerged that were to take humans into dark places. But for a moment a disentangling had occurred that we label as creativity.

Darwin is a special case. He was dealing with large and complex issues and his work entered into major struggles that we continue to deal with 150 years later. But all life, has the same three characteristics. All life is a making, a doing, as things fall apart. All life has a creative moment in which a way through is found. The everyday making and doing as much as the great scientific discoveries and works of art are characterized by moments of disentangling. Thus to make a pot out of an ungainly pile of wet clay is a disentangling, whereby the clay and the potter work together and with other parts of the entanglement to find a way through. In a similar way, Darwin found a way out of the maelstrom of competing and conflicting ideas about transmutation and evolution to produce a new solution. His solution may have created as many problems and messy contradictions as it solved. But for a moment he, like all of us, found a solution that worked.

Chapter 7

Beyond Entanglement: The Role of Religion

A characteristic of entanglements (and of many complex systems) is that they involve long, complex and intersecting chains of dependence that are unbounded. It thus becomes very difficult to find solutions to problems as they arise. Causality seems remote and uncontrollable, difficult to understand, difficult to grasp. In some areas of life the problems we encounter matter a lot to us, although the specific matters that concern us most vary historically. In dealing with problems that matter such as untimely death, illness, misfortune, suffering, we feel compelled to do something, to fix things. But often the solutions are unclear and beyond immediate understanding. Our impulse is to find a practical solution, and so we bring to bear the full range of practical and intellectual knowledge available at the time. In the case of complex entanglements that extend beyond immediate fixing, we get drawn into dealing with the beyond. With the hindsight of western rationalism and scientific understanding, many of the solutions that we find appear peculiar and irrational. It is thus that we have erected distinctions between the secular and the sacred, the mundane and the religious, the everyday and the beyond or transcendental. But the fixes that are found are logical extensions of existing knowledge and practices.

The beliefs and practices that are often described as religious are, in this chapter, seen as derived from the impetus to fix or deal with deep concerns faced by humans. The specific nature of what causes deep concern and how it is dealt with vary. Modes of religiosity vary (Whitehouse 2004). Many different specific techniques have been used from music, to dance, to trance, from rare moments of high drama and intensity to sober reading of doctrinal texts. Each society makes use of its own stocks of knowledge and practice in order to find fixes and to do something in practice to deal with problems that matter. But the underlying commonality is that things happen that matter deeply and yet causality is distant, complex, unclear. The solutions that are sought have to deal with this 'beyondness', using techniques that themselves extend into the beyond. Clearly, religious regimes do more than come into action when there are problems; they describe modes of conduct, imagine the world, develop cosmologies. My

hypothesis is that these wider frameworks, beliefs and institutions of the transcendent arise from and contextualize the pragmatic need to fix things.

The hypothesis that religion is about doing something in order to deal with specific historical and complex problems partly came about as a result of numerous instances at Çatalhöyük where what had been interpreted as religious rituals actually seemed to be ways of dealing with matters of import that had no easy immediate solution. One example was the placing of wild bull horns around the northeastern platform in the house called Building 77. The bull horns mark off the platform area that was dedicated to human burial. A large number of people were buried beneath this platform and around it. Many have argued that Çatalhöyük was an example of a house society in which the passing down of rights, ritual knowledge and heirlooms played a central role (Bloch 2010). Indeed, the term 'history house' has been coined to describe buildings like Building 77 that contained many burials, installations like bull horns, and were rebuilt in the same spot many times (Hodder and Pels 2010). It seems reasonable to argue that in such a society, transactions with the human dead would have been important, and we do see much effort invested in burial, retrieval of skulls, and memory construction through the circulation and deposition of human skulls. In such a context, death of house members, especially the frequent deaths of young children, would have been of deep concern. In such a context, using the power of wild bulls to do something in relation to the dead would have been a reasonable attempt at fixing things. We know from the use of wild bulls in feasting and in the art that they held a special social and symbolic role at Çatalhöyük. The large aurochsen would have been impressive and powerful creatures, difficult to bring down. But their power could be appropriated to protect or otherwise act in relation to the dead. Bloch (2010) has argued that the bulls re-animated the house after death at Çatalhöyük.

Much of the geometric wall painting at Çatalhöyük seems focused around burial platforms. There seem to have been a number of things that could be done in order to deal with the human dead, including putting large numbers of colored beads in graves with young children. All these actions can be seen as symbolic or religious, but they can also be seen as practical solutions to deal with matters of social and emotional import that are difficult to make sense of. We now know, as a result of contemporary medical science, some of the entanglements that reduce high infant mortality, but at Çatalhöyük a range of knowledge was developed that linked death to specific actions including placing bull horns or decorating the platforms and walls around graves.

A further example at Çatalhöyük is the treatment of the human skeleton. After burial beneath the floors of houses, some skulls were removed from the graves and kept and circulated, sometimes painted or plastered to reproduce human facial features. Here there seem to be the goals of keeping the ancestors alive in some sense and of treating them as social beings even after death. In this way the social relations based on these individuals could be sustained. The problem of the continuation of the 'house' after the death of a significant individual is 'fixed' by keeping that person alive, at least until the relevant social relations dissipate. Again the keeping of human skulls may seem like an irrational, symbolic or religious act, but it can also be seen as a practical solution to deal with socially and emotionally difficult issues

of continuity and rights. Extending the life of individuals through keeping and circulating their skulls, can be seen as a logical extension of existing social practices into the difficult and unknown beyond of the dead.

Humans get entrapped in specific ways of being as a result of human-thing (and human-human if the plastered skull is seen as an alive person) entanglements, and ways have to be found of dealing with this entrapment. Many religions offer salvation, agents (perhaps in the forms of skulls or gods), solace, support for the weak, identity, community. We could argue, as is often done, that religion performs the function of creating social solidarity at Çatalhöyük. This ignores the fact that religion is also often the cause of conflict and division, and the argument does not explain why supernatural means have to be found to enhance solidarity. The human skulls circulated at Çatalhöyük derive from the problem of potential conflict if house continuity is not maintained. The entanglement view is that humans get caught up, and this leads to the need for specific solutions and fixes. Social solidarity may have been one of the effects of skull retrieval and circulation at Çatalhöyük. But at the same time, many people (and their bodies after death) were excluded from skull circulation and from membership of dominant buildings in which special skulls were kept. Skull circulation may have been an extension of human practices into the beyond of death, perhaps even denying death, but it did not necessarily lead to social solidarity.

Towards religion as a fixing of entanglements that matter

There has been widespread acceptance in anthropology of the view that religion involves practice rather than just belief. For Asad (1993), the separation of religion from power is a product of a unique post-Reformation history in the Europe. He argues that there cannot be a universal definition of religion because it is always historically embedded and reconstructed. "Religious symbols - whether one thinks of them in terms of communication or of cognition, of guiding action or of expressing emotion - cannot be understood independently of their historical relations with nonreligious symbols or of their articulations in and of social life, in which work and power are always crucial" (Asad 1993, 53). For Meyer (2012, 11) too, "the study of religion is haunted by a Protestant legacy and bias that needs to be deconstructed". "It is key to approach religion as a mundane, practical and material affair – as *present in* and *making* a world" (ibid., 20). Boyer (2001, 314) argues that religion is practical – dealing with problems as they come up. It is not just contemplative. A good example discussed by Boyer is that much religious practice surrounding death is about what to do practically with the body. Super and Turley (2006, 428) argue that "religions seldom retreat into the spiritual realm and ignore the world around them. This might be the case in a few hermetic and monastic traditions, but it does not represent the mainstream of religious history".

Religion practices appear to be varied and universal characteristics have been difficult to identify. Many have argued that one universal aspect is that religions deal with problems and provide solutions. Prothero (2011) points to the diversity of religions, but he nevertheless admits that "what the world's religions share is not so much a finish line as a starting point. And where they begin is with this simple observation: something is wrong with the world.

In the Hopi language, the word *Koyaanisqatsi* tells us that life is out of balance" (ibid., 36). For Prothero, all religions identify a main problem, a solution or goal and techniques for achieving those goals. But religions differ in what they see as having gone wrong and in what they see as solutions. Thus Christians see sin as the problem, whilst Buddhists see suffering (Prothero 2011, 37). For Christians the solution or goal is salvation, for Buddhists it is nirvana. For Christians the techniques for achieving these goals are faith and good works, and for Buddhists meditation. For Confucius, chaos was the main human problem, order the solution, using the techniques of ethics, ritual and education (Prothero 2011, 291-301). As Burke (2004, 2) puts it, "each of the major religions has a message about the human condition; each points to something that it views as fundamentally wrong and unsatisfactory about our ordinary existence; each offers a diagnosis of the cause of that unsatisfactoriness and points to a possible remedy".

Super and Turley (2011, 22-3) argue that "we all suffer and most religions have much to offer as a way of coping with suffering". Bellah (Bellah and Tipton 2006) follows the work of Lienhardt on the Dinka to argue that religion in small-scale societies helps humans to deal with suffering and the conditions of existence. In ancient or dynastic Egypt, religion provided an elaborate set of technologies for dealing with death, including writing letters to the dead (Meskell 2004, 82), but equally there were rituals of birth and other life stages. In Egypt "the variety of religious and divinatory practices can be seen as integrating a variety of approaches to comprehending and coping with problems of normal existence" (Baines 1987, 94). "Because so many infants and mothers died, the gods were not simply beneficent in birth, which was an occasion of potential tension, affliction, and divine caprice as much as, or more than, others" (ibid., 95). For Boyer (2001, 58) "it is probably true that religious concepts gain their great salience and emotional load in the human psyche because they are connected to thoughts about various life-threatening circumstances."

The causes of suffering, misfortune or inopportune death are often difficult to define. Entanglement theory, like network approaches, points to the fundamental connectedness of things. What we do or make goes well beyond us. Latour (2012, 22-3) argues that "in all our activities, what we fabricate goes beyond us" (see also Meyer 2012, 21) and this may thwart attempts at fixing things, religiously or otherwise. It is difficult to follow all the threads of things and their inter-connections. And things and situations and relations keep changing. Things have vitality as argued by Bennett (2009). Even apparently stable things like stone churches in England are in a state of flux and need continual attention in order to keep them upright and functional (Edensor 2011). Misfortune can easily occur as things and relationships shift; things are unruly (Hodder 2012). For all of us there is a real beyond, connected to us, but difficult to define or make sense of. This real beyond is linked to us, contributing to entanglement but in ineffable ways.

It has become commonplace to argue that religion can be linked to the beyond, the transcendent. Indeed, this assumption gained considerable purchase in the discussions of religion at Çatalhöyük (see Hodder 2010, 2014). If theologians and anthropologists could not agree on a definition of religion, they came closest to agreement when defining religion in terms

of the beyond. In such discussions the beyond is often seen as constructed. Meyer (2012), for example, describes the material techniques through which we fabricate the sense of a presence of something beyond. Bellah and Tipton (2006) argue that the idea of the transcendent, with salvation or enlightenment as the goal, emerged only in historic era religions, linked to a shift from two-class systems in archaic periods to the four-class systems of historic to modern societies. There is of course a longer tradition of explaining religion as a constructed response to the human predicament. Freud argued that religion is an illusion created by deep psychological needs. Feuerbach, Marx, Engels described religions as constructed ideologies in the interests of dominant groups.

The entanglement view takes a different tack in that it sees humans as caught up in entanglements that extend into a real beyond. Religion is a pragmatic attempt to make sense of and intervene in that beyond. Certainly bull horn pedestals are made, churches are built, candles are lit. These are all fabrications. But they are fabrications in the form of technologies that do something to fix or deal with problems that extend off into the distant and apparently arbitrary. Certainly too, these technologies can be appropriated by those in power in order to increase and stabilize dominance. But in origin, such strategies of power are based on a good faith struggle to deal with difficult problems that matter. The unavoidability of human-things relations leading beyond pure instrumental use and understanding calls into being something we call religion.

Recent work on materiality highlights the ways in which material objects have agency, often described as a secondary agency imputed by humans to things (Gell 1998). Others (Bennett 2009) have argued for a primary agency in the sense that things are unstable and have impact. When a wall collapses or is on the verge of collapse it draws in the social in very active ways – an individual or social group has to respond to fix the wall. Whether in some sense we can talk of walls having intentionality, is beyond the scope of this chapter. But if we at least accept that things have primary agency in the sense of being impactful, and if we accept that things are enchained into remote spatial and temporal scales, then it must be the case that there is a real agency in the beyond that affects us but that we have little purchase on through direct everyday means. So it is not that we impute agency in the beyond or supernatural as a device. Rather, we need to find ways of dealing with real agencies that are beyond immediate fixing. These agencies cause death (we still have little understanding of what causes ageing), misfortune (often the result of complex conjunctures of which we have limited understanding including storms, earthquakes, tsunamis), illness (even today many illnesses are difficult to predict), suffering (the causes of inequality and violence are often deeply entangled in complex systems). The causal chains may extend back into deep time, they may extend into spatially distant realms, or into unpredictable conjunctures of invisible micro or macro processes. The interacting chains may be just so hopelessly entangled that sorting out causality appears impossible. And so we develop technologies to deal with these intractable problems – technologies that in some spheres we have come to define as religion.

The techniques used to fix things in the beyond often derive from the particular historical circumstances in which people find themselves. The example of the use of bull horns in

Building 77 at Çatalhöyük has been provided above. As another example of the extension of practical knowledge into areas of the beyond at Çatalhöyük, all house interiors were plastered in a fine white marl. Floors, walls, benches, platforms, bull heads were all plastered in the same material. Plastering was also extended as a technology to deal with the beyond, as in the example of the plastering of human skulls. Other examples of the extension of existing technologies to deal with the beyond include the use of agricultural symbolism in early agricultural societies in ritual contexts. For example, the soil beneath burial mounds was ritually ploughed before mound construction in early agricultural societies in Europe (Bradley 1998). In the so-called Axial Age historical religions, the writing of words or scriptures, texts and doctrines extended the existing use of bureaucratic technologies. In the modern world, science itself can be seen a technology of religion. In 1930 Einstein wrote that "in this materialistic age of ours the serious scientific workers are the only profoundly religious people" (ibid., 12) in that they seek "the grandeur of reason incarnate in existence" (ibid., 37). Our rational techniques, our enlightened reason provide a technology to probe and discover the beyond and thus to be religious.

This technological approach to religion might appear to differ from accounts grounded in cognitive evolution. For example, Guthrie (2014) argues that religion is linked to the evolution of cognitive tendencies to see agency in the world, often in our own image. We have an evolutionary tendency to see animacy in things, and in particular we anthropomorphize. For example, at Çatalhöyük the house was born, had a life and then died and was buried. In a related vein, Boyer (2001) describes religious forces as counterintuitive agents that we are drawn to because they are both familiar and unfamiliar. We believe that these agents can help us deal with misfortune because we have social minds and so we are predisposed to think that misfortune is social – is caused by someone. But it is not clear that the bull horns around the burial platform in Building 77 need involve either of these claims by Guthrie and Boyer. The bull horns can be seen as powerful in their own right without any anthropomorphism involved, and the agency of the horns can derive directly from the bull, without any social causality imputed. Rather, we can say that finding solutions to entanglements can make use of a very wide range of cognitive processes including anthropomorphism, or tending to seek social agents, but the religious impulse does not seem restricted to these techniques. Certainly, religious activities are often both familiar and unfamiliar as Boyer argues. But in my view this is not because of cognitive needs to memorize or to be drawn in. Rather, the familiar/unfamiliar mix results from using known technologies and knowledge, and extending or reinventing them to deal with that which is beyond. Cognitive predispositions of the sort defined by Guthrie and Boyer may well exist, but they are only brought into play in relation to religion in so far as they afford technologies to deal with the ineffable, the transcendent.

The materiality of religion increases entanglements

It is one of the prime arguments of this chapter that religion is a technology that involves a doing. Even in the case of meditation or monastic contemplation, something is done. Even in the case of doctrinal, text-based religions, there is a reading or listening. Religion, as noted

above, is not just about belief, but is a practical intervention in the world. As a result, materiality is a key component of religious practice. "As practices and materials are indispensible for religion's existence in the world as a social, cultural and political phenomenon, they need our utmost theoretical and empirical attention" (Meyer 2012, 23).

Meyer (ibid., 23) provides an example from the Ewe from Ghana and Togo. "According to Ewe cosmology, in principle all gods – *trõwo* or *vodu* – by necessity require some material vessel in order to be present and enact their power, and humans can access, and partake in, this power through certain religious acts. These acts begin with the actual carving or moulding of a figure, its subsequent animation through spitting alcohol and saliva, its regular maintenance through sacrifices and feeding, its worship through repeated incantations, body movements, and so on. Here, human action was indispensible for the gods to be present and act on people".

There are numerous examples of external powers and agencies being made present in religious practices. The Orthodox or Catholic icon itself becomes a being that is kissed, carried around, prayed to. Saints and prophets were made present in the form of circulated body parts. The body and blood of Christ are made present (in different ways) in the Catholic and Protestant churches. Why does the supernatural have to be made material to be experienced? I argue this is precisely because religious practice is about 'getting a hold on' the beyond, the divine. One gets a hold on the divine partly by making it human and anthropomorphic. As noted above, the practice of seeing human agency in things is found in all areas of life, but it is also used as a technology to intervene in the beyond. More generally, manipulating things allows the practitioner a sense of agency in relation to the beyond, it allows a connection to be made and interventions to occur. Material things are central to religion because they allow us to participate in the divine and to use religion as a technology to manage the beyond of the world in which we live.

This thorough dependence of humans on things in the religious realm creates further entanglement and dependency. At Çatalhöyük the bull horns used around the platform in Building 77 of course came from the slaughter of an aurochs. Much of the ritual practices that dominated domestic life in the early part of the sequence of occupation at the site depended on gaining access to wild bulls. Indeed this heavy ritual dependence on wild bulls may have been a factor leading to the late adoption of domestic cattle at the site (as argued by Arbuckle 2013). Humans entered into a dependency relationship with wild cattle in that they had to work harder to amass the numbers of wild bulls needed for a variety of rituals. In addition, social and economic relations all became caught up in wild bulls. These relations were threatened by the appearance of domestic cattle, which undermined many of the existing social and ritual relations (Der, pers. comm.).

We are used to conceive of religious institutions as laden with material trappings. As religious institutions grew, vast economic wealth often became attached to them. Land was acquired, buildings constructed, alliances made with political movements. Today the material investments and entanglements of churches and religious movements have global reach, including the sourcing of religious paraphernalia, the missionizing of distant populations, the control of media and the sustenance of online congregations. In all these ways, religion

contributes to entanglement, and it contributes significantly to entrapment, the sense of 'being stuck' within particular traditions and practices. The religious engagement with material things also incites counter movement. There have been long-standing debates about the use of icons throughout the Christian tradition. The iconoclasm of the Reformation came up against Catholic techniques/things that were criticized for bringing money to the church.

The long term

One of the distinctive characteristics of religions and religious movements is that they have the ability to endure over long time periods. This was as true in deep prehistory as it is today. Hodder and Meskell (2011) have discussed the long duration of specific ritual practices in the Neolithic of the Middle East and Anatolia by drawing attention to the remarkable similarities in iconography between Çatalhöyük and the site of Göbekli Tepe two thousand years earlier. In both cases there is a focus on dangerous wild animals, and in both there are depictions of headless bodies associated with birds. Vulture depictions are found widely across the Middle East. Sustained by myth or ritual practice, these continuities are remarkable. In more recent millennia we have become embedded in long-term religions and religious traditions many of which extend back two to three thousand years.

