Anales de Antropología

Volumen 38 **2004**

INSTITUTO DE INVESTIGACIONES ANTROPOLÓGICAS
UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

Anales de Antropología
FUNDADOR JUAN COMAS

Anales de Antropología, Vol. 38, 2004, es editada por el Instituto de Investigaciones Antropológicas de la Universidad Nacional Autónoma de México.
Ciudad Universitaria, 04510, México, D.F. ISSN: 0185-1225. Certificado de licitud de título (en trámite), Certificado de licitud de contenido (en trámite), reserva al título de Derechos de Autor 04-2002-111910213800-102.

Se terminó de imprimir en octubre de 2005, en *ENACH, S.A. de C.V.*, México, D.F. La edición consta de 500 ejemplares en papel cultural de 90g; responsable de la obra: Lorenzo Ochoa; la composición la hicieron Martha Elba González y Ada Ligia Torres en el IIA; en ella se emplearon tipos Tiasco y Futura de 8, 9, 11 y 12 puntos. La corrección de estilo en español estuvo a cargo de Adriana Incháustegui, la corrección de textos en inglés estuvo a cargo de Nicolás Mutchinick; la edición estuvo al cuidado de Ada Ligia Torres y Hélida De Sales. Diseño de portada: Francisco Villanueva. Realización: Martha González. Fotografía de portada: Bordado de Juchitán, Oaxaca. Adquisición de ejemplares: librería del Instituto de Investigaciones Antropológicas, UNAM, Circuito Exterior s/n, Ciudad Universitaria, C.P. 04510, México, D.F., tel. 5622 9654, e-mail: *libreria@servidor.unam.mx*

CONCEPTS OF DETERMINISM AND FREE WILL IN ARCHAEOLOGY

Travis W. Stanton
Universidad de las Américas, Puebla

Resumen: Los conceptos de determinismo y libre albedrío han sido empleados por arqueólogos en contextos implícitos y explícitos. En la mayoría de los casos, estos términos se han definido vagamente y la literatura filosófica sobre el tema no es frecuentemente mencionada. Esta literatura señala un extenso debate concerniente a la existencia del determinismo y libre albedrío, el cual todavía queda por resolver. Los varios usos de estos términos en filosofía sugieren la necesidad de una revaloración de su utilización en la arqueología. El interés de los arqueólogos en el libre albedrío ha ganado espacio por el énfasis que los post-procesualistas han puesto en el término "agencia" como equivalente a libre albedrío. El uso implícito del libre albedrío no sólo se toma como una presunción, sino que también suscita dilemas ideológicos problemáticos. Además, una resolución especulativa del debate no es indispensable para la dinámica empleada por los arqueólogos para modelar la selección y acción humanas. En este artículo examino el debate como existe ahora en la arqueología, siendo crítico en el uso explícito del pensamiento post-procesualista. Intento demostrar la futilidad de la continuación de este debate y los dilemas que se engendran cuando se emplea en el campo profesional.

Palabras clave: Determinismo, libre albedrío, dilema, ideología.

Abstract: Concepts of determinism and free will are used freely by archaeologists in both implicit and explicit contexts. In most cases, these terms are at best vaguely defined and the philosophical literature on the subject is seldom referenced. This literature points to an extensive debate concerning the existence of determinism and free will that has yet to be resolved. The varied uses of the terms in philosophy suggest a need for a critical reassessment of their use in archaeology. Archaeological interest in free will has recently gained momentum with the emphasis on the agency by postprocessualists who in some cases generally imply that agency equals the ability to have free will. Not only is the implicit use of free will assumptive, it also engenders problematic ideological dilemmas. Furthermore, speculative resolution of the debate is not central to how archaeologists model the dynamics of human choice and action. In this paper, I examine the debate as it exists in archaeology today with a critical eye towards its explicit use in some postprocessualist thought. I demonstrate the futility of the continuation of the debate and the dilemmas it engenders when used in the professional arena.

Keywords: Determinism, free will, dilemmas, ideological.

A central question that has long been a subject of contention among historians concerns the nature of the historical process. Is it characterized by the conflict of great forces, moving inexorably toward their 'natural' conclusions, uplifting some parts of humanity and crushing others, or is it rather the tale of great men, whose initiatives and decisions have written history, reversing desperate situations and opening new paths and horizons? (Allen, 1982: 347).

A proper scientific theory should leave the question of freedom, and of consciousness generally, open to interpretation. It should be equally acceptable for the man who revels in his freedom and for the man who revels in his bondage (Conrad, 1996: 470).