Why when so many other technologies and cultural practices are replaced and die out, do these religious traditions continue? In the entanglement perspective, things endure over the long term if they are central to many strands in the entanglement networks. Because religion is about things that matter, about ultimate questions, it becomes embedded in many areas of life. As Bellah (Bellah and Tipton 2006, 18) states, "religion is the key to culture". It becomes closely linked to identity. It becomes embroiled in politics and law, in right ways of acting. According to Weber (Weber and Parsons 1998) it is entangled with economics. It is of interest (Meyer pers. comm.) that Calvinist Protestantism rejected Catholic ways of fixing and insisted on the impossibility of intervening directly in the sphere of the divine. The insistence on this impossibility engendered the rise of the Protestant ethic, linked to the economy (for example through the idea that time is money) in rather different ways. If we were to draw a tanglegram (see Chapter 8) that showed all the dependences and dependencies of religion and religious institutions, most areas of life would be drawn in. This high centrality of religion means that while religions may adapt and transform as entanglements change, there is a strong tendency towards continuity.

Other technologies that endure over the long term are often entangled in multiple domains. When pottery was initially introduced at Çatalhöyük about 7000 BC, it was used as a container (Hodder 2016). At this early stage, pottery could have died out without major disruption to overall entanglements. At this early stage, pottery could have died out without major disruption to overall entanglements. But it quickly came to be used for other purposes as its various affordances were exploited. First it became used for cooking, and later for storage and display. Pottery was to have a long history over millennia at least partly because it was caught up in many entanglements. Much the same could be said of the wheel, initially used for carts and linked to the domestication of cattle as draught animals, later linked to horses

and warfare in chariots, much later to wheeled motorized vehicles, trains, planes, and all the time linked to other activities such as potting (the potter's wheel), gears, clocks, machines and engines. In these cases, technologies endure over the long term because they are central and dispersed through multiple hubs in entanglements.

Specific religions that endure appear to have similar characteristics. In the case of the Middle East Neolithic, special imagery using bulls lasts through multiple phases, but often in different forms. At Çatalhöyük, for example, early bull representations involved installing bull heads and horns into houses. In the later levels, perhaps associated with a shift from imagistic to doctrinal religious modalities (Whitehouse and Hodder 2010), wild bulls are commonly shown in narrative scenes in wall paintings. Later, bull imagery is found on pottery rather than on wall paintings, and seems more connected with mobile artifacts that can be moved around. As social and economic change occurs at Çatalhöyük, so the bull symbolism is reinterpreted. Historically, all major religions have seen change and re-interpretation as societies have transformed over centuries and millennia.

Religion may have a particular association with the long term because it deals with fundamental issues that matter. Humans are thus very invested in the religious practices and beliefs and are likely to tinker and transform them rather than see them overturned. This is a good example of path dependency, where it becomes too 'costly' to turn back or deviate significantly, although here the 'costliness' relates to deeply held convictions and embodied practices. An example of this process in relation to early farming in the Middle East is provided in Chapter 4: the social and ritual entanglements of hunting are there seen as delaying the adoption of domestic animals and farming.

It may also be the case that the very beyondness of religion allows re-interpretation and re-use. We have seen that religion is about the remote reaches of entanglements and it tries to find ways of fixing things in those distant spheres that nevertheless affect us in the here and now. Religion evolves in response to what goes beyond us. It is very striking how often religions provide a fixed point that is distant, elsewhere, transcendent. So many religions refer back to distant times, prophets, events and books. At Çatalhöyük religious practices involve past ancestors, wild and difficult animals. Much of the special deposition and 'magical' practices involve objects that have been obtained at great distances such as obsidian from the mountains of Cappadocia or crystals and speleothems from far-away caves. These objects provide fixed points in the unknown. They provide a way of handling and holding onto and so affecting the beyond. But precisely because these are distant points it becomes possible to interpret current events in their terms. The fixed points remain, but because they are distant, reinterpretation is endlessly possible.

Another interpretation of the long-term duration of religion is that it derives from the play of structures of power and domination. Religion has always been involved in struggle. For example, early Christianity provided a way of dealing with (a technology for) being on the margins of the Roman Empire, trapped and marginalized in a large-scale imperial system. Islam emerged on the margins of the Byzantine Empire. Prothero (2011, 291) argues that Confucianism emerged in the midst of "a particularly chaotic period in Chinese history". Religion

as a technology provided solutions to these problems. But precisely because it was successful in these ways, it became appropriated by elites in order to establish new forms and extents of power. Elites enlisted religion in order to impose and extend power and to underpin violence and intervention. Asad (1993, 35) argues that "it was not the mind that moved spontaneously to religious truth, but power that created the conditions for experiencing that truth".

Conclusions: religion as disentangling the beyond

The entanglement view of religion turns it into a practical technology of doing that makes sense within a particular frame of knowledge. This practical technology deals with real problems that extend into the beyond within complex, unbounded entanglements. The term 'religious' can be used when we try to fix things that are of ultimate significance but that extend beyond our immediate abilities to find solutions. We therefore resort to using the full breadth of human embodied knowledge and intellectual ingenuity available at the historical moment in which we are caught up, in order to deal with and manage the beyond, with all its uncertainties.

In his classic account of the Azande of Sudan, Evans-Pritchard (1937) went beyond cataloguing strange beliefs and showed how sensible the Azande religion was in the context of Azande knowledge and the problems that were being faced (see also Boyer 2001, 35). One day a granary collapsed onto some people sheltering beneath it from the sun. The inhabitants of the village explained the event in terms of witchcraft. Evans-Pritchard pointed out to the Azande that the granary probably collapsed because the house was infested with termites. The villagers responded by saying that they knew full well that the termites had undermined the granary structure, but they asked why the roof collapsed at a particular time when people were beneath it, rather than before or after. It is only witchcraft that can explain this particular conjuncture, this particular timing. So, here we see that 'religion' describes a situation in which it is difficult to make sense of complex, entangled interactions. The solutions that are found (that witchcraft was involved) are perfectly rational within a specific frame of knowledge. Cause has to be found and it is provided by witchcraft; and indeed rational Western humans may find it equally difficult to explain conjunctures emergent within complex systems. We may indeed, like Einstein, invoke a god when we are faced with the enormous complexity of large systems, beautiful in their order, but uncertain in their emergent properties.

In describing religion as a 'fixing' or as a finding of a solution to intractable and messy problems, it is possible to suggest that it disentangles. Earlier I discussed ways in which religion is often seen as a response to suffering. The notions that something is wrong with the world and that life is out of balance motivate religions, but they also describe the contradictory flows and counter-flows that the theory of entanglement strives to capture. A key theme of many religions is peace, tranquility, transcendence. Religion may be a technology that fixes entanglements, but in doing so it also provides a disentangling, a moment of release, a fixed point.

Uncertainty derives from the complexity of interactions within the entangled threads that extend outwards all around us, threads that are heterogeneous mixes of the cultural and biological, the social and the environmental, human and non-human. The beyond emerges out of these long-standing complex chains and path dependencies. The chains produce a beyond that is then 'filled' or claimed by religion, and develops into religious regimes with their own technologies to fix things in relation to that beyond. When the complex chains produce effects that matter deeply to us, as in the case of the untimely death of a child, we are forced to deal with the beyond. We do what we do in all areas of life, we try and fix things. Religion describes the varied technologies that attempt to fix things in the beyond, using familiar techniques, but extending them to deal with the beyond. In this chapter I have argued that religion is both a response to, and a major contributor to, entanglement. The entanglement with religion is productive but also pernicious. The existence of an ultimate fixed point provides security, a moment of disentangling, and a response to suffering, but it also embeds us in ways of being that, because they are bound to the ultimate, entrap us in domination and exclusion. While such a conclusion is contradicted by religious and spiritual movements that promote tolerance, openness and multiple faiths (such as the Sufism of Jalal ad-Din Rumi, buried in Konya just down the road from Çatalhöyük), the tendency has been for the entanglements of religion to be associated with a long history of intolerance and violence. The impulse to staunch the flows of entanglements by providing fixed points seems to lead too frequently to power, domination and entrapment.

The initial motivation for dealing with the topic of entanglement and religion in this chapter derived from a difficulty that I had encountered in developing methods for the study of networks of dependence and dependency between humans and things (see Chapter 8). It quickly became clear that defining the edges or boundaries to entanglements was problematic. Entanglements that dealt with clay use at Çatalhöyük seemed to blend into other entanglements that themselves were entangled with yet further sets of interactions. Entanglements did not seem to have bounds. Wherever one defined a boundary or limit in order to produce a diagram of entanglements, there was a beyond that could not be mapped but that nevertheless had an impact on whatever was occurring within the limit. Given the presence of this effective beyond of entanglements, it seemed of interest that most of the work on religion that we had undertaken at Çatalhöyük had defined religion in terms of the beyond. I wanted to ask the question whether religion might be a way of dealing with the beyond of entanglements; and to ask the question whether the two types of beyond might be linked.

But is my claim that religion is indeed a technology for dealing with the beyond of entanglements simply a version of the Enlightenment view that religion only has a role where rational science ends? Is it only where we cannot understand or control entanglement using rational means that religion has purchase? For E.B. Tylor religion was about explaining the world so that in the modern world science has taken over from religion. For Tylor religion was an intellectual endeavor. But the entanglement view sees religion as involved in all areas of life, including the emotional. Marett (1914) had long ago emphasized the role of emotions, arguing that religion emerges where thought breaks down. As noted above, entanglements are heterogeneous mixes that include the emotional, and it is often deeply felt internal trauma

that leads to search for the religious. So religion deals with the beyond in all its forms, not only where the rational breaks down.

Even in everyday actions that have a matter-of-fact rationality there is uncertainty. At Çatalhöyük people responded to the collapse of walls by making sandier bricks or by shoring up the walls with buttresses or by doubling the walls so that they could support each other. These eminently sensible solutions worked, but they could not deal with the uncertainty of which walls might collapse next, or which walls erode first. So in addition to practical solutions they also protected the walls by placing human skulls at the base of posts or conducting feasts at the foundation of houses. These 'religious' responses, in addition to the 'practical' everyday solutions, were needed to protect the walls, and my argument is that they were needed in order to deal with the indeterminacy or with entangled processes that were beyond contemporary understanding. Today, science has come further in understanding the complexity of things and their interactions. However much rational science extends into the world, there remains much (or more) uncertainty and lack of control in our daily lives. Where this matters deeply to us religion plays a role.

And science certainly has failed to deliver an end to inequality and suffering. In recent centuries the scale of inequalities has increased and solutions seem ever more complex as empires and globalization have extended their reach. Solutions to suffering seem intractable and global institutions seem gridlocked in their attempts to direct social and economic change. There do not seem to be simple solutions to the problems that a rational modernity has produced. The causes and solutions to poverty, suffering and disease seem remote and unmanageable. It is thus not surprising, given the argument in this chapter, that religious practices, including religious fundamentalism, are on the rise.

Chapter 8

Network Analysis and Entanglement

with Angus Mol

This writing of this chapter came about as an attempt to explore the extent to which formal network analysis could be used to study aspects of entanglement. We recognize that in archaeology at present there is a broad family of approaches that explore networks and relationality (Knappett 2011, 2013; Watts 2013). For all these approaches, exploratory network methods may have value. Indeed, archaeology has long used network approaches to explore relational structure as in the example of the seriation diagrams produced by Petrie based on matrix ordering.

By network analysis we refer to methods based in graph theory that allow the study of the pattern of relationships between nodes or vertices and the links or edges or ties between them (Borgatti et al. 2009; Brandes et al. 2013; Collar et al. 2015; Knappett 2011, 2013; Scott 2000; Terrell 1977). Network analysis can be applied to a wide range of phenomena, but the specific measures most used in archaeology often derive from social network analysis, defined by Brughmans (2013, 633) as "concerned with exploring social relationships as media for the flow of resources between active individuals, corporations, or communities". However, although the aim of a network study may be to analyze social systems, networks in archaeology are never built on the observation of interactions between people. Rather, they are based on the ties that exist between people and things. Even if social network analysis cannot be straightforwardly adapted to archaeological cases, methods from the broader network sciences, such as structural, centrality and path analyses, can be of use to explore these interdependencies or entanglements.

By entanglement analysis we mean study of the ways in which the collective set of dependencies between humans and things (HT and TH), between things and other things (TT), and between humans and other humans (HH), create potentials but also entrapments that direct change down specific pathways (Hodder 2012). Although the term entanglement is used to describe a wide range of phenomena in numerous disciplines (Thomas 1991; Edensor 2011), and although the term is used in a variety of ways in archaeology (Dietler 1998, 2010; Fuller et al. 2010; Stahl 2002), it is used here in the sense defined by Hodder (2012) as

the dialectical relationship between dependence (the reliance of humans and things on each other) and dependency (the constraints that humans and things place on each other). This definition attempts to capture the ways in which human reliance on material things draws humans into the lives, interactions and uncertainties of things. Because things are unstable and have their own complex interdependencies, humans get caught up in things, trapped into co-dependent pathways.

In many ways, the two forms of analysis seem close. It is possible to draw 'tanglegrams' that describe the dependencies of things and other things. These tanglegrams (Fig. 8.1) can look very like network diagrams. "At the heart of network science is dependence, both between and within variables" (Brandes et al. 2013, 6). This focus on exploring, analyzing and modelling dependencies between entities, but also between entities, relational processes and structures is what sets network approaches apart from other forms of data-analysis.

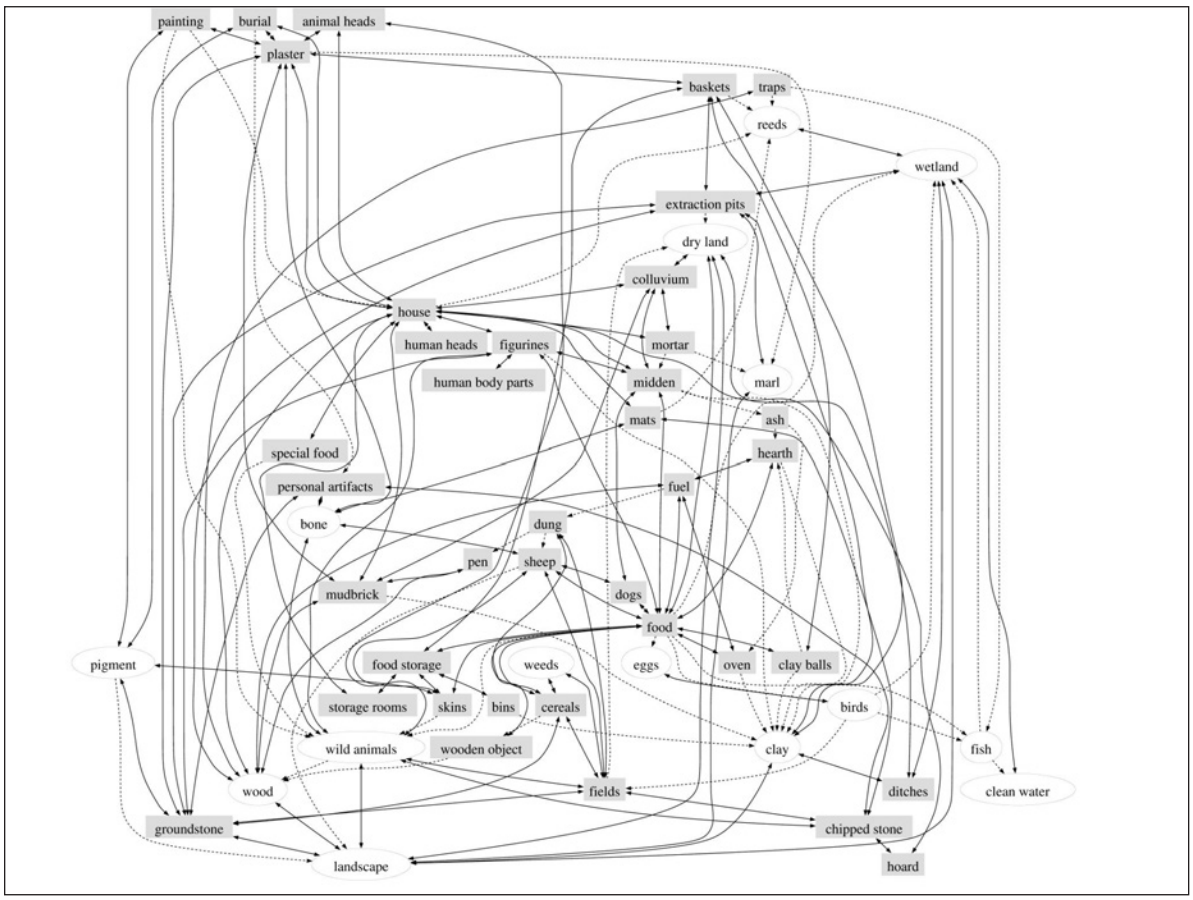

Figure 8.1. *Tanglegram for clay use at Çatalhöyük, adapted from Hodder 2012.*

Indeed, some aspects of entanglements seem readily to lend themselves to network analysis. An important aspect of entanglement is that any human-thing dependence is tangled up in other human-thing dependencies. The human dependence on wheat in early agricultural

societies was tied up with the operational sequences involved in making digging tools, threshing and winnowing implements, regenerating the soil, providing sufficient water, providing storage and so on. Network analysis would seem useful in describing and mapping these 'interactions' (Schiffer 1987), cross-craft interactions (Brysbaert 2007) or 'equipmental totalities' (Heidegger 1973). Here the constraint, or 'caught-up-ness' in the entanglement derives from the large number of interactions that surround any particular event or operational sequence.

Network analysis can also aid in the description and analysis of the overall structure of entanglements between humans and things. In any entanglement there may be particular combinations of humans and things that are very central, and on which many other humans and things depend. In other cases, entanglements may be dispersed or diffuse. Similarly, in a network of nodes and links, there may be 'hubs' that constrain movements and flows, as in the case of networks of flights that are routed through major airports.

Despite the apparent similarities between entanglements and networks, we started with a suspicion that the two forms of analysis had incompatible components. Although any quantification of social interactions involves a degree of reductionism, entanglement is concerned with exploring the full complexities of real-world practices. If it was possible to fully disentangle entanglements they would no longer be entangled. But, as Brughmans (2013, 641) emphasizes, "neither SNA nor complex networks techniques are designed to unravel the full complexity of social interactions, and archaeologists should definitely not apply them as if they were". Network approaches aim to abstract real-life phenomena as complex systems to uncover and explain patterns in the relations between nodes based on the structure of the network; they are not designed to delve into the substance of the human-thing relations that create entanglements. We suggest therefore that network analysis can most profitably be used to explore aspects of entanglement, not to model or reduce their complexities. Network analysis provides "a formal mechanism for representation, measurement, and modelling of relational structures" (Butts 2009, 414); it does not by itself allow interpretation of the full complexity within and behind networks.

While network analysis focuses on the overall form of dyadic links between multiple nodes, entanglement is primarily concerned with the substantive nature of those links. In particular, the focus on the dialectical relationship between dependence and dependency implies that the links between nodes may be difficult to summarize in network terms. For example, a dependency relationship between humans and emmer wheat at the dawn of agriculture led to genetic change in the wheat such that, as a result of a tough non-shattering rachis, wheat could no longer reproduce itself without human intervention. Humans and wheat thus became co-dependent or co-reliant. But as a result, humans were also drawn into harder labor in order to thresh and winnow (Fuller et al. 2010). The relationship involved dependency in that humans became both enabled by and constrained by wheat, trapped into pathways involving new forms of labor and new technologies. It would seem difficult to encapsulate such complex relationships between humans and things in a network analysis, although we will explore this issue further below.

Another potential problem in applying network analysis to entanglements is whether paths in networks are the same as operational sequences in entanglements. Operational sequences of humans and things seem to be mimicked by the notion of paths in network analysis, but there is a difference. In much network analysis in archaeology the focus is on geodesic paths, i.e. the shortest path between nodes, and on how many ties or degrees separate A from B. Any point in the network can be the origin and any point the destination. But in an entanglement of operational sequences, the nodes are arranged in a particular sequence related to the temporal processes of production and consumption (rather as in the narrative networks described by Pentland and Feldman 2007). Operational chains have an upstream (the sourcing of materials and their manufacture into tools) and a downstream (use, repair and discard). We will need to explore whether network analyses can be adapted to such aspects of entanglements.

There are some general problems we have encountered in using network approaches to study entanglement, though these problems are not specific to the entanglement case. One is the problem of defining nodes. This is a widely found problem. For example, in plant biology is a feeding site the leaf, the bark or the whole tree (Butts 2009, 414)? In social analyses, is a node or actor one individual or a group of individuals? In the archaeological case is the 'house' a node or should one delve down to smaller entities such as the walls of the house? How the entity is defined will affect the analysis. In addition, in the case of entanglement there may be a problem in the non-equivalent status of nodes. For example, it is entirely possible for an entanglement to consist of human individuals, animals, an action, an element of the landscape and material things.

Another general problem is how to define the boundaries of the networks (Strathern 1996). In entanglements things depend on other things that depend on other things in endless sequences that often have no obvious bounds. We have attempted to follow the advice of Butts (2009, 414) that "the set of nodes should be defined so as to include all distinct entities that are capable of participating in the relationship under study". Another approach to the problem has been to focus more on ego networks. An ego network consists of a node (ego), its first order ties or neighbors (alters), and all the ties between alters. Looking at first order neighborhoods is attractive, because it somewhat diminishes the problem of the fragmentary nature of archaeological relational data (Mol et al. 2015). Instead of trying to complete and explain the absences in whole networks, ego-networks focus on the dependencies in much smaller networks. Everett and Borgatti (2005) have shown that there is a relationship between the betweenness (see below) of overall networks and ego betweenness.

In this paper we explore aspects of the data from the 7100 BC – 6000 BC site of Çatalhöyük East in central Turkey (Hodder 1996, 2000a, 2005a,b,c, 2006, 2007, 2013a,b, 2014a,b,c). The site was originally excavated in the 1960s by James Mellaart (1967), and more recent work has concentrated on renewed excavations in the North and South Areas. The original sequence of occupation identified by Mellaart has more recently been changed to take into account new stratigraphic evidence (Farid 2014) and the main South sequence now runs from Level South G at the base to Level South T, with TP levels above. For the purposes of

this paper the sequence has been grouped into Phase 1 (Levels South G to O), Phase 2 (Levels South P to T), and Phase 3 (TP Levels). In parts of the analysis we have further subdivided Phase 1 into 1A and 1B (see below). Our aim in this paper is to use the Çatalhöyük data in order to see whether and to what extent network analyses can contribute to the study of entanglement as defined above.

Entanglement networks

Our point of departure was to transform the tanglegram published by Hodder (2012) (reproduced here as Figure 8.1) into a formal network (Fig. 8.2). The original tanglegram (Fig. 8.1) attempted to diagram all the relationships between things associated with clay and plaster in the lower levels of occupation at Çatalhöyük (Phase 1). More specifically it attempted, in the terms identified by Butts above, to include all things that are capable of participating in the uses of clay at the site. An asymmetric matrix of dependencies, i.e. a directed network, was produced. The reason for this was that some dependencies are not reciprocated: A depends on B (thus mudbrick depends on clay) but B does not depend on A (in this case the existence of clay in the landscape does not depend on mudbricks). One unexpected outcome of the process was that the step-by-step construction of the relational matrix was itself of value. The format of the matrix forced the analyst to consider all possible dyadic relations, several of which had been missed or not thought through in the drawing of the original diagram. Visone (Brandes and Wagner 2004), the network analytic software that was used to plot the new graph, also has several algorithms for the automated laying out of networks. This yielded a better visualization (Fig. 8.2) of the information contained in the relational data than was the case in the original figure.

The process of discerning links between nodes in an entanglement has been described (Hodder 2012, 181-2). Each link is based on evidence, or more properly on the interpretation of evidence. Thus mudbrick depends on clay because analysis of the fabric of the mudbrick shows that clay was involved in their manufacture, and we have sourced the types of clay used at different time periods (Doherty 2013; Love 2013; Tung 2013). But clay does not depend on mudbrick because even with extensive use of clay to make mudbrick there remained large available resources in the landscape – thus the presence of clay in the landscape is only marginally affected by use for mudbrick, so clay does not depend on mudbrick. Midden too depends on clay in the sense that clay or marl was spread over middens, either to clean or to level them or as a result of other clay-based activities (an interpretation based on the micromorphological work of Matthews 2005 and Shillito et al. 2011), but again clay does not depend on midden. Houses depend on middens (since houses were carefully swept clean and the middens contain small lenses of material that are interpreted as likely coming from houses), and middens depend on houses (for the refuse that constitutes them). Drawing up the tanglegrams is thus based on detailed contextual knowledge about activities on a site and the large volume of research that has been conducted there.

The tanglegrams initially discussed here all describe thing-thing relationships. There has not been an attempt at this stage to model separately human and social dimensions, that is

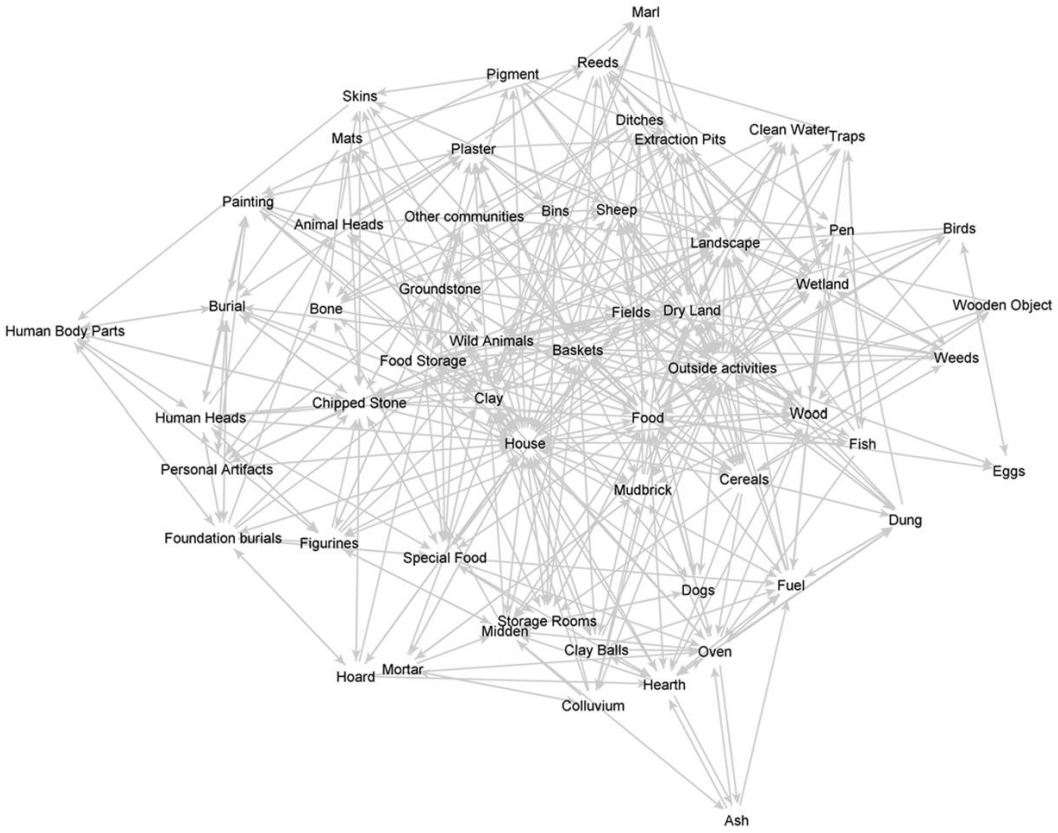

Figure 8.2. *Formal network for clay use at Çatalhöyük.*

human dependence on things, and thing dependence on humans, and human dependence on humans. A node's betweenness centrality in the thing-thing tanglegram can be measured by determining the shortest paths between a pair of nodes in a network and calculating which fraction of the paths run through the node in question, repeating this measure for all pairs of nodes in the graph and summing up all of these fractions. In essence, a node with a high betweenness rating functions as a gatekeeper, controlling access from nodes to other nodes in the graph: even if such a node does not have the highest number of ties it may have a position that is structurally important.

The network analyses provided measures that described the tanglegrams in ways that allow comparison. It was decided to conduct network analyses of equivalent tanglegrams for other Phases at Çatalhöyük (Phases 2 and 3) and at the earlier site of Boncuklu (Baird 2007b). The overall period of time from the early 8th millennium BC to the late 7th millennium BC sees the introduction of pottery and domestic cattle, and there are many changes in the overall organization of society, economy and culture. As a result, the nodes in the tanglegrams for each time period differ, and this has to be born in mind when evaluating the results.

It is of interest that across all four time periods, house and food remain the highest ranked nodes in terms of betweenness (Fig. 8.3) and centrality. This very much aligns with current interpretation of the two sites Boncuklu and Çatalhöyük. The latter site in particular has been interpreted as an example of a house society and individual houses have been termed 'history houses' because they seem to be the foci for handing down ritual objects of importance while at the same time being the houses of burial (Hodder and Pels 2010). Houses at Çatalhöyük are used for burial, food preparation and consumption, ritual, artefact production. Indeed it has been argued that at this time "everything is brought into the house" (Hodder 2006b), and there is much evidence for a house-based scale of economic production (Hodder 2014c). Clay use too was often organized at a house level, with some evidence of separate houses using their own mudbrick recipes. There is no evidence of public buildings, chiefly centers, or religious elites; many aspects of life were organized through the house. This was largely a domestic mode of production although larger sodalities and groupings existed (Düring 2006; Marciniak and Czerniak 2007; Mills 2014).

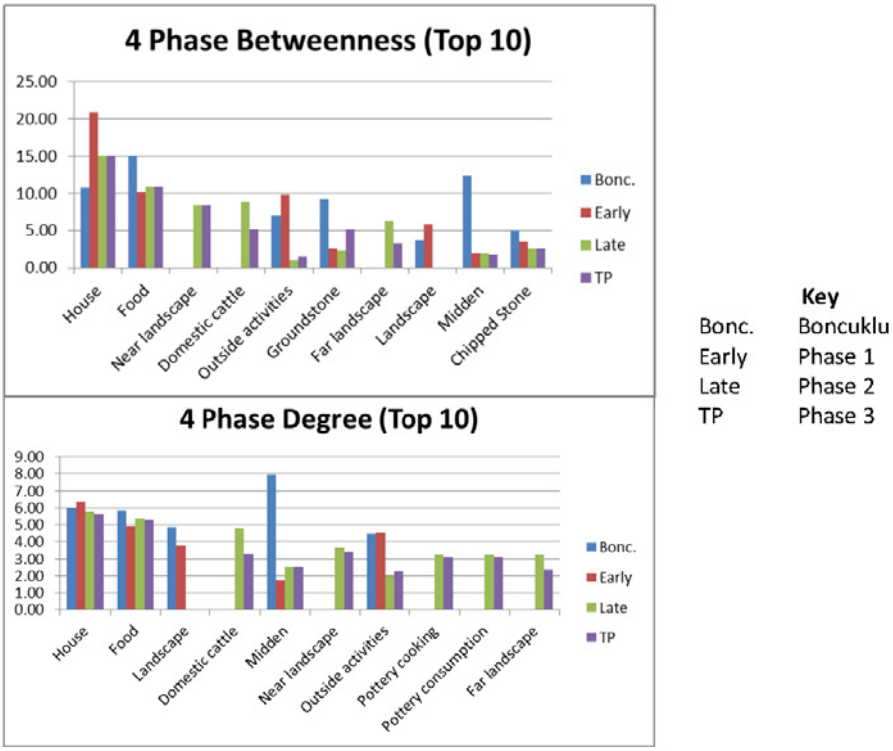

Figure 8.3. *Top 10 four phase betweenness and degree.*

Equally, food was a central focus in the domestic realm. Many of the activities in the house involved the use of clay to make ovens and hearths, and cooking initially in Phase 1 involved the use of clay balls heated in the oven (Atalay 2005). Clay was used in food storage bins and domestic and wild animals were involved in different scales of consumption and group feasting, mostly house-based (Demirergi et al. 2014). Cereals were stored still husked

and were processed at the house level by pounding and grinding using querns (Bogaard et al. 2013).

It might be objected that houses and the food in them appear as central because we only dig houses at Çatalhöyük. It is true that at this site, as already noted, a domestic mode of production and a lack of public buildings reinforce the notion of a house-based society, which the network analysis picks up well. But there are also middens and open areas at Çatalhöyük and these could have come to the fore in the analysis. Indeed there is an important shift through time. There is markedly less going on in the Boncuklu houses in comparison to Çatalhöyük. The Boncuklu houses are smaller, there are not room divisions and there is little evidence of storage facilities. More activities take place on the outside middens than at early Çatalhöyük. This latter point is expressed very clearly in the changing betweenness of midden through time. At Boncuklu the value for midden is 12.37, but the value drops to around 2.00 in the three Phases at Çatalhöyük. The settlement pattern at Boncuklu is much more open; houses are not tightly packed against each other as is found in the classic agglomerated neighborhood structure at Çatalhöyük. There is more space for activities in open areas at Boncuklu and the social system seems less house-based. At Boncuklu food is ranked higher than the house in comparison to Çatalhöyük in terms of betweenness (Fig. 8.3). These shifts express very well our current understanding. In the Neolithic of the Middle East and Anatolia there is good evidence that houses gradually increased in size and internal functions. Throughout the region, more and more was brought into the house during the aceramic Neolithic (Byrd 1994; Kuijt and Goring-Morris 2002).

Phase 1 at Çatalhöyük includes the classic levels of Mellaart's VII-VI and the current team's South M-O. This is the time period when the house is at its most elaborate, with most evidence of burial, and most plastered installations of bull crania and other animal parts. This is the period when most reliefs are found on the walls of houses. In the later levels at the site, the house remains important but there is more separation of houses from each other, and more use of adjacent open areas and yards. Doorways into open areas appear. These changes are well expressed in the high betweenness in Phase 1 for the house (20.83) and the lower values in the later levels (15.06 and 15.08 in Phases 2 and 3).

Other shifts in the betweenness values are equally informative. In comparison to the early role of wild animals, domestic cattle, introduced by Phase 2 at Çatalhöyük, immediately have a greater impact. Domestic cattle come in immediately at a high value. We know that the introduction of domestic cattle had considerable impact, being used for a wide range of functions including milk consumption and taking a role in special feasting and deposition (Pitter et al. 2013; Russell et al. 2013). Wild bulls are less frequently found in installations in the upper levels. There is also evidence for more focus on individual personhood in the upper levels, with more evidence of personal ornamentation and more evidence of long-distance materials being used in bead production (Vasic et al. 2014). The increase in the betweenness values of personal artifacts (0.78 and 0.37 in Boncuklu and Phase 1, and 4.66 and 3.49 in Phases 2 and 3 – not shown in Fig. 8.3) expresses this shift.

It is not surprising that the results of these representations correlate so well with existing knowledge since it is that knowledge that led to the construction of nodes and links in the matrices of dyadic relations. Thus at one level the resulting tables and graphs simply reproduce existing knowledge. On the other hand, they allow a transparent and visual representation that promotes comparison and discussion. They allow the degree of change between periods to be explored and related to wider theories. The network exploration is thus a useful component in an interpretive procedure. It contributes to debate, clarifies arguments, and leads to new inquiry. For example, why do the betweenness values for midden decrease after Boncuklu while those for outside activities do not decrease until after the early Phase at Çatalhöyük? While this dichotomy had not been noticed in earlier discussions, the network analysis draws out a clear pattern. In the early Phase at Çatalhöyük the range of activities in midden areas is greatly reduced in comparison to Boncuklu, but outside areas are used for a range of non-midden activities such as animal pens or lime plaster firing, and areas near the site are used for fishing and the collecting of eggs. The network analysis has helped to identify a change in the use of space through time.

As already noted, the overall betweenness and degree of centrality values depend on the overall density of the network (the percentage of ties that are present relative to the amount of ties that would be present if every node was maximally connected), particularly in relatively small networks. In addition, it remains difficult to compare networks when they do not consist of the same nodes and the same amount of nodes. Yet in these models the type and number of nodes necessarily change as cooking pottery and domestic cattle are introduced. An alternative approach is thus to focus on ego networks. An ego-network aims to abstract, model, and analyze the direct network around one node, referred to as ego. Also known as centered graphs, they were pioneered by the sociologist Linton Freeman (1982) and were developed with an eye to better understand the position of individual actors within larger social structures. Instead of focusing on the structural properties of social networks as a whole, ego-networks can be used to understand the effects wider networks have on a particular individual (Mol et al. 2015).

Figure 8.4 shows the ego networks for house across the four time periods. In this case the ego network consists of a node (ego), its first and second order ties or neighbors (alters), and all the ties between alters. The size of nodes in the diagrams is based on betweenness centrality. The color of the nodes is: black (ego), 1 distance (dark grey) and 2 distance (light grey). The networks show nicely the greater centrality of the house after Boncuklu as well as the greater importance of midden at the earlier site. Comparison of the four networks also shows the greater betweenness centrality of the house in Phases 1 and 3 at Çatalhöyük. This visual impression is supported by a series of measures of the four networks, as shown in Figure 8.5. The overall network density percentage, and the absolute degree of house betweenness show peaks in Phases 1 and 3 at Çatalhöyük.

These results fit very well with our understanding of the changing role of the house at the site (Hodder 2014b). Phase 1 includes the high point of 'classic' Çatalhöyük, made famous by the excavations of James Mellaart in the 1960s. At this time, population densities are at their

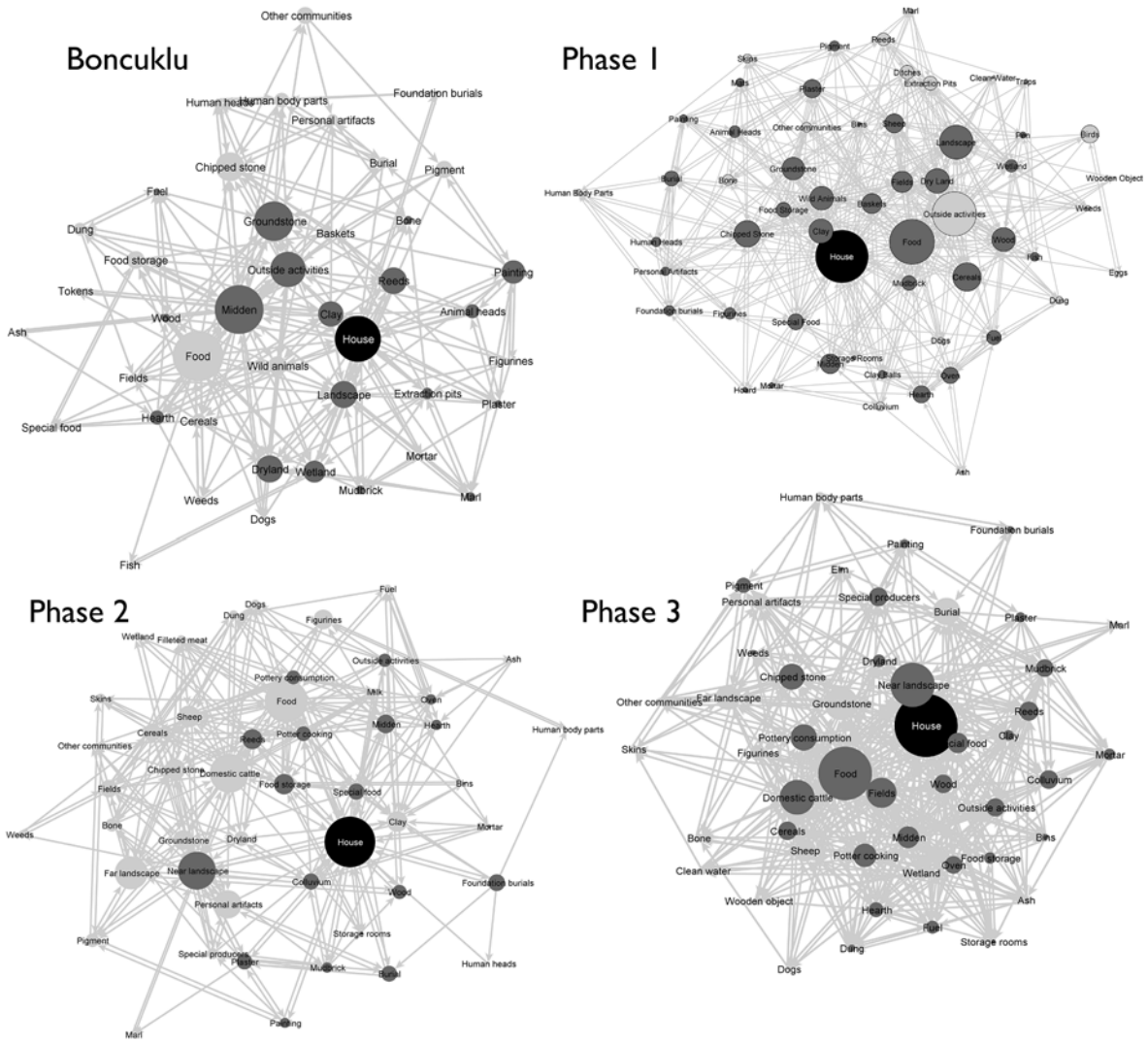

Figure 8.4. *Ego networks for house across the four time periods.*

highest, there is high reproductive fertility, much burial within houses, and a great elaboration of ritual and artistic expression. Bucrania and other animal installations are common in houses. After Phase 1 there is a major change in the sequence at Çatalhöyük, and increasingly in the upper levels there is a greater focus on the independence of house units and their productive capacities. By Phase 3, in the final centuries of occupation on the East Mound, the house has become very large, with very thick walls, large central rooms with central hearths, and a greater focus on mobiliary art and pottery rather than wall art; burial occurs in tombs rather than in houses (Marciniak and Czerniak 2007). By Phase 3 the house has taken on a new centrality based less on rituals associated with the dead, plastered animal heads and long-term ancestry, and more on production and social exchange, for example through the use of more elaborate pottery used for social consumption. Comparison of the ego networks for Phases 1

and 3 shows these differences clearly. The ego network for the house in Phase 1 shows the house strongly linked to clay (including for plastering animal skulls) and wild animals, as well as linked to burial, human head circulation and foundation burials. In Phase 3, on the other hand, the house has strong links to domestic cattle, fields, and pottery consumption, although food is still involved in special deposits, and the near landscape is intensively exploited. There are no first or second order links to burial. The analysis of ego networks picks up details of the changes through time in the role of the house that were not picked up in the earlier analysis of the overall entanglements (Figs. 8.2 and 8.3). The results of the two types of analysis are similar, but the focus on one node and the first- and second-order links of that node allow a more careful consideration of the role of the house through time. In particular, the shift in the nature of the house centrality between Phases 1 and 3 becomes clear.