Two general types of analyses dominate the social sciences today; systems-centered and actor-centered studies. On the one hand, system-centered studies focus on top-down processes where the decisions of human actors are framed in terms of how they respond to the influence of various criteria such as the environment and population density. On the other hand, actor-centered studies are bottom-up in the sense that the actual decisions of individuals are given priority in the study of historical processes. While there is a gray area between stereotypical extremes, this dichotomy is aptly characterized in archaeology by debates between the processualists and postprocessualists; who generally speaking favor the triads of functional, adaptive, and behavioral interpretations and symbolic, structural, and practice-oriented interpretations respectively (Preucel and Bauer, 2001). Despite the fact that the two approaches to understanding social behavior are to a great degree complementary as they study the data from different scales (but see Lucas, 1995; Renfrew, 1993), the general trend is that the systems-centered approaches of many processual archaeologists are increasingly criticized by the growing numbers of archaeologists who are loosely labeled postprocessualists, a term that is now applied to a diverse range of methodological and theoretical approaches, but which generally encapsulates the ideas of those who favor research designs accounting for the agency of social actors or agents. Some of the criticisms of processualism, such as the characterization of behavior as entirely adaptive response and some uses of systems theory, have motivated many researchers to explore new and exciting avenues for analyzing data. I will not reiterate these numerous critiques here (see Brumfiel, 1992; Cowgill, 1993; Dobres, 1995, 1999; Dobres and Hoffman, 1994; Dobres and Robb, 2000; Dornan, 2002; Earle and Preucel, 1987; Hodder, 1982, 1986; Hutson, 2001; Marquardt, 1992; Peebles, 1992; Shanks and Tilley, 1987; Wobst, 1997). Yet there is one criticism that I find troubling; that the processualist search for deterministic laws of human behavior is misguided because social agents have agency that operates outside

of deterministic systems. It is not that I find the critique of the *search for* deterministic, predictive, universal, or natural laws, disturbing, but it is the generally implied equation of agency with free will in some critiques that I find problematic.

Many archaeologists, like scholars in other social science fields, have actively engaged in theoretical discussions using concepts such as determinism and free will. They have for the most part, however, avoided the central philosophical debate which lends meanings to these terms. The question of whether the universe operates on deterministic (fate) or a mixture of deterministic and indeterminate (free will) principles has been addressed by philosophers throughout the millennia (Adler, 1958; Dilman, 1999; Honderich, 1993; Kane, 1985). Although great philosophical, and in many cases 'moral,' issues rest on its answer, the question has never been resolved. Even so, the Binfordian quest for 'science' in archaeology that began in the 1960s directed American archaeologists to search for universal laws of social behavior (Binford, 1962). Building upon Darwinian thought, this approach, at its inception, implicitly tried to be a paleoethology of human societies and create a Newtonian social physics to predict human behavior. In many ways, the processual revolution pushed the field in positive directions. The goal of predictable laws of human behavior, however, has not yet been met. Postprocessualists and other critics have made this point and criticized the general premise of universal laws as contributing to the homogenization of the actors of the past (v.gr., Brumfiel, 1992; Shanks and Tilley, 1987). Instead of dropping the issue of universal laws in a deterministic universe to explore the dynamics of agency, however, some postprocessualists have uncritically and often implicitly adopted the humanistic assumption advocated by Giddens (1984) that to have agency means to have free will. Confusing the issue further, postprocessualists have not explicitly engaged in philosophical debate over determinism and free will leaving some discussions of agency riddled with implicit philosophical assumptions. Their inadequate use and critique of the concept of determinism, some explicit uses of the term 'free will,' and an often implicit assumption that the poorly defined phrase 'acting otherwise' means that we have free will are problematic to the continued debate over agency in archaeology.

In this paper, I attempt to make two main points. First, the Binfordian assumption that determinism exists in the social realm and the Giddensesce assumption that free will guides human behavior are both unfounded. Second, that the uncritical adoption of such assumptions, specifically free will, has no bearing on how agency is studied by social scientists, but has practical and ideological

implications of which we should remain cognizant. To make these points I need to accomplish three goals. First, I need to demonstrate the usage of determinism and free will in archaeology. To do this, I begin by concisely summarizing some important points of the long, storied, and often tedious debate on determinism and free will, in order to clarify the meanings of these terms. Citing radical viewpoints on both sides of the issue, I then explore current examples of the use of these concepts in archaeology. The use of free will is isolated as problematically wedded to agency in some postprocessualist thought. Second, to critique the use of free will by postprocessualists, this concept must be proved to be an assumption. To do this I turn away from philosophy and take a naturalistic look at the two possible sources of free will; randomness and vitalism, the idea that the body is controlled by an nonphysical property. Third, the practical and ideological dilemmas engendered by the use of free will need to be outlined. To accomplish this last goal, I briefly outline how concepts such as vitalism have an impact outside of our academic discipline. Further, I discuss how the Western concept of the individual is sometimes linked to free will. The use of this concept of the individual can lead to methodological individualism rather than true studies of agency. Finally, I argue that we need to be more self-reflexive in our use of these terms in the professional arena, especially since the existence of free will is unimportant to the study of human agency.