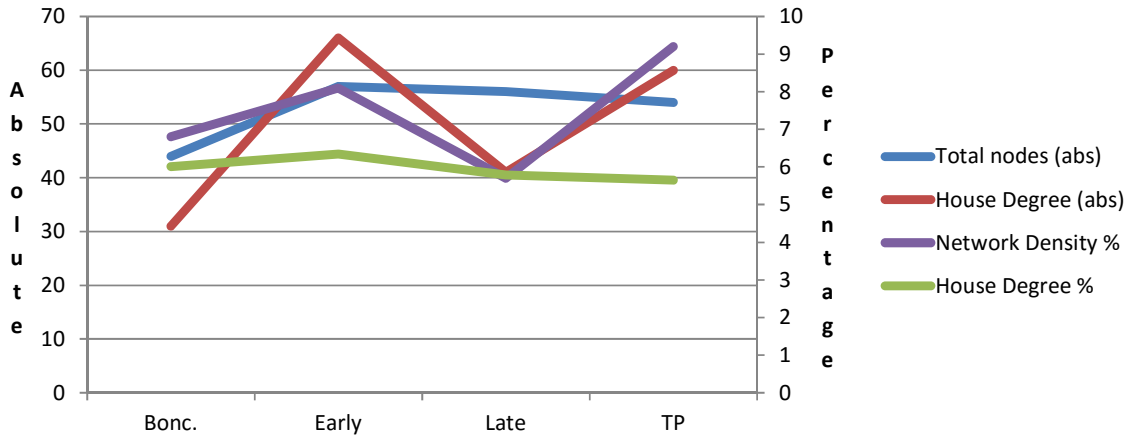

Figure 8.5. *Comparison of the four ego networks for house.*

From networks to chainworks

However, the focus on first- or second-order links can in other respects be seen as a disadvantage. In practice, archaeologists know that nodes in operational sequences are arranged in long sequences from procurement to discard often described as behavioral chains or *chaînes opératoires* (Schiffer 1987; Leroi-Gourhan 1943; Lemonnier 1993). While these two types of operational chain are usually described as unilinear sequences from procurement to discard, it is widely recognized that they may loop back on themselves, as when a clay mudbrick is broken down and used to make new bricks. A more complex picture is built by pointing to the other artifacts used at any stage along a chain. For example, in the manufacture of an obsidian blade, a bone or antler point may be used that has its own sequence from procurement to manufacture to use (to make the obsidian blade) to discard. Thus all operational chains are threads in numerous cross-cutting chains. These different chains have to 'wait for' each other – they have to be organized temporally in relation to each other. The making of the obsidian blade depends on the pre-production of the bone or antler point. One of the oft-cited criticisms of Actor Network Theory is that it pays insufficient attention to temporality (Latour 2005), and the same can be said of the spatial focus of network analysis more generally. We wished

to explore whether the description of paths in network analysis (Brughmans 2010; Knappett 2013) might allow an understanding of the operational chains within entanglements. A key component of entanglement is that individual humans and things are caught up in multiple threads or chains of intersecting sequences (Hodder 2012). Can network analysis capture some of this 'chainwork'?

One advantage of approaching networks and entanglements in terms of operational chains is that the latter provide some degree of solution to the problem of how to determine boundaries. Earlier, we stated that the boundaries of networks of entanglement could best be identified in terms of functional inter-dependence, but in practice it is often difficult to determine where such inter-dependence might cease. It remains difficult to discern what node to include and what to exclude. The use of ego networks constrains the search, but on arbitrary grounds (in the above case to second-order links). The following of operational chains allows a less arbitrary and more secure identification of what is relevant to the network and what is not. Operational chains start with upstream activities (procurement and manufacture) and end with downstream (use and discard) and although looping and intersections occur, this rule of thumb provides some constraint on the choice of relevant nodes.

Another advantage of approaches to entanglement that focus on operational chains is that the nodes are actions rather than things or humans. In the networks described above, the nodes have been things and the links the dependencies between things. The advantage of such a formulation is that it draws stark attention to the way that humans get caught in the entanglements of things and their inter-dependence, but the disadvantage is that humans are not directly involved as co-producers of entanglements (Ingold 2000, 2010). By focusing on human-thing actions in operational sequences (humans making pots, humans discarding refuse), the artificial separation of humans and things is avoided, and the wider links between networks and theories of practice and agency can be explored (Knappett 2011) . Pentland and Feldman (2007) describe forms of network analysis that explore how humans use tools to do tasks in complex re-combinable sequences. Their notion of narrative networks in which the pathways in operational sequences are defined, is built upon Actor Network Theory, structuration theory and theories of organizational routines.

An example is provided here of the application of network path analysis to entanglements of operational chains. In early Phase 1 at Çatalhöyük, cooking was achieved by firing clay balls that were then reheated and placed with food in containers such as baskets (Atalay 2005). In later Phase 1 and in Phase 2, cooking was increasingly carried out using clay pots (Last 2005; Yalman et al. 2013), and residue analyses of lipids in cooking pots demonstrate a preponderance of ruminant adipose fats (Pitter et al. 2013). Why did the inhabitants at Çatalhöyük switch from cooking with clay balls to cooking in pottery? In her experimental and ethnographic research, Atalay (2005) showed that while cooking with clay balls was very efficient, it demanded more time from the cook as balls had to be frequently reheated and changed over. The cooking pot, on the other hand, could be set on the hearth and allowed to cook – the pot acted as a delegate for the cook (Latour 2005).

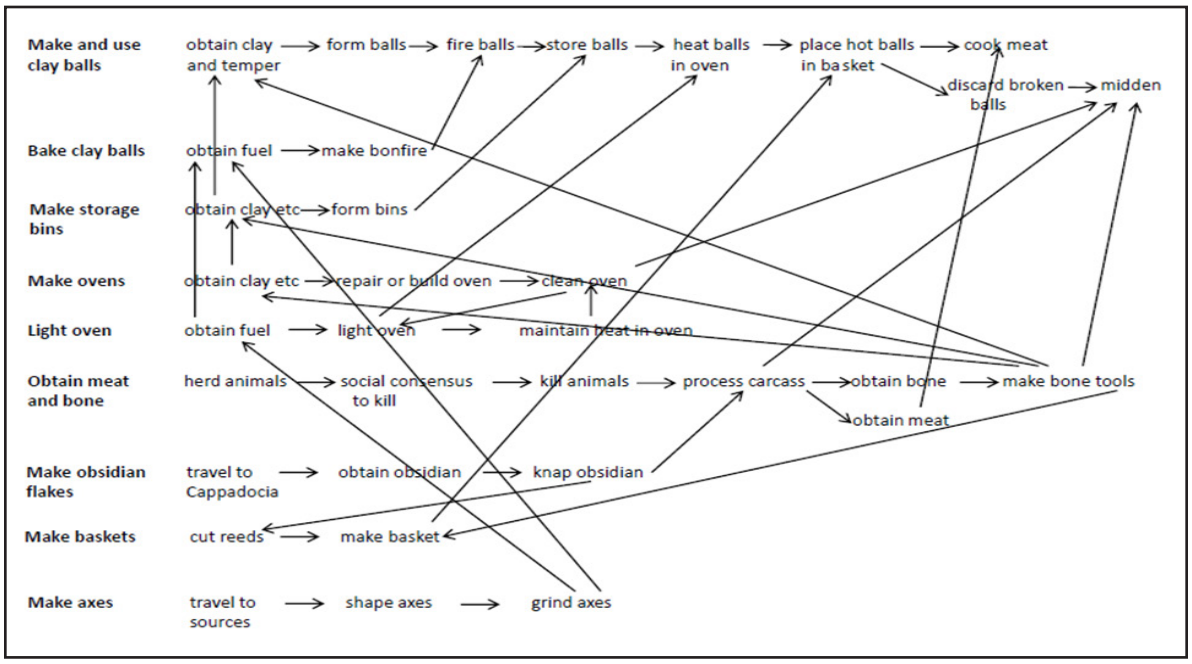

Figure 8.6. *Operational chains for cooking with clay balls and their cross-connections.*

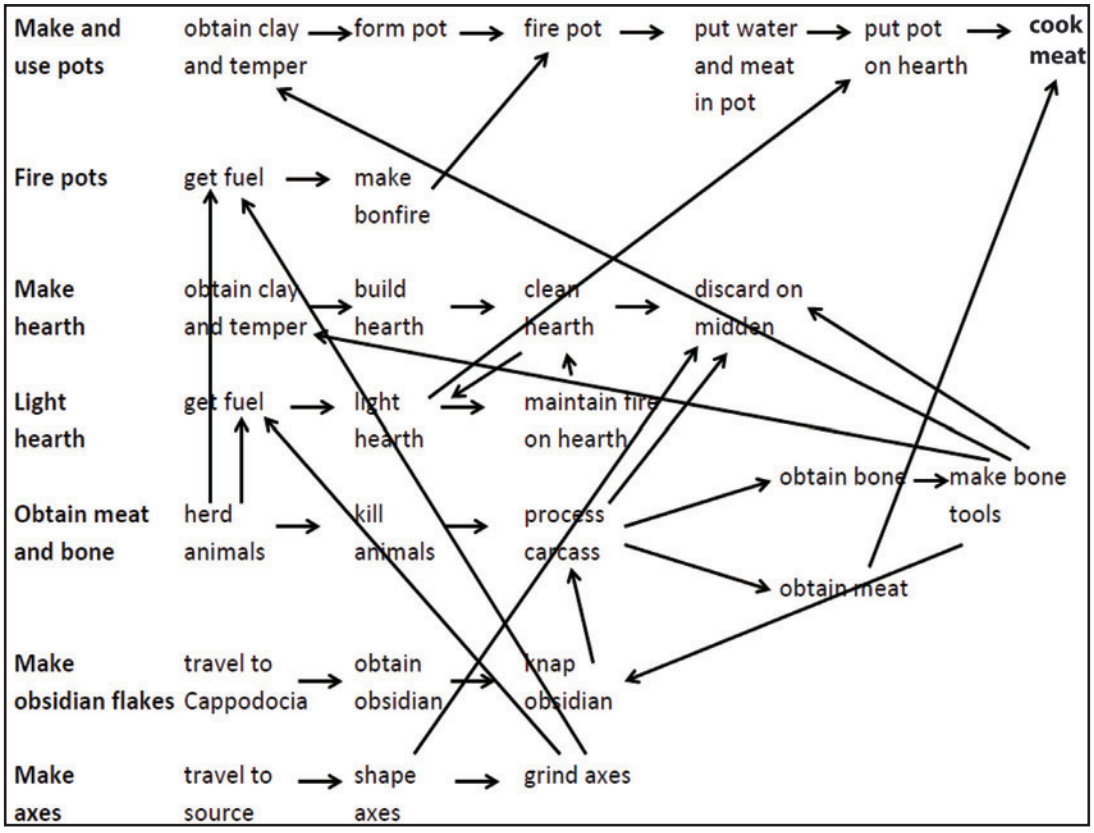

Figure 8.7. *Operational chains for cooking pottery and their cross-connections.*

But what about all the other operational chains involved in these cooking processes? Was early pottery used for cooking because it involved fewer cross-cutting chains? In order to explore this question we described the operational chains for cooking with clay balls, as well as their cross-connections (Fig. 8.6). We did the same for cooking pottery (Fig. 8.7). We then diagrammed the same information as paths within a network analysis (Figs. 8.8 and 9.9). It is particularly clear in the latter cases that operational chains overlap and intersect. For example, in the clay ball network diagram (Figs. 8.6 and 8.8), obtaining obsidian and knapping it is part of the paths to both process meat and to cut reeds. In addition, the paths are sometimes circular. For example, knapping obsidian to process a carcass produces bone from which tools are made to knap obsidian. So the paths are complex and it was not as easy to define their beginnings and endings as had been hoped. The overall connectivity of the clay ball network (Fig. 8.8) gives a Density of 0.048, and an Average Degree of 1.400. For pottery (Fig. 8.9) the figures are 0.053 and 1.280. As a result of the issues identified above we found it difficult to interpret these values.

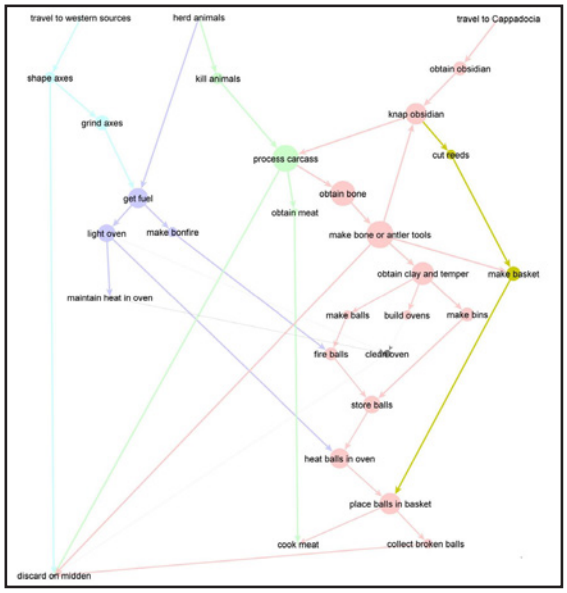

Figure 8.8. *Diagram for cooking with clay balls as paths within a network analysis.*

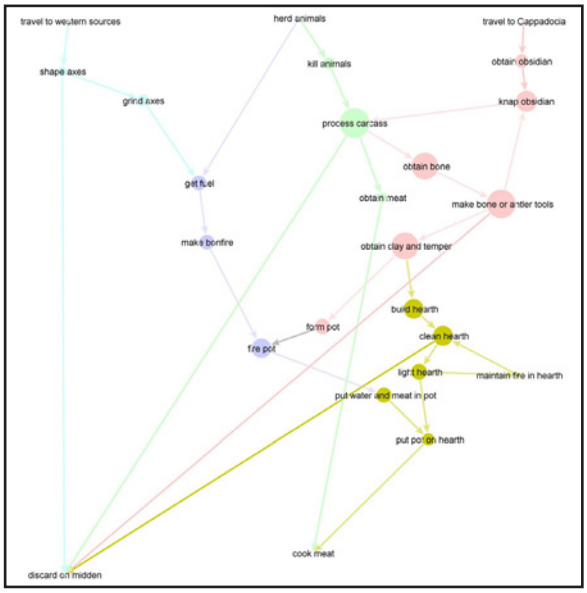

Figure 8.9. *Diagram for cooking pottery as paths within a network analysis.*

The main result of the transforming of operational chains into paths in networks is that some temporal confusion is caused, because the network method tries to find as few short paths as possible. For example, the clay balls network suggests that in order to cook meat one kills an animal, then processes the carcass to obtain meat. But in the diagram one cannot cook the meat until the bone from the carcass has been obtained, so that tools can be made in order to dig for clay, so that clay balls can be made, so that they can be heated in the oven - finally allowing one to cook meat! In fact, however, the making of the clay balls would usually have happened prior to obtaining meat to cook. As another example, the network diagram for cooking with clay balls makes it seem as if every lighting of the oven involves travel to the

source of groundstone in order to shape and then grind axes so that wood can be obtained for use as fuel in the lighting of the oven. In fact, however, the groundstone axes could be used multiple times and fuel could be stored for multiple oven lightings.

So, in this case, the enumeration of separate operational chains, where each chain is defined as having upstream to downstream components - that is from sourcing to use and discard – proved more productive (as in Figs. 8.6 and 8.7). This approach allows the chains to be better controlled (each defined in terms of upstream to downstream), and it allows sequences to run in parallel, thus retaining a fuller sense of the temporalities involved.

The descriptions provided in Figures 8.6 and 8.7 allow the following comparisons to be made of the entanglements of cooking meat with clay balls in comparison with cooking meat in pots.

	clay balls	**pottery**
Number of chains	9	7
Average number of links per chain	2.4	2.7
Number of cross links between chains	21	16
Average number of cross links per chain	2.3	2.3

In this example it is evident that cooking with pottery is less entangled than cooking with clay balls, in the sense that fewer operational chains are involved, with fewer cross links between them. In other instances one might find that the average numbers of links per chain (the lengths and interconnections between chains) might show major change, which is not the case here. Cooking with pottery does not necessitate the manufacture of other containers (baskets or wooden bowls) that were needed in the case of cooking with clay balls, and it does not necessitate making storage bins specifically for storing clay balls. Pottery was rarely discarded in contrast to the clay balls that frequently cracked and broke as they were heated, cooled and reheated. The initial adoption of cooking pottery thus makes sense not only in terms of saving time and energy (as determined by Atalay 2005) but also in terms of the overall entanglements of using pottery. In addition, we have assumed in the pottery cooking scenario that the pots were locally made but there is evidence that some of the pots were obtained by exchange (Doherty and Tarkan 2013); this again would decrease the number of operational chains for pottery cooking even if exchange links are included.

An additional way of exploring the wider entanglements that are brought into play in a particular operational sequence is to link the chainwork analysis described above with the earlier study of betweenness in wider entanglements. This allows us to explore different scales of entanglement. A local entanglement in which only a few variables are considered may look very different if other cross-cutting chains are considered. We have already seen one example of this: the adoption of cooking pots results in baskets not being necessary for cooking, but baskets may still have to be made if they are used for non-cooking functions. Thus the

fact that the baskets are not used for cooking may not be an overall saving. More generally, the objects used in an operational chain may be tied up in other operational chains not considered in a small-scale analysis. For example, we can consider the main sets of objects used in cooking sheep meat in Phases 1 and 2 at Çatalhöyük. As already noted, the lipids found in cooking pottery at Çatalhöyük indicate the cooking of ruminant adipose fats rather than milk, and it seems very likely that the pots were mainly used for processing domesticated sheep products given the very high predominance of sheep bones in the faunal assemblage (Russell et al. 2013) and given that the pots are too small to hold very much cattle bone. If we only consider comparable objects (eg hearth or oven, clay balls or pottery), used in cooking sheep meat in Phases 1 and 2, the following betweenness centrality values are obtained from the analyses of overall entanglements described above (e.g. Fig. 8.2).

	clay	balls	sheep	oven	chipped stone	fuel	**Total**
Phase 1	2.93	0.33	1.84	1.35	3.53	1.03	**11.01**
Phase 2	0.52	1.27	2.79	0.63	2.57	0.38	**10.16**

Here we see that the overall betweenness centrality values associated with cooking meat in the house decline slightly, again contributing to the attractiveness of switching from clay balls to pottery. But we also see that pottery itself is rather more nodal in relationship to the entanglements as a whole than are clay balls. This is because pottery affords a wider range of functions than clay balls, and this higher nodal functionality may have been an attraction.

It should also be noted that while the analysis of chainworks rather more satisfactorily captures the involvement of humans and things with each other within entanglements, it is still the case that the sequences described here are very material-centered. The operations do not take into account social and ritual components and there are no social and ritual events in the sequences. For example, the killing of an animal to obtain meat would have been preceded by a social decision to go hunting or to take an animal from the domestic herd. We have no reason to think that cooking with clay balls and pottery involved different amounts or scales of social and ritual involvement at Çatalhöyük and it is for this reason that they have been excluded here. Nevertheless, the involvement of social dimensions needs to be considered and included where possible, as will be shown below.

Relational costs and benefits

The network and chainwork approaches described above evaluate a link or edge between nodes simply in terms of presence or absence. They focus on the overall structure of the network. They thus allow exploration and representation of entanglement that comes about through the overall structure. One part of a chain, or a dyadic pair, is seen as entangled if its

nodes are very central in relation to the whole chain or in relation to the network as a whole. Thus, in the chainwork example used above, cooking pottery was introduced at least partly because it meant that cooking meat was less entangled in relation to all the component parts and practices.

But this type of analysis is not allowing representation and exploration of the nature of the dyadic ties themselves, the ways in which dependence and dependency inter-relate in any specific process. For this we need to develop quantitative analysis of the ways in which things and humans afford and constrain each other. One approach would be to work out the costs and benefits of individual things or practices in relation to the wider entanglement. Human Behavioral Ecologists have attempted to develop mathematical analysis of technological investments amongst hunter-gatherers and have included variables such as manufacturing time to make a particular technology, procurement or return rates of using that technology, foraging time, 'utility' in terms of calories (Bettinger et al. 2006, 2009; Ugan et al. 2003)

In such approaches, costs and benefits are often assessed in terms of universal optimization or maximization criteria. Winterhalder (1983) does evaluate foraging costs and benefits relative to the time and energy required for other activities, but a limited set of variables are included. In the entanglement approach, costs and benefits can only be seen as relative to the entanglement as a whole. For example, the costs and benefits of cooking pots of a particular type or fabric cannot be assessed universally, in terms of optimizing heat transfer or maximizing liquid retention. Rather, the costs and benefits are assessed in terms of specific cooking pots (of a particular size etc.) in relation to a specific function, such as cooking sheep bones. Cooking sheep bones in small pots differs from cooking cattle bones as the latter are larger and the overall carcass is bigger, so using small pots is less efficient if the aim is to cook the whole carcass. So the costs, benefits, and efficiency of a cooking pot are relational. How effective they are at cooking also depends on cooking method, for example suspended over a hearth or placed on or in an oven. In addition, it is important to evaluate the social dimensions of technologies. For example, the costs and benefits of cooking sheep with pots are also affected by the social values given to cooking, pots and sheep. The study presented here as an example explores again the introduction of pottery at Çatalhöyük, but extends to the introduction of domestic cattle. In this case, the stratigraphic sequence has been divided so as to allow more detailed discrimination between the levels of occupation in which pottery is introduced. As noted above, cooking pottery was introduced in the later part of Phase 1. Phase 1 has therefore been divided into subphases 1A and 1B.

Phase 1A: Lowest levels: South G–L in which cattle were wild and cooking was carried out with clay balls as described above. There was heavy processing of domestic sheep carcasses in the house to produce meat that was cooked on the bone, and to obtain marrow, fat and grease. Clay balls were heated in the oven and then placed in baskets. Most wild cattle meat was processed outside the house and often in relation to larger social groups than the house. Bulls were preferred in feasting and bull horns were often placed around burial platforms in houses. Use wear analysis (Lemorini 2014) suggests that obsidian flakes were used for a wide range of functions including the processing of meat.

Phase 1B: Lower levels: South M-O in which domestic cattle have been introduced and cooking was carried out in pots. Heavy processing of sheep carcasses occurred, cooked in pots on hearths. Domestic and wild cattle are found in feasting contexts. There was more burial in houses and more symbolic elaboration. Houses gradually got larger and there were more activities going on inside them. Obsidian flakes continued to be used.

Phase 2: Later levels: South P-T in which there were more domestic cattle, a heavier dependence on domestic sheep, cooking with pottery and the filleting of meat (based on the evidence of cut marks on bones – Lemorini and D'Errico 2014; Demirergi et al. 2014). There were more activities taking place in an around still larger houses, but less burial and wild animal installations. Obsidian was now made into blades used to fillet meat cooked as stews in pots.

In the following analyses two types of cost and two types of benefit are considered, including nutritional, material and social components. The two benefits are calories obtained from food, and prestige within the social network of a house, house group, housing sector or in the whole Çatalhöyük community. The two costs are labor, and the maintenance of social networks, for example in providing gifts or investing time at social gatherings. The relational costs and benefits are each graded on a scale 0 None, 1 Low, 2 Moderate, 3 High, 4 Very high.

The four cost and benefit values given for each relation between nodes in the network are based on interpretation of the archaeological evidence. To what extent is it possible to estimate the relational costs and benefits? The following examples demonstrate the types of arguments that have been made in relation to the tanglegram networks shown in Figures 8.10 to 8.12.

In Phase 1A consider the link between sheep and clay balls. There is archaeological evidence for heavy processing of domesticated sheep carcasses to produce meat that is cooked on the bone, and to obtain marrow, fat, grease using clay balls. As described above, our inference is that animal products were heated by placing clay balls in the oven and then placing the heated balls and meat products in a basket or other container (Atalay 2005). This intensive processing is interpreted (on the basis of the ethnographic and experimental work surveyed by Atalay showing the high efficiency of the process) as having produced a very high number of calories per person (score 4 for calories), but there are high labor costs because of the need to watch over the cooking, to change the balls, to break up bone into small pieces to retrieve marrow, fat and grease (score 3 for labor). There is low social prestige because the processing is done indoors, in unmarked areas of the house (that is in parts of the house that have less symbolic decoration and little ritual), and domestic sheep do not have high social status as can be seen from their absence from symbolism and art and ritual (score 1 for social prestige). There is much archaeological evidence in terms of artifact patterning, that processing and cooking of domestic sheep occur at the house level as part of daily routines. As a result, very little extra investment is needed in maintaining this small network, and there is little evidence of domestic sheep being involved in special events in larger social groups (score 1 for network costs). The overall relational benefit less cost is 1 for the link between clay balls and sheep.

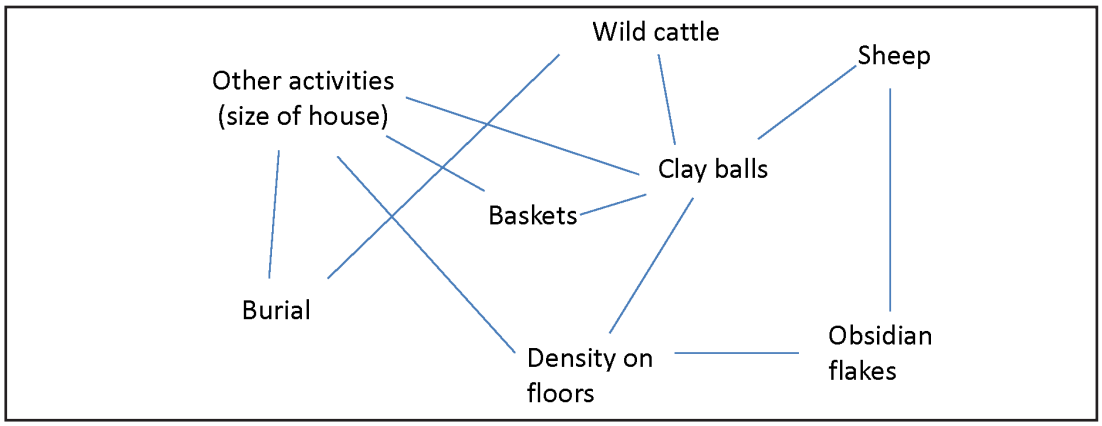

Figure 8.10. *The links studied in Phase 1A.*

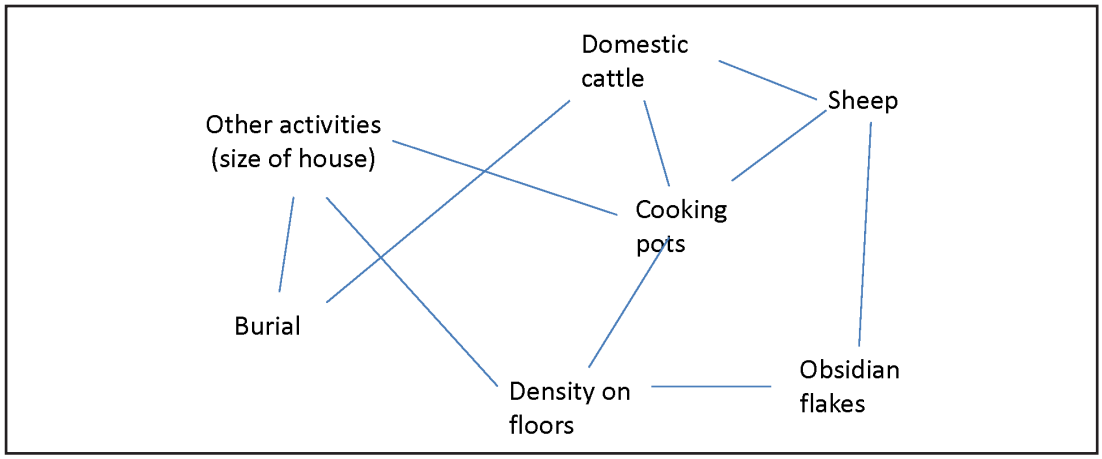

Figure 8.11. *The links studied in Phase 1B.*

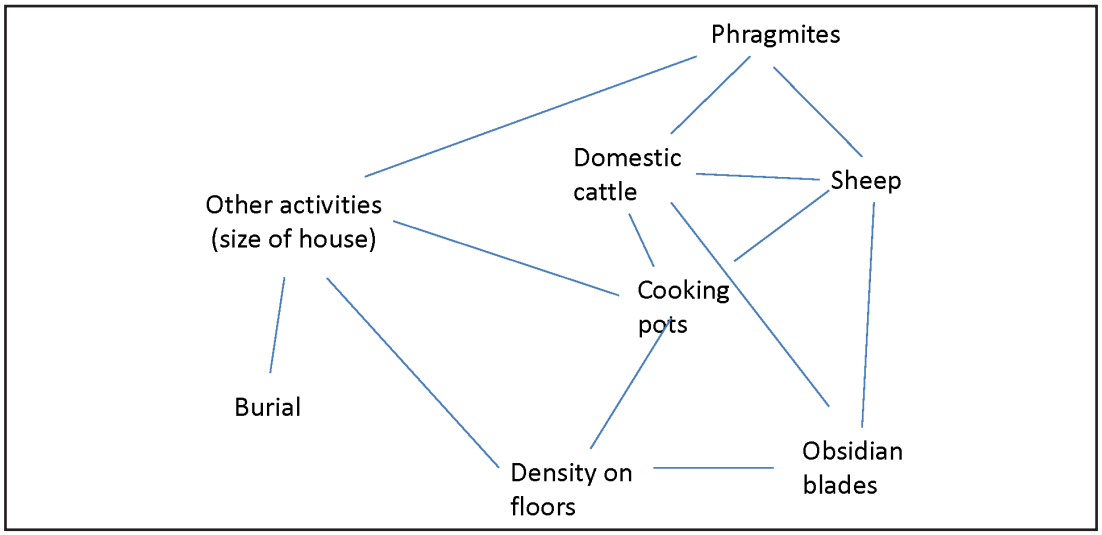

Figure 8.12. *The links studied in Phase 2.*

As another example, consider the link between other activities and cooking pottery in Phase 1B. The increase in the number of activities taking place inside houses can be assessed in terms of the increasing size and internal differentiation of houses. There is good evidence for the gradual increase in house size and internal differentiation, as part of wider regional trends (Byrd 1994). Although this was a ceramic Phase there were very few pots in circulation, perhaps one per house and there is no evidence that they were made inside houses. The use of mineral tempered cooking pots rather than clay balls and baskets allowed more space and time for other activities (since, as noted above, cooking pots can act as delegates for the cook). Other activities in the house such as tending the hearth and stacking fuel do contribute to cooking in pots, and the organization of other activities has to leave time and space for cooking with pots, so the link between other activities and pottery does contribute to caloric intake although not directly (score 2 for calories). Other activities are less involved in maintaining pots in cooking than clay balls (score 1 for labor costs). There is no evidence of prestige involved in pottery amongst the activities in the house. The pottery is not marked or decorated and it is used in unmarked parts of houses (score 1 for social prestige), and the networks involved in the links between pottery and other activities in the house are small scale but with some extension outside the house (score 2 for network costs). The overall relational benefit less cost is 0 for the link between other activities and pottery.

As a final example in Phase 2, consider the link between sheep and obsidian blades. In the upper part of the sequence obsidian blades were used instead of flakes. These are more efficient at cutting meat in the sense that more cutting edge is produced per equivalent block of obsidian (Sheets and Muto 1972). The blades were used to fillet meat off the bone (based on cut mark evidence and use wear evidence) so they played an important role. The meat was then boiled in pots. Percussion blade techniques are more difficult and involved specialized labor, partly in-house and partly obtained by exchange (Carter and Milić 2013b). Obsidian blades thus contributed significantly to meat consumption and thus to caloric intake (score 3 for calories), but the labor costs in the production of the blades and the filleting of meat off the bone were high (score 3 for labor). Sheep did not have high prestige but the use of fine blades to process meat may have attracted moderate social prestige (score 2 for social prestige). The social networks involved in obsidian exchange were very widespread and complex, but the networks involved in cutting sheep meat off the bone were small scale (score 3 for network costs). The overall relational benefit less cost is 0 for the link between sheep and obsidian blades.

The scores ascribed arise from a systematic heuristic process that is necessarily complex. In the examples given above, there is use of ethnographic analogy and experimental data. But most of the scorings derive from detailed contextual knowledge of a site on which there has been large scale excavation over a long period of time. For example, the low score for social prestige for processing domesticated sheep bones in Phase 1A is assigned because of much other evidence that the southern parts of the house in which processing residues are found are not surrounded in decoration, symbolism and ritual in contrast to the northern parts of houses (Hodder and Cessford 2004). Similarly in Phase 1B, pottery is undecorated and is used in the southern parts of the house where the hearth occurs and where pots are sometimes set into the plaster floors. So cooking with pots is given a low score in terms of social prestige. In Phase 2

the use of blades to process sheep meat is given a slightly higher score because of the evidence from the site that obsidian blades involved some degree of specialized production and they were often found in special deposits (for example in niches or along the edges of platforms). The scorings are transparent and open to critique and re-evaluation in relation to the evidence from the site.

Table 8.1 summarizes the relational costs and benefits for all the links shown in Figures 8.10 to 8.12. The links included in the different Phases are similar and there are an equivalent number in the three Phases (11, 10, 10). The overall benefit less cost in Phase 1A is -13, in Phase 1B -6, and in Phase 2 -4. The absolute values are of little interest in themselves; it is the relative values that are the foci of this study. Through time this particular set of links becomes less costly in relation to benefits. Why is this? We can consider the effect of each variable in turn. For example, if we consider all the one-distance links to clay balls in Phase 1A the overall benefit-cost is -7. But for pottery in Phase 1B the benefit-cost jumps to +3. It is +2 in Phase 2. These results demonstrate very clearly that pottery is attractive as a new cooking technology because it is much less costly and provides more benefits, both material and social, than clay balls.

The network analysis indicates that the use of clay balls for cooking in Phase 1A was time consuming and the processing of carcasses with obsidian flakes was relatively inefficient. As a result the amount of time and space that could be devoted to other activities in the house was restricted. There was thus a high degree of entanglement that limited what could be achieved. In Phase 1B there was some release from this entanglement because the shift to cooking pottery allowed a wider range of activities in the house. In Phase 2 there are benefits from more efficient animal processing with obsidian blades and cooking pottery.

As in the earlier analysis of chainworks, these conclusions from the analysis of relational costs and benefits are very sensitive to the numbers of variables included. For example, in Phase 2 we know that there was an increase of phytoliths of the reed *Phragmites australis* (Ryan 2013); this has been interpreted in terms of the aggressive expansion of this species in disturbed ground around the site, partly caused by the more intensive grazing of sheep and cattle by the site. This invasive species would have had to be managed by cutting back using obsidian blades. If we add in the relational costs and benefits of the links between *Phragmites* and domestic cattle, sheep and other activities then the overall benefits-costs shifts from -4 to -15.

The more variables are considered, the more we can appreciate how things get entangled up in each other. If we move from considering costs and benefits in terms of optimizing a few variables (for example, in relation to technological specialization see Stevens and McElreath 2015), to evaluating costs and benefits in relation to the entanglements as a whole, we find that certain things become nodal in the network of entanglements such that they dominate or entrap. For example, in the case of obsidian blades, these allow more efficient filleting of meat so that meat off the bone can be cooked in larger quantities in small pots, but they also

	labor costs	network costs	calorie benefits	prestige benefits	benefits -costs	
clay balls/sheep	3	1	4	1	1	
sheep/obsidian flakes	1	1	1	0	-1	
obsidian flakes/floor residues	3	2	1	1	-3	
floor residues/clay balls	3	2	1	1	-3	
floor residues/other activities	2	2	2	1	-1	
other activities/clay balls	3	2	1	1	-3	**PHASE 1A**
other activities/baskets	2	2	2	1	-1	
other activities/burial	2	3	0	3	-2	
burial/wild cattle	1	3	2	4	2	
wild cattle/clay balls	1	1	1	2	1	
baskets/clay balls	4	2	2	1	-3	
Totals	**25**	**21**	**17**	**16**	**-13**	
domestic cattle/sheep	3	4	4	2	-1	
domestic cattle/cooking pots	2	1	2	2	1	
domestic cattle/burial	4	4	2	4	-2	
sheep obsidian flakes	1	2	2	1	0	
sheep/cooking pots	2	3	4	1	0	
obsidian flakes/floor residues	3	2	2	2	-1	**PHASE 1B**
cooking pots/floor residues	1	2	4	1	2	
floor residues/other activities	3	2	3	1	-1	
other activities/burial	2	3	0	1	-4	
cooking pots/other activities	1	2	2	1	0	
Totals	**22**	**25**	**25**	**16**	**-6**	
domestic cattle/sheep	4	4	4	2	-2	
domestic cattle/cooking pots	3	2	4	3	2	
domestic cattle/obsidian blades	3	3	3	2	-1	
sheep/cooking pots	3	2	4	1	0	
sheep/obsidian blades	3	3	3	2	-1	
cooking pots/floor residues	2	2	2	2	0	**PHASE 2**
obsidian blades/floor residues	3	2	2	2	-1	
cooking pots/other activities	2	2	2	2	0	
floor residues/other activities	3	2	2	1	-2	
other activities/burial	1	2	2	2	1	
Totals	**27**	**24**	**28**	**19**	**-4**	

Table 8.1. *Relational costs and benefits for all the links shown in Figures 8.10 to 8.12.*

allow more efficient cutting back of reeds. By the end of Phase 2, many processes would have become dependent on obsidian blades so that it would have difficult to do without them. It would have been difficult to 'go back' to using obsidian flakes. Similarly, through time at Çatalhöyük the affordances of pottery become increasingly used (Hodder 2014c). Initially important as containers and for cooking, they later become used for storage and they came to take on important social roles and be richly decorated. Initially, perhaps in Phase 1b, it would have been possible to 'go back' to cooking with clay balls. But very quickly, so much became entangled with, dependent on, pottery that it would have been very 'costly' (in material and social terms) to go back. Humans and pots had become so entangled that it would have been difficult to get out of this particular 'path dependency' (Wilsford 1994). The various network measures described in this paper contribute to an understanding on this entrapment.