Free Will and Determinism in Historical Perspective

The debate over whether or not determinism or free will exists is one of the oldest philosophical discussions recorded by human societies. There are three major camps in this debate; libertarians, determinists, and compatibilists. Libertarians believe in an unfettered and constant free will. This free will is such that while a person may be influenced by the antecedent universe, the past does not determine the choices they make. People are always free to make some sort of choice no matter how constrained their actions may be. This conception of indeterminism in social action is how I define the notion of free will in this paper. Such a definition is quite simple, although, as I will outline below, considerable confusion arises in the philosophical literature as to *how* people have free will. In contrast, determinists maintain that choices are completely determined by the antecedent universe and that free will is an illusion. Therefore, prior events determine the choices that people make.

This rather strait-forward definition is my conception of what I will term complete determinism to avoid confusion with some compatibilist arguments. Finally compatibilists attempt to argue that free will is compatible with a deterministic universe. I will at times refer to this line of argumentation as incomplete determinism, although it could easily be labeled incomplete free will. Compatibilist thought contains some of the most varied and confusing set of philosophical arguments on the issue, and although it is never explicitly cited in the archaeological literature, most archaeologists who employ the terms determinism or free will appear to adhere to some version of it. Compatibilists are not true or complete determinists as they believe in the existence of free will, no matter how restricted they make this concept. As the primary objective of this paper is to address the use of free will in postprocessualist thought, it serves to review the relevant arguments for complete determinism and the concept of free will in compatibilism.

Plato is one of the earliest Western philosophers to have written about this issue when he argued that people have free will when their thoughts are good, but are enslaved when their thoughts are evil. As this demonstrates, themes of morality and the nature of evil are part of this debate near its written inception. Importantly, these themes continue to the present day and are vital elements in the philosophies of St Augustine, St. Thomas Aquinas, Descartes, Hume, and Kant among others (Dilman, 1999).

Turning to the Libertarian-Christian philosophical tradition of St. Augustine and St. Thomas Aquinas, free will was metaphysically argued to be a gift from God. The emphasis on God as the vitalistic source of free will began to be de-emphasized during the beginnings of the scientific revolution. Descartes' work is a good marker for this transition (Dilman, 1999), although the thematic triad of God, freedom, and morality can be seen in the later work of Kant and others (Kane, 1985; Zammito, 2002). It is important to keep this transition in mind as there are two types of arguments for the source free will; vitalistic and random (Double, 1991). Vitalistic arguments, that there is a external source of free will divorced from the physical realm (God, soul, etc.), dominated Western philosophy just prior to this transition. Vitalism remains a popular explanation in Libertarian thought, although the source of the vitalism can vary. Random arguments, that random properties of the universe serve as the source of free will, became more popular after this transition, although they appear centuries earlier among Epicurean philosophers among others (Cicero, 1960: 219). These latter arguments are perpetuated in the modern era primarily among philosophers interested in Neuroscience, Quantum Theory, and Chaos Theory (Compton, 1935; Dennett, 1978; Eccles, 1970).

Although compatibilist doctrine is usually traced to Kant, this philosophical position has deep roots, reaching back at least into the Stoic tradition (Bobzien, 1998). Numerous philosophers including Hobbes, Locke, and Hume are argued to have developed their own compatibilist frameworks (Kane, 1985). The distinction among these frameworks is important as some fundamentally differ in how they define free will; and it is the confusion over what compatibilism and free will mean that so complicates this issue. To illustrate this problem I will compare the writings of Kant and Hobbes.

Kant (1958) believed that people can have free will only in certain situations. In other situations, the spontaneity of action is impossible, because "the entire world at that time and the laws of nature together determine a unique future." (Hudson, 1994: 9) Thus, for Kant compatibilism means that free will and determinism are fluctuating states of existence for people. Hobbes, on the other hand, is credited by some for having developed a conception of compatibilism that does not include the sporadic Libertarian ideas found in Kant (Kane, 1985). Hobbes (1958) argued that a person may be free to do what they intend or desire, but that those "intentions and desires are determined or necessitated by antecedent causes or circumstances" (Kane, 1985: 7). "[B]ecause every act of a man's will, and every desire and inclination proceedeth from some cause, and that from another cause, in a continual chaine…proceed from necessity" (Hobbes, 1958: 71-72). In fact, this is a very deterministic view and should be divorced from compatibilist doctrine. Hobbes is in fact a complete determinist despite his label as a compatibilist. Yet the distinction between the so-called compatibilist philosophies of Kant and Hobbes serves to bring up important points about definitions of free will and de-terminism in compatibilist thought, especially in regards to the phrase 'acting otherwise.'