Conclusion

This account has involved the differentiation of three types of entanglement that can be represented and explored using methods taken from the network sciences.

1. The first type is that every HT, TH, TT or HH dependence is tangled up in other HT, TH, TT and HH dependencies. Any relationship between particular humans and things is tied up in the temporalities and chains of other things with which they interact. A network approach allows a movement away from individual humans and artifacts to explore how those individual things and humans are produced within and constrained by the wider entanglements.

2. But it is not just that humans and things are linked to other humans and things in 'interactions' (Schiffer 1987) or 'equipmental totalities' (Heidegger 1973). These larger spheres of entanglements are themselves structured in such a way that certain nodes are more significant than others for particular tasks. In the same way that network analysis allows analysis of the airport 'hub' that a passenger has to go through to get from A to B, so it allows study of how individual humans or things are dependent on particular nodes, such as the house or food in the Çatalhöyük example. The centrality of nodes such as houses and food, and the operational chains that lead into and out of them, themselves create a structure that network analysis can assist in describing.

3. A third type of entanglement is the dialectic of dependence and dependency that may exist between two humans and things in terms of the affordances and demands that they make on each other. We have already used the example of the ways in which the domestication of cereals entangled humans into the labor of winnowing and threshing. Humans come to depend on things that depend on them, and make demands on them. The study of networks of relational costs and benefits allows exploration of these more complex dependencies.

We started this chapter with the aim of exploring the extent to which formal network analysis could be used to study aspects of entanglement. We have used the detailed evidence from

the excavations of Çatalhöyük in order to evaluate various forms of network analysis. In the most general of terms, it seems that formal network analysis has much to offer the study of the first type of entanglement. Despite problems associated with the definitions of nodes and boundaries, network analysis provides ways of summarizing and visualizing thing-thing, and human-thing dependencies. Networks can be produced that are based on dependency matrices, as in Figure 8.2. In contrast to networks that focus on social or cultural interaction, we can term such networks tanglegrams. The tanglegrams shown in Figures 8.2 and 8.4 summarize complex relationships between large numbers of variables in clear and simple ways. They encapsulate the research expressed in many thousands of narrative pages of text. They provide clear summary information that allows new patterns to be seen and further explored.

The network analyses also allow exploration of the second type of entanglement. In particular, the ego-networks in Figure 8.4 show that the structure of various forms of centrality can be studied (Fig. 8.5). In these examples the importance of the house was demonstrated, building on previous work, by tracing the shifts in degree and betweenness through time. Entanglements are also structured by the presence of long interlinked operational chains. These chainworks can be explored through network analysis of paths, but we have so far concluded that there are difficulties here in that there are analytical advantages in keeping simultaneous paths separate rather than linking them into shortest paths. We have so far found that the most informative, productive and robust approach is to identify simple upstream-downstream sequences and then to explore the links between them (Figs. 8.6 and 8.7). The problems we have identified seem to correspond with wider discussion of the limited focus on temporal structure within social or actor network analyses (Latour 2005; although see Pentland and Feldman 2007).

Finally, network analysis in the forms in which it is used most frequently in archaeology, does not describe well the tensions between dependence and dependency that are at the heart of entanglement. However, when allied with quantitative coding of the relational costs and benefits between specific operations within a tanglegram, it is possible to conduct productive analyses that explore the ways in which certain humans, things or operations increase or decrease local or wider entanglements. It is possible to explore how the affordances of, for example, cooking pottery produce temporary disentanglement, and thus openings for other changes to occur. It is possible to explore how cooking meat with clay balls led to constraint and limitation on what could take place inside houses. Such analysis, however, depends on having access to rich data sets in which the links between humans and things have been well studied. It is only in these ways that contextual evidence can be used to substantiate the quantitative coding of specific relational costs and benefits.

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Chapter 9

Afterward: A Response to My Critics

The first part of this chapter is a commentary on the entanglement ideas compiled by Susan Pollock, Reinhard Bernbeck, Carolin Jauss, Johannes Greger, Constance von Rüden and Stefan Schreiber as a result of discussions that took place with me and other invited participants in Berlin in December 2013. The second part is my response to the issues raised.

Critique

A very brief summary

Entanglement sets out to turn our typically anthropocentric view of the world on its head and examine the relationship between people and material things from the point of view of things. Hodder identifies four key sets of relations – things depending on humans (TH), humans depending on things (HT), things depending on other things (TT), and humans depending on other humans (HH) – which he discusses in terms of the entanglements they produce. Crucially, he envisions entanglements as involving all of these relationships and as occurring both synchronically and diachronically. Although three of these four sets of relations involve humans as distinct from things, he also considers humans to be to some extent things.

In this commentary we explore seven main themes that derive from our readings and discussions. These are 1) the concept of entanglement and its use in archaeology, 2) multitemporality and the diachronic dimension of entanglement, 3) disentanglement, 4) the notion of care in connection with things, 5) relations among people, 6) the politics of entanglement, and 7) issues of universality with respect to entanglement.

1. Entanglement as a way to enlarge our perspectives on the past

One of the overriding positive elements of Hodder's presentation of the concept of entanglement is the way it encourages us to extend and expand our perspectives on the past, as seen through the lens of archaeological research. Instead of constructing arguments analytically

and typologically, a focus on entanglements challenges us to think in an associative fashion similar to the approach of a symmetrical archaeology (e.g. Shanks 2007; Olsen 2012; Witmore 2007). The approach works against tendencies to focus on single categories of artifacts; instead, we find ourselves engaged in different ways of arranging things in relation to each other. Tracing entanglements means making our way through a strongly heterogeneous world and following links and chains in a fashion that is rhizomatic[1] rather than linear or dendritic.

These multidirectional and multifaceted explorations have important consequences for the strict disciplining of academic boundaries that is characteristic for continental Europe. Rather than upholding the traditional units, we might understand entanglement as a manifesto to "tear down this wall!" A simple example: through the insistence on the material qualities of things, we find ourselves turning to archaeometry both for analytical help and as a source that can enrich archaeological discussions but without succumbing to archaeometry's epistemological restrictions. A question we did not explore in our discussions was what happens when we take seriously the call to step regularly and decidedly across academic boundaries. What might the results be of such new forms of knowledge production and dissemination? How would they differ across the global world of academics, given the varied ways of carving up archaeological knowledge production in, for example, the United States and Germany?

2. Diachronic entanglement and matters of multitemporality

When we examine the entanglement of things and people synchronically, we come quickly to a recognition of the complexity of the links that connect them. In addition, strands of entanglement are built on preconditions that must be identified, and entanglements often produce diverging sets of consequences. Entanglements are always in flux, whether today, in the past or in the future. Therefore, exploring the threads of an entanglement brings us immediately to the importance of diachrony. Relationships over long periods of time, together with those between multiple categories, can and should be thematized.

Hodder has noted the connection between the domestication of cattle in the Neolithic in western Asia and global warming spurred by today's industrial-scale farming and the methane gases thereby produced. This is, of course, a process that will affect us well into the foreseeable future. Another unintended *longue durée* consequence of cattle domestication can also be mentioned: in his *Barbed Wire: A Political History* (2002) Olivier Razac observes that barbed wire was first used in 19th century North America to fence off private property in order to protect cattle from wild animals. This same barbed wire was then used in World War I trench warfare where it viciously entangled soldiers; its later electrified version compartmentalized people in Nazi concentration camps. Such diachronic entanglements have been highlighted in some historical writing and in science studies but rarely in archaeology[2]. Here Hodder's approach challenges us to explore previously uncharted territories in archaeology.

[1] *See Deleuze and Guattari's well-known introduction to* Thousand Plateaus *(1987).*

[2] *An excellent example for a culture history that exposes entanglements (without use of the term) is Wolfgang Schivelbusch's* The Railway Journey: The Industrialization of Time and Space in the 19th Century. *A host of "things" such as new types of literature and "new" diseases including trauma resulted from the practice of travelling by train. For an archaeologically informed study in this vein see Michael Schiffer, Tamara C. Butts, and Kimberly K. Grimm (1994)* Taking Charge: The Electric Automobile in America.

One of the corollaries of Hodder's notion of entanglement is that connections between things, people, and people and things are productive of change, bringing about different kinds of consequences. The notion that actions produce unintended consequences is not a new one; it plays a central role in the scholarship of Anthony Giddens who considers them to be the main source for the contingent nature of history (Giddens 1979). But in Hodder's approach the emphasis is on a diachronic and especially on a long-term perspective that goes far beyond the temporal dimensions envisioned by Giddens. Although Hodder's view opens new realms for examination, he simultaneously narrows the range of unintended consequences by contending that they always lead in the direction of greater entanglement: we are inevitably "digging ourselves into a hole" even as, and perhaps especially when, we make efforts to alleviate the problems brought about by entanglement. Despite his claims to the contrary, we consider this stance to be reductionist, as it insists that historical change has a particular direction, even if the specific forms of change may vary.

This specification of a rather strict directionality makes Hodder's diachronic understanding of entanglement tend toward determinism. While he claims that his approach is not teleological, it seems to depend on the level at which one examines entanglement. Specific kinds of entanglement may be unpredictable, but at a more general level the assertion is that there has been and will continue to be increasing entanglement. Thus, on a specific level his theory may not be teleological, but on a general or world history scale it is. This is a remarkable return to a way of thinking that minimizes historical contingency and is much closer to social evolutionary ideas than Hodder's other writings since the early 1980s. We are alleged to have become increasingly complex throughout history, although how that growing complexity has manifested itself may be more or less variable and is in the end judged negatively.

Many of us might agree that from the perspective of the broad sweep of human history people have become more and more entangled in a material world they have created. However, by making this into a central argument of his theory of entanglement, Hodder risks writing human history from the perspective of those who are considered in the public sphere as the "most successful," because they have been able to impose their specific materiality on their contemporaries as well as on things that endure, something that may be termed "political taphonomy" (Bernbeck 2005). Alternative directions that might have been chosen for some period of time but that did not last over the long term would potentially be written out of history if we follow Hodder's approach, because they do not fit the progression of growing entanglement that leads us to where we find ourselves today.

A final element of diachronic entanglement that seems to us of particular relevance is connected to Hodder's remark that entanglement forces us to think of relationships that have neither beginning nor end. One can therefore enter and exit a piece of research at any point, as there is no validity in searching for origins or for some sort of final collapse. This point is not a new one (e.g. Conkey with Williams 1991), but it has remained underexplored in archaeological (and historical) research. A lingering question is whether there is a logic to where one begins or ends in examining a temporal slice of entanglement, or perhaps more importantly, what difference does the choice of temporal limits make to the results of a piece of research?

Is it really the case that any point is as suitable as any other at which to begin, or is there something special about, for example, the Neolithic as a time when entanglements underwent a major change, with the consequence that the speed of further entanglement processes was faster than ever before?

3. Is disentanglement possible?

A striking element of Ian Hodder's presentation of entanglement is what he himself describes as his pessimism with respect to the potentials of disentanglement. Put simply, he argues that disentanglement is not possible: any attempt in that direction results in being caught in other, even more entangled kinds of nets. We take a different position, contending that the problem resides in Hodder's tendency to see entanglement as an all-or-nothing status rather than a process that proceeds in degrees that can be enhanced or reduced, sped up or slowed down. It may also help to specify the context(s) in which disentanglement may occur: we suggest that it is more likely to do so in the realms of dependencies of humans on things, rather than in "inter-thing relations" (T-T) or the dependence of things on humans.

We also see Hodder's credo regarding the irreversibility of entanglement or "directionality" and path dependence as falling prey to the capitalist dogma of growth. Whether in material production, the educational sector, scientific "output", or at the individual level of a CV, growth has become such an unquestioned and unquestionable background to our reality that entanglement is also enveloped by it. But on the historical plane of H-T relations, aren't the many asceticisms of Eastern religions, the millenarian movements at the time of Jesus, or the *decroissance* and altermondialist ideas of people like Jacques Ellul (1954) a sign of such reversibilities? Hodder intimates that, in the long term, their effect does not count as much as the historical junctures through which entanglement processes are accelerated, of which the Neolithic revolution is the one with which he is most concerned. We imagine a comparative study of entanglement in, for example, an Old Babylonian city in Mesopotamia such as Ur, the Inka center of Cuzco, and the medieval town of Cairo. Can we find an increase in entanglements in the various human-thing matrices of dependences? We doubt it, but it would mean a rigorous quantified analysis, an endeavor that seems impossible because of the heterogeneity of entanglements as well as their diachronic dimension, as Hodder himself admits. A methodological point not raised in our discussions but noted by some of the participants afterwards is the question of where one begins a "tanglegram," and, perhaps more importantly, how tanglegrams can be compared. This would be of particular relevance if we wished to examine the question of whether and how there are changes in the relative weight accorded to different kinds of dependencies between people and things or amongst people or things. Can, in fact, the degree of entangledness at different moments or over specific trajectories be measured?

If anything, we would think that a world history conceptualized under the notion of entanglement is characterized by a stage-like movement, perhaps similar to "punctuated equilibria" (Gould and Eldridge 1977) in biological evolution. The modern age, with its horrendous onslaught of material products and their continuous growth in numbers and kinds, certainly gives the impression of rapidly increasing entanglement, indeed that it speeds up at a yearly if

not monthly rate. But this may be a historically specific and even aberrant case. What if we turn to archaeological methods: has there ever been a systematic comparison of densities of object categories ("things") through time and space? The productivity of *terra sigillata* in La Graufesenque in southern France was certainly way beyond that of later medieval production output, for example. Despite our own situations in which we are drowning in things, we claim that the world can still be steered in different directions. The increasing interest in the commons (Hardt and Negri 2009), involving sharing rather than possessing things, is only one potential way out of the impasse of entrapment in a world of things.

Positionality or the place from which one examines entanglements also plays an important role that is insufficiently addressed by Hodder. What happens when entanglements are observed from an internal vs. an external perspective? Hodder's perspective on entangled worlds is a decidedly external, rational one. But must we not assume that there was also an awareness in the past of entanglement and a desire on the part of some to disentangle? Overall, what are the potential responses to the awareness of being entangled? Must disentanglement be envisioned as something that happens only by force of necessity – for example, in contexts of "collapse" (McAnany and Yoffee 2009; Yoffee and Cowgill 1988) – or can it occur as a matter of choice? We suggest by way of a few examples that partial disentanglement can indeed take place and may be the product of intentional choices on the parts of actors.

In a recent discussion of settlement and demography in the Ur III period (c. 2100-2000 BCE) in the city-state of Umma in southern Mesopotamia, Robert McC. Adams argues that there was a steady stream of people who freed themselves, at least partially, from the demands of the state by leaving cities (Adams 2008). In doing so, they chose to pursue a more mobile lifestyle or one that was located on the edges of the densely settled belt of irrigation. In other words, these were people who disentangled themselves from a particular kind of settled life and many of the demands it placed upon them. If we silence them, one reason is our own preference for writing history from the perspective of material heritage producers similar to ourselves. And in doing so we seem conveniently to forget that such groups leave fewer traces than those who actively pursue human - thing entanglements.

Another example are the Anishnabeg of Upper Michigan who were employed in the 1920s-1930s by the Bay de Noquet Lumber Company. They attempted to avoid becoming entrapped in capitalist relations that would have forced them to purchase food from a company-owned store. Instead they engaged heavily in canning and hunting in order to provide for themselves in ways that sidestepped the use of money (http://www.fs.usda.gov/detail/hiawatha/learning/history-culture/?cid=stelprdb5106493).

Yet another example is the small Late Neolithic site of Tol-e Bashi in the Zagros Mountains of southern Iran. Here, the minimal quantities of durable objects have been interpreted as a refusal to become caught in a life surrounded and channeled by things (Pollock and Bernbeck 2010, 283-7). Things often have a temporal surplus; they easily survive a human lifetime. People not only display an attitude of concern and care for things - they may often experience the world of things as a threat. Hodder considers the persistence and durability of things, but he evaluates them as a largely positive element: they provide stability for "transient and uncer-

tain lives". He uses a logic that corresponds to Freud's widely cited story of his grandson who symbolically replaced his mother with a spool while she was absent (Freud 1998). But might the scarcity of material objects not imply an intention toward disentanglement (or avoidance of entanglement), rather than a status of being less "civilized" or less complex? Would John Chapman's (2000) fragmentation theory not also fit such a general scenario of durability as a threatening temporal surplus?

A rather different view was also raised during our discussions: could historical changes in entanglement be a kind of zero-sum game in which variability lies in the extent to which different kinds of human-thing relations are entangled? In one specific example it was argued that the complexity of the entanglement embodied in human-human relationships is much greater in hunter-gather than in capitalist societies where relationships involving things are the primary locus of complex entanglements. While we do not necessarily propose that the sum of entanglements is the same in all cultural contexts, in all times and places, the point is that a hunter-gatherer world in the Upper Paleolithic of Eurasia may have been as entangled as that of Stanford, California today. Whereas the former may have been characterized by complex entanglements between people, non-material forces, animals and a few things that were based on an entirely different ontology than ours, in the latter entanglements are denser and more complex only in the realms that imply things.

This argument can be linked to a more complex issue. Hodder depicts his matrix of relations as being so fundamental that *as relations* they remain independent of each other. But what if this independence is not taken as given? Might it not be that different historical instances exhibit situation-specific "relations of relations"? So when human interrelations predominate over those that connect people to things, then human-thing relations will be conceptualized against a background of those between humans. On the other hand, when things take center stage, relations between people can metamorphose into relations patterned after those involving things. This is exactly György Lukács' (1971 [1923]) reification thesis: the contention that in modern societies things have had such an enormous impact that social relations have taken on the character of human-thing relations. Lukács insisted on a difference in the material world that is at the core of Marx's writings, and which curiously disappears entirely in Hodder's entanglement: that between the use value and the exchange value of things. Hodder's work as well as much of the materiality literature in general seems to assume the dominance of the use value of objects, from prehistory to postmodern times, as if we did not live in a world that is saturated with exchange values and associated ways of thinking (e.g. Sohn-Rethel 1985).

Nowadays we see the growing entanglements involving things as a part of the way in which people are increasingly disciplined and thereby entrapped in situations in which the variety of relations among humans is comparatively small, largely as a result of the fact that they are dominated by commodification. In the long term, one could even insert Norbert Elias's arguments about the process of civilization into such a history (Elias 1977).

André Gorz (1989) has offered a possible way out. He argues that an important step away from commodified relations (the dominant form that determines intersubjective rela-

tions in contemporary societies) is, to take a simple example, to avoid taking a taxi and instead hitchhiking or at least agreeing on mutual, non-monetary exchanges in which anyone driving a car from point A to point B takes whomever wishes to travel in the same direction, in a kind of delayed-return system. The idea can, of course, be extended to fit a wide range of other contexts such as community gardens in which people work together harvesting what they can use as well as expanding and cementing social ties. This arrangement offers a largely non-commodified alternative to having one's own garden and hiring a service to take care of it.