For Hobbes, having free will means that we can choose, even if our choices are really determined. If Hobbes is correct and choices are determined, then does choice really exist? This is an important semantic issue, because libertarians argue that choice coupled with action, or the ability to 'act otherwise' (Moore, 1911) goes hand-in-hand with an undetermined free will. For Hobbes, it is in the perceptual world that we can act otherwise. In his logic, we perceive that we choose and therefore we do, although choices are ultimately determined by the physical universe and its antecedent history. For Hobbes, intention equates with free will, although his version of free will is ultimately determined. Thus, people intentionally choose among various options to act, but people cannot 'act otherwise' as the antecedent universe determines their intentions. Kant on the other hand does not consider this free will. Free will

can only be derived from situations where a person's actions are not determined by antecedent history. Intention is not strictly tied to the physical universe. Therefore, people could have had different intentions in the same situation. It is not just that we perceive that we have free will, our choices and actions are not determined by the antecedent universe, at least in certain situations.

This differential usage of the term free will has caused some considerable confusion among scholars. Therefore, we should make a distinction between the perception of choice in a deterministic framework (Hobbes) and choice which is derived from true free will (Kant). Such a distinction is laid out by Walter (2001) through his concept of natural autonomy. Natural autonomy is the Hobbesian conception that within a completely deterministic framework, we still make decisions of our own choice; only our choices are determined by the universe. For Hobbes, and most complete determinists, we still perceive that we make choices of our own making. Natural autonomy is this perception of choice.

Hobbes' position can be further illuminated by a mind exercise similar to one posed by Gould (1989; see also Fontana and Buss, 1994b; Honderich, 1993: 29). This exercise sets up some central questions of free will to be addressed in a following section; when and how did we evolve free will? Gould argued that if 'the tape were played twice' in evolutionary history, the result would be different. This argument for a divergence in evolutionary trajectories is predicated upon the assumption that there might be minute historical differences in the initial conditions. Like the butterfly effect of chaos theorists (Waldrop, 1992), these differences would change the entire course of evolution. If differences in initial conditions are not assumed, however, how does action unfold? Stated another way, if one could completely simulate the universe by creating an exact copy of it, for arguments sake let us make this universe in a parallel dimension that has no real ties to the original universe, would events in both the original and the copy duplicate each other? Given that every particle of matter and energy could be duplicated in the copy of the universe and placed in the exact positions they are found in the original, that the principles of the physical universe and time were exactly the same, and that social agents were thinking about the exact same things, would the social agents in the original universe make the same decisions and end up in the same situations as their counterparts in the copy? These are hypothetical questions, but if all of the variables that agents use to make 'free-willed' decisions are exactly the same in both universes, including the agents themselves and the tensions between structure and action, as well as among

physical domain, time, and space, would it not be expected that those agents would make the exact same decisions? Would people really chose to act otherwise? Hobbes would say that action would unfold in the same manner, and he would call it free will. On the other hand, Kant might say no. Kant, and I would hazard a guess that many postprocessualists would follow his lead, might argue that some sort of spontaneity of action could occur. This brings up a question of vital importance, how can people be spontaneous or 'act otherwise.' I will return to this question, but it serves to keep this issue in mind.

While Hobbes' position on determinism is fairly strait-forward, clarifying Kant's version of the debate is rather difficult. For Kant, free will is vitalistic and not determined by the past, although it can be negated by situational determinism. An example is the forced behavior of prisoners. In Kant's arguably questionable logic, prisoners cannot chose their actions, because other forces, in this case judicial systems, guards, etc., prevent them from realizing their 'intentions' and 'desires' (see Foucault [1979] for an alternate view). This is an important point, because Kant and others who follow his logic, do not always treat determinism in an all-encompassing fashion. It is not the complete physical universe and its antecedent history which governs deterministic situations in Kant's framework, but it is selective factors such as guards and prison systems, or more aptly for archaeologists, factors such as environment, genetics, or social structure that are cited as determining human action. I make this point to bring up a subtle, yet important distinction between conceptions of complete and incomplete determinism, two conceptions whose conflation in the archaeological literature confuses the situation. Monocausal factors, common in processualist thought, are sometimes treated as determinants of human behavior (e.g. environment). Such arguments certainly account for situational influences on human behavior, but they are not adequate for complete determinism. Monocausal and even multicausal determinism are not really determinism in the strict philosophical sense. Furthering this problem, some postprocessualists explicitly and emphatically reject the possibility of social determinism by deconstructing the incomplete determinism of monocausal arguments. In my view, both sides have treated the concept of determinism incorrectly by conflating the two types. This is problematic. With that said, I now turn to current uses of determinism and free will in processual and postprocessual thought.