Such changes would, however, also impinge on time and an issue best termed "temporal justice". According to Hodder, things all have their own temporal rhythms to which people have to adapt. Therefore, the more things we arrange around ourselves, the less we master our own time. We become slaves of "altertemporality", a form of temporality that is objectified in material things. The loss of "time sovereignty" (Münkler 2007) plays a major role in present conditions of entanglement and imparts a historically highly specific character to it. Time sovereignty, and an emerging notion of temporal injustice, was likely of much less import before modernity, despite dependency on a yearly cycle organized around climate and weather.

Hodder uses two notions, entanglement and entrapment, to describe the conditions that keep people and things in a situation of mutual dependency. In our discussion he explained that he uses them interchangeably, although entrapment appears in several places in his writing as the more negative alternative. We think that he misses an important potential of his concept by making little or no distinction between these terms. Whereas we are convinced, based on some of the examples given above, that it is possible to observe and to take part in disentangling, understood as processes that occur by different degrees and kinds, entrapment can be understood as a state in which entanglement can no longer be reversed without a more or less complete collapse. Thus, at Çatalhöyük things – from decorated houses to beautifully shaped stone knives and multifarious figurines – entrapped people, whereas in the aforementioned Tol-e Bashi such effects were prevented by a world of material scarcity, so that people dominated rather than succumbed to a specific level of material entanglement.

Ultimately, we argue on epistemological grounds that a theory of entanglement that sees no possibility for *dis*entanglement, other than the collapse of an existing system, turns into a self-fulfilling prophecy.

4. Caring for things

An important element of Hodder's ideas about entanglement is the notion that people are drawn into the care of and for things. This concept of care encourages us as archaeologists to think in new ways about the objects we excavate and study, to focus on efforts at maintenance and repair and not just on their original production or use. At the same time this perspective assumes that people always and everywhere attempt to maximally extend the temporality of things, trying to care for them so that they do not disintegrate, break or become otherwise useless. The universality of this postulate seems to us to be misplaced.

In drawing attention to the much more difficult issue of disinterest and disregard for the survival of things, one might think about the common practice of depositing hoards in Bronze Age central Europe. In these cases things were removed from the realm of care and concern by turning them into offerings (cf. Hansen et al. 2012; Hansen et al. in press). The argument that the large quantities of luxury goods deposited in the Royal Tombs at Ur involved the public "disposal" of major amounts of wealth on the part of public households (Pollock 2007) could also be understood as a way to remove some of the oppressiveness of material wealth by burying it with the dead. In some cases, grave goods are not supposed to "live" on after the death of their owners. Another example is the abandonment and deliberate burning of houses or whole settlements, as has been argued for Neolithic structures in southeastern Europe (Tringham 2005) and the Burnt Village in Sabi Abyad (Verhoeven 2000). These are acts that may serve to deliberately separate people from things they took care of.

Care for single items is archaeologically attested, for example in the multiple mending holes in pottery from the Iranian Late Neolithic sites of Chagha Sefid and Ali Kosh. We can identify more or less care used in production processes, for example in the making of a stone relief, the writing of a cuneiform tablet, etc. Once produced, things also require care – but perhaps do not get it. A simple drive through parts of the United States reveals a large number of slowly decaying houses, garages, and other buildings, a neglect of structures that is astonishing to the eye of a visiting European. Abandonment cultures and production processes are clearly related. What characterizes the threshold at which an item is discarded? And what is the relation between specific production processes as more or less skilled *labor* (artistic, handicraft, industrialized) and the willingness to dispose of things? Do we not live in a world of garbage heaps and landfills more than in one characterized by care for things?

Hodder only briefly points out the possibilities of elaborating distinctions between the production of longevity by caring for things and another kind of temporal production, that of brevity. Things may require care, without getting it: the German word *ent-sorgen* -- to "discare" – meaning to throw away, appropriately expresses an intrasubjective positioning towards a thing and an external practice, denoting neither simple carelessness nor socially sanctioned mechanisms for removing things but rather a fundamental and conscious shift in attitude away from care. Recognizing these tensions encourages the investigation of distinct chrono-spatially anchored practices of care and dis-caring, rather than seeing care as quasi-universal. At the same time we must be attentive to the diachronic dimensions of these examples: a glance at a hyper-consumerist society, such as the contemporary United States reveals that the rapid discard of objects may be directly related to the desire to acquire new things, itself an essential element of advanced capitalism which only thrives by promoting constant growth accompanied by waste and (more or less planned) obsolescence (Reuss and Dannoritzer 2013).

A further concern is whether one can use a single concept to encompass care for things and care for people. In the realm of intersubjective relations, Axel Honneth distinguishes between *Anerkennung*, recognition or acknowledgment as a process that occurs between people, and *Kennen*, to know, involving objectification and complete reification of the other (Honneth 2005). People may attempt to dissolve these boundaries by ritually animating things, as is the

case in the mouth-opening rituals practiced in both Mesopotamia and Egypt to bring statues to life (Walker and Dick 2001). Here, one sees a kind of *Auskennensvergessenheit*, or deliberate forgetting of skilled production knowledge, in that through ritual one was encouraged to forget the human practices that are at the origin of animated things (Bernbeck 2009).

5. The neglect of human relationships

Many of us who took part in the discussion remain decidedly anthropocentric, in contrast to Hodder's avowed aim to take a thing-centered perspective on the world. There are numerous reasons why we insist on the importance of people and of "human-human" dependency relationships, not to the neglect but also not to the privileging of relationships with and between things.

The first of these is that in a thing-centered perspective on the world, people can be easily marginalized. When people are objectified by placing things at center stage, or at least on the same level, it is all too easy to end up treating (other) people as lesser than members of one's own group.

We argue that only by dissolving the human-thing boundary is it possible to dehumanize and objectify people. Critique of the subject - object divide, the mantra of current anthropology and archaeology, meets its political counterpart in early 20th century writings on critical theory: instead of elevating things to a level equal to people, the concern was then - and we claim that it should be today as well - to fight against the objectification of people. The obfuscation of the boundaries between people and things, initially advanced in Appadurai's (1986) introduction to *The Social Life of Things* where he declares that people and things both can turn into commodities and exit such a status, opens the philosophical door not only to the recognition of animal rights, but also to the legitimization of slavery, the annihilation of whole groups of people, and the glorification of war. Ideas about a world history are always themselves situated in historically specific discourses. In a German intellectual environment, any preoccupation with the past has to take into consideration the fundamental historical and cultural rupture of the "Third Reich". This rupture includes the impossibility of any adequate historical representation of the Holocaust (Lang 2000) and stands in the way or at least leads to hesitations in considering non-anthropocentric conceptualizations of world history. And so it should. Theoretical considerations must be historically situated, and the German context may well be fundamentally different in this regard from a U.S. (or other Anglophone) academic and intellectual environment.

Second, we are of the opinion that Hodder's discussion of entanglement works on the basis of a normative or generic image of being human, although he explicitly denied this in our discussion. By generic or normative human we refer to the elision of gender, age, (dis)abilities, etc. that results in Tringham's critique of a past peopled by "faceless blobs" (Tringham 1991). If we wish to write histories of entanglement, we must insist on the specificity of the people whose social and material worlds became, in different ways, entangled and how those entanglements differed at one time and place for different kinds of people. Many of the concrete examples used by Hodder are chosen so as to minimize the roles played by relationships

among people; rather, they often tend to consider single individuals and their material environment. Interactions between *one* person and *one* thing are situations and practices in which means and ends coincide: the act of playing music does not gesture to anything beyond itself. However, over the long term such practices are not central to Hodder's ideas, as for example in his diachronic account of the growth of entanglement or the sequence of changes documented at Çatalhöyük. Interestingly, this statement of position on entanglement seems to be quite different from his own positioning a decade or so ago, when he wrote, "There is too little emphasis on subjectivity and self as constructed by individual agents" (Hodder 2000b, 25).

Let's formulate Hodder's argument the other way around and contend that behind every dependency of humans on things as well as things on humans there lies an intersubjective relation. One engages in environmental activism to try to slow climate change because of concern about the world to be left to one's grandchildren and their children. Things are always a means for intersubjective relations, except when it is a question of a single person and her/his wellbeing (as in the example of playing music) or when one becomes so mired in a concern for things (in the above example, the environment) that one loses sight of why one is engaged. The latter could be understood as a sort of forgetting of intersubjective relationships, along the lines of Honneth's *Anerkennensvergessenheit* that results in an overemphasis on people's relations to their material world. Nonetheless this does not amount to the disappearance of dependencies between people or of their centrality; rather, one might draw here on Hodder's own notion of "hidden entanglement."

A third issue is how we should understand the important concepts of dependence and dependency in the case of relationships between people. We contend that these are qualitatively different when inter-human relations are involved than in either HT or TH connections. As already discussed, the notion of *Anerkennung*, or recognition, is the condition of possibility for *dependence* in human-to-human relationships. However, this is not the case when it comes to things: if they stand in a relation of recognition with us, we have turned into the fetishists that symmetrical archaeology wants us to be. *Dependency*, described as reliance on things that can become compulsive, even addictive, is thought by some of us not to be qualitatively different whether it is a matter of a dependency on things or on humans. Others claim that dependency of humans on other humans is a quintessential necessity for the mutuality that turns us into (human) subjects in the first place.

Finally, as already noted, Hodder's examples often revolve around individual people and things. If, however, one begins with a collective, one more easily arrives at the idea that people can indeed make changes in the world, including in the direction of disentanglement. Here we think of the hippie movement of the late 1960s, which included a strong anti-consumerist element, a "back-to-the-roots" effort to disentangle; or the founding of the Green Party in Germany at the beginning of the 1980s, which laid the essential groundwork for changing to more renewable sources of energy and today to efforts to substitute small, local energy providers for large, centralized monopolies; or the above-mentioned urban gardening, which allows people to disentangle themselves to a modest degree from industrial agriculture. Such

efforts may seem ridiculously minor. However, changes in entanglement by necessity start somewhere on the margins.

6. The politics of entanglement

A significant point of concern for at least some of those participating in the discussion was Hodder's lack of an explicitly political position on the subject matter at hand. One of the principal problems is that he thereby takes a position, albeit perhaps an unwanted one.

To a significant extent, Hodder's work is inspired by a concern with global warming and late capitalist technology. As such, it has inevitably a political stance. However, the retreat to the position of an external observer of a world history with apocalyptic tendencies implies an attempt at de-politicization. What is more, his pessimistic attitude toward the (im)possibilities of disentanglement disavows any attempt to construct a utopian future, however unrealizable that may seem under present conditions.

According to Hodder, such a utopia would include the recognition that we indeed become more and more entangled even as we attempt to disentangle. Yet this should provoke us to rethink the ways in which we try to extricate ourselves from webs of dependency. Although developing new technologies may seem like a possible way out and one that is regularly touted as a solution, they do not resolve the problem either. Instead, they may entangle us still further.

An alternative approach might start from the fact that entanglements exist at different scales and are due to specific perspectives. Over the past few years we have been accustomed to hearing about banks that are "too big to fail," energy giants that are too big to decentralize, and the size of the automobile industry that is too large to allow it to change to the production of ecologically more responsible cars. In each case we are confronted with the large-scale of phenomena that ostensibly prevent change. We contend as a counterpoint that reduction of the scale of entanglement is one main issue, rather than disentanglement *per se*. New movements such as Gezi Park in Istanbul or "Stuttgart 21," the protest against a huge project involving the construction of a train station in southern Germany, work against the *scales* of entanglements and a whole network of humans and things - but not against a museum or train travel *per se*.

Once again, we see here a problem that derives from the focus on human-thing/thing-human relationships. It brings with it a privileging of technological change rather than an equal focus on the human-human dimensions. The forces of entanglement may not have the degree of time depth that Hodder wishes to see in them; rather, entanglement without any way of return apart from complete collapse – what we would refer to as entrapment – may be a product of capitalism. It is capitalism that has been able to turn intersubjective relationships into forms characteristic of relationships with things. This line of thinking implies that the irreversibility and universality of (high degrees of) entanglement is in fact a quite recent product. It is exactly the reification (*Verdinglichung*) resulting from capitalism that leads Hodder to give relations among humans such short shrift.

His pessimism with regard to the (im)possibility of disentanglement has a fatalistic side to it, one that carries with it a conservative, things-cannot-be-changed-so-why-try message. This is even more striking in the long term, as it results in a picture of Spenglerian decline and reminds us of the figure of Walter Benjamin's *Angelus Novus* in the reverse, as recently described by Agamben (2009): Hodder's archaeologists walk into the past backwards, not knowing and seeing that past, but rather perceiving the wreckage of the future.

Günter Anders, one of the most outspoken philosophers of technology of the 20th century, is in some respects a precursor of Hodder's pessimism. Anders describes in great detail the discrepancy between human abilities to produce all kinds of machines of destruction and our inabilities to imagine these potentials. Instead, humans feel a need to become as perfect as their creations but remain "antiquated" - for Anders, a terrible danger for the entirety of humanity (Anders 1956). Anders took practical consequences from his philosophical reflections. He resisted the university apparatus, was one of the first post-WW II activists in anti-nuclear campaigns, and later wrote a controversial "call to arms" against an increasingly violent technologized world (Anders 1987).

Here it is relevant to mention the notion of the Anthropocene, a new geological age in which humans have so severely impacted the world that the background for global processes are human creations, rather than the other way around (Crutzen and Stoermer 2000). How can one bring a thing-centered perspective on the world together with one in which human agency has come to occupy such a central place that people have replaced geological processes at center stage? In answer to this question, Hodder argued that the Anthropocene can be seen as a quintessential entanglement, in which even the globe needs to be managed and cared for. However, this confronts us with the aporia of decentered subjects in an anthropocentric world. Somehow people remain at the core, yet at the same time the theoretical rug is pulled out from under humanity: *people are responsible for the state of the world, yet this responsibility can no longer be shouldered*. This seems to us both epistemologically and politically problematic.

7. A theory with claims to universalism leaves little space for future research

In response to the question of whether he sees his theory of entanglement as one with global applicability, Hodder's answer was a definitive and, to us, astonishing "yes." But here we must ask ourselves, what then is left to research, and why? After all, the results are seemingly already known, and all we can do is fill in some illustrative details. Following this reasoning, we would be back in a situation similar to the heyday of neoevolutionary archaeology, where the direction of change was clear to all and the primary work of archaeologists was to identify when the next stage was reached as well as the precise steps involved in reaching it. To take a more concrete example, what happens if we accept the idea that all late Neolithic societies in Western Asia were on a path toward entanglement? Do we learn anything from our study of them? Shouldn't we rather consider the possibility of different kinds of entanglements in different places or even different directions, not all of which involved a growth in the degree of entanglement?

In addition, the global ambitions of Hodder's theoretical outlook is too eclectic in its derivation. Can elements of human behavioral ecology really be used alongside those of metaphor, mimesis and Latourian actor-network theory? At least some of us see a need to begin with a coherent ontology from which to build a convincing argument and theoretical position.

Overall, an engagement with positionality is missing. Hodder takes a neutral, outsider perspective, apparently without reflections on the consequences. Is this a return to a kind of positivism, in which the scientist can survey the world objectively? In adopting this viewpoint the effects of one's own entanglements are not taken into consideration. What happens when someone with a quite different position and her/his own entanglements describes the world? In the introduction to *The Phenomenology of Spirit*, Hegel claims that a valid theory needs to be applicable to itself: in this regard, how is entanglement decisive for its own recognition?

As the above comments show, the participants found much to engage with. Although many of us are in disagreement with parts of the argument, we found the discussion with Ian Hodder enormously fruitful and continue to learn from the efforts to position ourselves with respect to the new challenges he has set out for us.

Response

I found the commentary very helpful in thinking through my ideas about entanglement and in developing them further. I would like to react to some of the issues selectively, and to make some general points that deal with broad groups of comments, for example those that deal in some way with directionality and the possibility for disentanglement.

Directionality

In their commentary the authors state that "many of us might agree that from the perspective of the broad sweep of human history people have become more and more entangled in a material world they have created". This statement summarizes succinctly and effectively one of the main arguments of entanglement. And yet the authors spend the largest part of their commentary arguing the opposite, preferring to focus on contextual diversity and the human potential to disentangle. Regarding the notion that entanglements seem to have increased over the long term, the authors say "we consider this stance to be reductionist, as it insists that historical change has a particular direction". Why do archaeologists so quickly retreat from, even hide from, their own evidence for long-term change? Why do archaeologists retreat from their own observation that in the "broad sweep of human history people have become more and more entangled in a material world they have created"? We are all aware of the dangers of social evolutionism. But is it not irresponsible to draw attention away from the one conclusion that archaeologists can readily agree on and provide evidence for, especially when the direction of that broad sweep of increasing entanglement is leading us as a species into difficulties?

I have spent most of my career arguing for contextual variation and for the potential of human agency to transform. I have always argued that long-term history is best understood in terms of small-scale change and the manipulation of small things such as pots, calabashes,

houses, and ash from the fire. And I still argue that agency has transformative potential. The commentators suggest that my position on entanglement differs from the earlier focus on individual agency. That is not the way I see it at all. I still believe in the centrality of agency to social theory, but have shifted my attention to the effects and conditions of agency. It is important to ask 'what makes agency possible'? If we are to focus on how individual agents transform their social worlds in the making or using of a tool, or in the negotiation of space or pot design, we also need to understand how those tools or built environments are themselves not isolated as things. Around each thing there are filaments, often largely invisible, that spread outwards to other things. These threads of connection are themselves entangled in each other. And these entanglements have effects in the world that then channel or constrain agency. I have tried to avoid reverting to some form of environmental determinism in understanding this wider frame of action, and to avoid a determinism based in the forces or relations of production. Instead I argue for a heterogeneous entanglement that frames and makes possible forms of agency that can transform and create change.

The argument that entanglements have increased overall is at first solely an empirical statement. And it seems that the commentators mostly agree on the empirical evidence that we have as a species become more entangled. The question of why entanglement has relentlessly increased is a different matter. I do not feel at all certain that I have given the right answer. For the moment, it seems to me possible to argue for a certain logic of increasing entanglement that focuses on the instability and multi-temporality of things and their relations. Things and their interactions are unruly because things tend to fall apart, die out, transform so that they cannot be relied upon. Of course on the day to day we manage to stabilize things, often with a lot of work. But the stone wall is gradually eroding at its base and will one day collapse, the coal will one day run out, as will North Sea gas. Over time bacteria become resistant to antibiotics, and climate is slowly changing as the result of impact over millennia. All these complex interactions and temporalities mean that humans are forever seeking new solutions. These solutions nearly always involve using new materials, new technologies, new restrictions and regulations, new forms of representation. They are additive. Sometimes, the things that are added may be simpler, replacing more complex forms. As I will agree below, it is certainly possible to achieve disentanglement. But in most solutions most of the time, something new is added – and since all things are embedded in a web of filaments, new strands are added to entanglements. On the whole it makes most sense to fix things as they are in an additive process. This is what I have discussed as path dependency. It becomes very difficult, costly in economic, social and cultural terms, to disentangle things and go back to the beginning. At some point humans become so invested in particular entanglements that going back can no longer be a preferred option. So while local disentanglements are possible, in the end the tendency is towards increases in entanglement. The hypothesis is that entanglements tend to increase over the long term because of the instability of things and because of path dependency.

This hypothesis about why entanglement tends to increase over the long-term may or may not be shown to be justified by evidence. But whatever the answer to the 'why' question, it seems more important to consider the implications of the empirical evidence for increased entanglement for modern predicaments. It is certainly possible to argue on a case by case basis

that technological solutions to resource depletion have their environmental dangers. Many will agree, for example, that 'fracking' in order to access oil and gas has numerous environmental risks, including contamination of ground water, that lead to greater entanglements. But it is a different and broader argument to point out as an archaeologist that humans have always sought to deal with problems by finding additive technological solutions. Some in the post-environmental movement (Latour 2008 2009; Nordhaus and Shellenberger 2007) indeed argue that we should focus not on restraint in our relations with the environment but on an increased rate of technological innovation. It seems important that archaeologists use their evidence for the directionality of long-term increased entanglement to contribute to these contemporary debates.

One of my motivations in writing about entanglement was to draw attention to the dangers of the idea of the Anthropocene. We now live in a world in which all things are effectively man-made, even the weather, climate, soil and air we breathe. This means that humans are having to find solutions on an enormous global scale, and yet the institutions that are needed to find and implement such solutions do not exist, or they do not function effectively: most are in various forms of 'gridlock' (Hale et al. 2013). Presumably at some point, solutions will be found and the political road-blocks will be resolved. But the entanglement view is that managing the Anthropocene will be very costly and difficult to reverse. Investing in new technologies will drag us down yet further in the direction of entrapment, constraint and regulation. And there are further dangers. The singularity of the Anthropocene, that fact that we are now all connected in one global system, means that there is little room for mistake. Things are always going wrong in unexpected ways in human-thing entanglements. In the past, collapse in one system would often allow another to regenerate (see below in the discussion of 'hubs'). But today and in the future, the interconnections are such that if something goes wrong there are no alternative places to go.

A good example of socio-material gridlock in the contemporary globalized world is that despite massive global hunger, including the appearance of food banks in developed countries, up to half the food produced in the world is thrown away. In 2013 a series of reports by, for example, the Institution of Mechanical Engineers in the UK and the Natural Resources Defense Council in the USA, provided data showing massive discard of food both at the production end of the food chain and in storage and consumption. While these data were vigorously countered by super-markets, and quantification of the scale of the waste of food is undoubtedly difficult, the problem seems real. The causes of the waste are complex and contested by the different players in the food chain, but they include the globalization of food, the great distances between producers and consumers, the mechanization of storage, the control of food by large super-market conglomerates, and new consumer life-styles that depend on the availability of fast food. Whatever the specific causes of food waste, it is clear that complex socio-material interactions have entrapped us as a species into forms of food procurement that are harmful, unjust and irrational. This is a classic example of entanglement where our dependence on food has led to harmful and destructive dependency.

I would be the first to applaud community gardens, the production of one's own food, recycling, advocacy of fuel-efficient transport and so on. While such grass-roots movements in the 1960s onwards often seemed exciting and transformative, many in the environmental movement have become disillusioned. The calls for restraint and 'small is beautiful' do not seem to have been effective in denting the directionality of increased global warming and social inequality (Nordhaus and Shellenberger 2007). Indeed, it is this sense of inadequacy that has fueled the post-environmentalist concern with new technological, large-scale intervention (Latour 2008). These small-scale actions have not been effective because they are not 'fitting' (Hodder 2012) – or rather they are fitting in relation to the aspirations of the participants, but they are not fitting in that they have not turned the tide. In my view the reason they are not effective is that they deal only with the proximate problems, not with the deeper issues which have to do with the directionality of human-thing entanglement. We need to move beyond agency to understand the socio-material entanglements within which agency takes place.

Whether I car-share rather than take a taxi, or plant a community garden, or recycle or otherwise take active steps to decrease human-thing entanglements depends itself on those entanglements. Whether there are cars, or space to plant gardens, or recycling systems all depend on entanglements. Take the extreme example of one essential personal human action – taking a breath. Is this an example of individual agency, to fill one's lungs when and as one wishes with fresh air? As a child in the London smog it was difficult to breathe. Recently in Beijing and Xian I had to retreat to the pharmacy as my breath and health suffered in the pollution. To be able to breathe clean 'free' air depends on governments and laws, degrees of industrialization, police that enforce laws, technologies that decrease carbon emissions and so on. All agency is embedded, then, in entanglements that both facilitate and constrain. To recognize the complex entanglements of even taking a breath, is to recognize the forces against which agency arrays itself in order to achieve change.

So yes of course there is local disentanglement. The commentators ask "might the scarcity of material objects not imply an intention toward disentanglement (or avoidance of entanglement)". Of course. To be human is to be one with but also separate from things. We depend on things to think, work, be, but we also see ourselves as separate from, free of things. We have an ambivalence towards things, a to-ing and a fro-ing. There have always been movements that eschew materiality, the market, or new technologies. The commentators talk of care and dis-care. And I recognize the excitement of new ideas about the collaborative commons, prosumers (Rifkin 2014) and the common wealth of the multitude (Hardt and Negri 2009), involving sharing rather than possessing things. The commentators argue that Hardt and Negri offer "only one potential way out of the impasse of entrapment in a world of things". Perhaps we can, in our more sophisticated modern utopic imaginings, stem and even reverse millions of years of increasing entanglement. But at present it is not at all clear that the commons will lead to a lesser entanglement with things. After all, there is the possibility of the 'internet of things' (Rifkin 2014), and I have discussed elsewhere the notion that 'the cloud begins with coal' (Hodder 2014d). Hardt and Negri have very little to say about the material thingness of the commons, even though the new forms of biopolitical power they describe seem very technology-based.

In a separate critique, Harman (2014, 46) suggests that I speak "longingly of a time before we became entrapped" and he argues that a return to such a way of being would be difficult. Thomas (2015, 1289) too argues that "Hodder advocates a return to a state of hunter-gatherer simplicity, but Harman counters that people and 'things' have always been thoroughly bound up with each other". I do not argue that we should return to a state of hunter-gatherer simplicity. Rather, at the end of *Entangled* I posed a challenge: can we respond to global warming and other examples of contemporary entrapment in some other way than increasing our technological manipulation of the lived world? The challenge was intended as forward-looking, not as a nostalgic longing for a lost simplicity. The lived world has become altered through millennia of human-thing entanglement. While degrees of disentanglement are possible, too much has changed and the contemporary entanglements are too complex and large-scale to admit such simple solutions.

Over the long-term, disentanglement is often temporary and ineffectual in relation to the larger juggernauts of entanglement. Why is it so difficult to change entanglements? I have already outlined above a theory of why entanglements tend to increase, and further discussion takes us to the question of what entanglement is really about and how it differs from related terms like network, behavioral or operational chain analyses, or symmetrical archaeology. Ultimately the problem is that going 'to' things is more difficult than getting away 'fro' them.

What is entanglement?

The commentators say that like symmetrical archaeology, "tracing entanglements means making our way through a strongly heterogeneous world and following links and chains in a fashion that is rhizomatic rather than linear or dendritic". This focus on relationality is also seen in (social) network analyses although here the relations are between humans rather than between humans and things or between things themselves. Even in archaeological applications of network analyses (Knappett 2013; Mills et al. 2013), studies use material relations in order to construct human social networks. It is true that entanglement involves taking the thing seriously, and it is right that it focuses on the invisible filaments that spread out from things in behavioral chains, operational chains, commodity chains and many other forms of relation. But entanglements are not just networks or rhizomic flows. They are more than that. This 'more' is captured by the ideas of dependence and dependency – that rather than the flatness of many network analyses, there is asymmetry and hierarchy within the networks and flows. To put it another way, the chains, networks and flows are tangled up in each other. As the invisible filaments spread out from things, they get caught up in other filaments that connect other things and humans. So there is a fundamental difference between chains, networks, flows and entanglements. The former are often seen as flat and symmetrical. The focus on entanglement, however, sees the operational sequences and flows as caught up, tangled up in each other in asymmetrical ways.

This point can be made very directly in archaeology. We have become used to the idea of the life-histories or biographies of objects (Appadurai 1988; Gosden and Marshall 1999; Meskell 2004). Lithic technologists have examined the operational sequences of tool produc-

tion (Leroi-Gourhan 1993). Behavioral archaeology has explored the sequences of procurement, manufacture, use and discard through which artifacts pass. There has been interesting research on cross-craft interactions (e.g. Brysbaert 2007), and there is much potential for moving beyond single behavioral or operational chains to the ways in which they are entangled or intersect as discussed in Chapter 8 (see Figures 8.6 and 8.7). We can, then, move from the study of operational sequences to the study of the grids that lock them together. Because each operational sequence has its own processes, needs and temporal or seasonal rhythms, it is in a dependence and dependency relationship with the other sequences. For example, events in one sequence have to 'wait for' events to happen in other sequences. There is thus continual tension and asymmetry.

The question of what is entanglement is also raised by the interesting question of whether entanglement might be a zero-sum game: however much entanglements may change and differ, the degree of entrapment remains the same. It is suggested that "the complexity of the entanglement embodied in human-human relationships is much greater in hunter-gather than in capitalist societies where relationships involving things are the primary locus of complex entanglements". It is of course the case that there are many forms of entanglement, and that human-human relations, and human-spirit relations are often extremely complex and entangled. Emotional, religious, spiritual, intellectual ties bind humans together in numerous complex ways that involve dependence and dependency. But in fact it is very difficult for humans to separate emotional and spiritual worlds from things. As the vast panoply of material culture studies have shown, in a great variety of social forms things come to have agency within human worlds, however different the ontologies. Humans thus get drawn into things and they get entangled in the way that I have described. It is this thingly nature of human-human interactions which creates the movement towards long-term greater entanglement.

Of course one can also argue that hunter-gatherers are entrapped in very thingly ways in the sense that they have to fit into the natural cycles and rhythms of the environment around them. It might be argued that being entrapped in a natural world is no different from our own entrapment in a human-made world. This takes us close to the blurred boundaries between entanglement and ecology, as illustrated by Darwin's entangled bank. For some the material world is just another niche – providing a particular selective environment. But my argument is that entanglement is fundamentally different – that gathering and harvesting wild resources at a low and small scale, do not necessarily entrap humans into particular forms of care. Of course, as soon as densities rise and the scale of resource use increases, humans get drawn into management and care. But even at the earliest stage, humans are already transforming their environments and getting drawn into the double bind that is distinctive of entanglement as I have defined it – that is humans depending on things, but also having to produce or care for the things on which they depend.

Shifting hubs

The notion that there is good empirical evidence for the increase in entanglement over the long term leads to the justified criticism that "alternative directions that might have been chosen for some period of time but that did not last over the long term would potentially be

written out of history if we follow Hodder's approach, because they do not fit the progression of growing entanglement that leads us to where we find ourselves today".

However entanglement is not something like 'higher civilization' or 'greater complexity in the management of resources, social and economic relations' that are handed down from society to society in a linear flow towards ever more sophisticated and complex systems. As a student of European prehistory I was always struck by the way that the 'centers' would never seem to stay in the same place. As one studied the development and growth of the Neolithic, the 'hot spots' of change and innovation seemed to start in the southern Levant, then move to upper Mesopotamia, and then to central Turkey. For the later prehistory of Europe, Sherratt (1998) mapped the changing centers north of the Alps through the late Bronze Age and into the Iron Age. The centers shifted between central Europe, Austria and central France through the phases of the Hallstatt and La Tene cultures, partly in response to changing trade relations with the Mediterranean, and partly as a result of the affordances of river systems and the distribution of ores. On a larger scale, Ian Morris has charted the shifting centers of power within East and West since the end of the Ice Age (Morris 2010, 160, Fig. 3.2).

In my view these shifts should not be seen in terms of the linear flow of culture from high to low, from place to place. Of course these various centers were often in contact with and reacting to each other. But an alternative view to the 'flow of culture' idea is that the hubs, centers of power, cores were embedded within larger entanglements. Those wider entanglements were continually changing because of the instabilities of things and of human relations with things. These changes resulted from small-scale local problem-solving. As these wider entanglements changed, certain areas afforded a centrality for a time. The shifts of cores occurred as the potentials of particular times and places became realized. Thus in the rise of industrial capitalism Britain came to play a core role for a number of reasons, including supplies of coal and iron, a Protestant work ethic and a long tradition of mercantile investment. Thus certain areas, regions, institutions, social systems, individuals become hubs at certain moments in time not because of some innate superiority, and not because advanced culture has been handed down to them on some evolutionary path towards a better society, but just because they afforded something at a particular place and time. So it is not that specific alternative directions are "written out of history", but that all directions are brought into play relationally. Whether an entity is a hub depends on place and time within entanglements. There is no determinacy here. It all depends.

Similarly with 'collapse', discussed by the commentators with reference to McAnany and Yoffee's (2009) important contribution. From the perspective of entanglement, and indeed following McAnany and Yoffee, 'collapse' does not equate to decline. Rather, we need to understand the reasons for shifts in the location of hubs as entanglements transform. Certainly we can talk of the decline of Britain in the mid-20th century, and that is the way it was perceived from the inside. The decline was often experienced as a disentanglement from Empire and the world. But from an entanglement perspective, it would be more appropriate to say that the resources and systems of government and management that had previously afforded a core role, came to be less relevant in the late-industrial age and as larger economies became more

central to global entanglements. Whether Britain became less entangled would be a matter of empirical analysis (see below), but it is not at all obvious that it did; in many ways it became increasingly part of global networks and processes. It is not obviously the case that 'collapse' means less entanglement; it may just mean a different entanglement and one with different cores.

The politics of entanglement: entanglement and power

"His pessimism with regard to the (im)possibility of disentanglement has a fatalistic side to it, one that carries with it a conservative, things-cannot-be-changed-so-why-try message". I hope it is clear by now why I absolutely reject this claim and indeed find it a strange reading of my work. By way of contrast, in a recent discussion of entanglement, Graham Harman (2014) talks of 'Hodder on the Dark Side' because of the focus on asymmetry and the constraints and entrapments produced by human-thing dependencies. For Harman, entanglement has an "utterly radical character" (Harman 2014, 46) because it asks us to "truly rethink what it means to be human" (ibid., 47). According to Harman "Hodder's essay is nothing if not political" (ibid., 44). At the end of *Entangled* (Hodder 2012) there is a call to arms that focuses on the need for change at a fundamental level in human relations with the world. The Anthropocene is the logical result of the long-term increase in entanglement such that now everything, including the climate and the air we breathe, is a human product, needing our management and intervention. In my view it is important for archaeologists to give their long-term view on this state of affairs, how it has come about, how deeply it is engrained, how much it is a logical result of our humanity.

In my account, the problem of our entrapment is not just capitalism, even if industrialization and capitalism have of course markedly exacerbated human-thing entrapment. But most of the things and processes that entrap us started well before capitalism, including cattle, wheels, fire, iron. We had passed the point where we could return to a pre-wheel technology well before capitalism. Our dependence on fire long preceded the internal combustion engine. Metals had become essential for agriculture and tool-making long before steel factories. To understand the particular entanglements of capitalism and colonialism is important, but the entanglements that entrap us go far deeper and are far more pervasive. Entanglement does not offer a way out, but it does argue for fundamental rethinking and for grasping the issues at a deeper and broader level.

I do, however, recognize that my work on entanglement should have engaged more with the question of power, and how entrapment and power compare. Indeed what separates entanglement from operational chains, social networks and symmetrical archaeology is precisely a focus on asymmetry. By the latter I mean initially the asymmetries of dependence and dependency between humans and things, but it is often the case that such asymmetries are the basis for or are entangled up with human-human relationships of power. Chapter 5 in this volume attempts to offer a fuller discussion of the relationships between entanglement and power.

The radical dispersal of causality, as discussed in Chapters 1 and 3 in this volume, should not be used to justify the dispersal of responsibility. To talk of the heterogeneous assemblage of actants that are involved in producing events in the past, as is common in a symmetrical archaeology (Olsen et al. 2012), does not vitiate the need for ethical consideration. As already noted, networks and entanglements are not the same thing. Networks are claimed to have a flatness and a symmetry. Entanglements work beneath or behind networks. To study entanglement is to scrutinize the imbalances and entrapments between humans and things and between humans with respect to things. Or to put it more succinctly, "Thing-human (TH) is not the same as human-thing (HT), since one term of the pair can be in a state of dependency on the other without the reverse being true" (Harman 2014, 44). For Latour there is a "reversible symmetry of any assemblage" whereas Hodder takes the "un-Latourian view that dependency relations are not so easily reversible" (ibid., 45). Human-thing networks have provided enormous opportunities for humans while at the same time entrapping them in inequality and poverty.

Measuring entanglements

Another area of concern raised by the commentators is whether entanglement can be measured. Is "a rigorous quantified analysis, an endeavor that seems impossible because of the heterogeneity of entanglements as well as their diachronic dimension"? Certainly, there are logical and practical difficulties here. If one could disentangle an entanglement it would no longer be an entanglement! At one level I think it is important to avoid the simplification and reductionism that numerical analysis brings (even in complexity theory analyses). Narrative forms and thick description may be best able to draw out the specific historical intertwinings of entanglements.

At another level, however, some degree of reductionism and simplification is an important analytical tool and there are clearly advantages in being able to compare tanglegrams and in being able to measure degrees and intensities of entanglements over time as is shown in Chapter 8. I do not argue that tanglegrams are any more 'objective' than other forms of analysis. An entanglement produced in relation to clay will be different from one produced with a focus on obsidian. This leads to the question of 'positionality' discussed by the commentators. Figures 8.1 and 8.2 show the house as a central node in Neolithic entanglements in the Middle East. One could argue that my long-term interest in the house and domus have led me to produce a biased description of Neolithic entanglements that favor the house as central node. But at least the laying out of all the links around houses allows others to critique and argue for alternatives. In addition, the entanglement network allows us to measure how the betweenness centrality of the house changes over time.

Another issue related to the measurement of entanglement concerns where the entanglement begins and ends as discussed in Chapters 1 and 8. If everything is entangled with everything else then how can one draw the entanglement of say clay or the house and differentiate it from other entanglements? I have tried to argue that entanglements are often heterogeneous and partial, more or less connected to other entanglements. Certainly network analysis demonstrates that some nodes are more linked than others (Knappett 2013). For example, at

Çatalhöyük, the earliest tanglegrams around pottery are very sparse (Hodder 2016). In the network analyses, pottery has a low connectivity score. But through time pottery becomes more connected. The affordances of pottery are gradually exploited until it is fully entangled with a wide range of processes. It seems one can measure degrees of entanglement of nodes within the overall unbounded matrix of dependences and dependencies.

Conclusion

Other accounts of directionality in human affairs have often argued for a progress toward higher civilization, or increases in the ability of humans to harness energy from the environment, or increases towards greater complexity. These are all directions that have positive connotations, and such approaches have been criticized for stacking societies in relation to more and less advanced forms, ultimately justifying the expansive reach of empires. While there are positive aspects of entanglement linked to flows of energy and information, and to innovation and problem solving, there is also a focus on a 'darker' or more negative entrapment. This is because the networks and flows also get caught up in each other's temporalities and in their thingness. There are the grids and dependencies that entrap and constrain. So it is not at all clear that the 'hubs' at any one place and time are 'better' in some sense.

There is of course an understandable fear of the dangers of social evolutionism and of thinking of humans as things. And with these dangers and fears I of course thoroughly concur. But in contrast to ANT, one of the distinctive aspects of entanglement as I have defined it is that humans and things differ. The focus is on how humans are drawn or dragged along by things and their needs and entanglements. The theory starts with the ways in which humanity is thingly, but it does not argue that humans are only things. Rather it sees humans and things in dialectical tension; humans needing things in order to 'be', but also needing not to 'be' things. It seems to me to be important to move beyond our fears of the reductionism of social evolutionism so that we can recognize and deal with our contemporary entrapments in thingness.

Most social evolutionary theory has the directionality of development going towards something better. Progress is towards higher civilization, more just states, greater democracy. Or there is movement towards more complex systems in which societies are better able to harness energy or manage information, be more resilient, more sustainable. Increased entanglement has its positive sides, affording greater use of energy, providing longer and better lives, but it also has the darker side of increased constraint and entrapment. Increased entanglement is not automatically something better, something to be strived for. To discuss entanglement is to talk critique. While other commentators such as Harman have understood this, and while in many ways I learned much from the debate in Berlin, I am disappointed that I was not able to persuade my critics of this key point.

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