Processualism and the Ascendance of Determinism in Archaeology

The real question is not whether machines think, but whether men do
(Skinner, 1969: 288).

To approach the concepts of determinism and free will in archaeology, it is appropriate to begin with the processualists. Following White's (1959) direction in the mid-twentieth century, many processualist approaches have focused on universal laws of human behavior. The person to carry the archaeological flag of this approach was, and continues to be, Binford (1962, 1972, 2001a, 2001b; see also Salmon, 1975; Salmon and Salmon, 1979; Wylie, 2002). Binford's major point is that the field of archaeology is problematically characterized by 'just-so' stories. He argues that explanations should be derived from rigorous hypothesis building and testing so that metaphysical explanations are avoided and that our understanding of the past arrives closer to an empirical truth. Processualism is characterized by an intense focus on the linkage between behavior and adaptation and tends to examine behavior in systemic contexts. Culture is viewed as an extrasomatic means of adaptation. Decision-making is couched in terms of people's responses to a limited number of variables that the researcher deems important (e.g. water availability, arable land, etc.). Therefore, the connections among aspects of culture (these aspects are defined etically by archaeologists in the present) are given priority over the actions of ancient people. Prediction of social behavior is the ultimate goal of this approach, although as I will outline further, the methodologies of many studies falling under the processualist umbrella have been undertaken with compatibilist frameworks limiting their predictive value in an assumed deterministic universe.

As with all schools of thought, processualism was reinterpreted and transformed immediately after its inception. The use of systems theory is a good example. While Binford couches many of his analyses in terms of systems, he does not propose that all individuals act in the same fashion. He believes that variables such as the environment have strong influences on the manners in which people behave, but that the influence of a wide array of variables can produce novel behavior among individuals.

> In cultural systems, people, things, and places are components in a field that consists of environmental and sociocultural subsystems, and the locus of cultural process is in the dynamic articulations of these subsystems. This complex set of interrelationships is not

> explicable by reduction to a single component – any more than the functioning of a motor is explainable in terms of a single component, such as gasoline, a battery, or lubricating oil (Binford, 1965: 205).

Although Binford is a determinist in the sense that he supports the idea of universal laws and, as demonstrated above, makes analogies between physical and social systems, he does not believe that the environment is the sole determinant of human behavior. Some scholars who reacted to the scientific rhetoric of the 'New Archaeology' and answered Binford's call, however, became preoccupied with the application of systems theory in Archaeology (for instance Allen, 1982; Plog, 1975; Flannery, 1972). Some of these processualists put undo stress on certain variables, such as warfare (Carneiro, 1970; Webster, 1975) and the environment (Sanders and Webster, 1978), as causal factors of certain events, such as the rise of state-level societies. Such studies are explicitly deterministic. Yet others have used the language of determinism without actually arguing for deterministic processes. Saxe and Gall's (1977) article entitled *Ecological Determinants of Mortuary Practices* is a good example. Despite the title, this study is actually an analysis of whether certain environmental factors influence people's decisions concerning how to bury the dead. This is a comparison of individual decision-making with the environment, not a confirmation of the power of systemic processes.

Binford's (2001a) latest work continues to be very deterministic. After spending numerous years collecting environmental data which he has correlated with a large sample of traits from ethnographic and ethnohistoric contexts, Binford has devised a method for predicting the likelihood that any given modern, historic, or archaeological group will have a certain pattern of cultural traits based on their environment. This work demonstrates that while Processual methods may change, the underlying worldview continues to remain deterministic. Although research such as Saxe and Gall's study tend to complicate the characterization of processualism as following a deterministic world-view, Binford's (1962) call for a 'scientific' archaeology generally influenced processualist researchers to model their thought in this direction. It is important to keep in mind, though, the distinction between complete and incomplete determinism, because the single or even multiple factor 'determinists' do not model their data in a completely deterministic framework. I now turn to a discussion of this problem in Complexity Theory, a neoprocessualist movement in its archaeological application.

Complexity Theory in Archaeology

The most radical forms of deterministic thought in archaeology today are coming out of Complexity Theory research; primarily based in studies of the American Southwest (Dean *et al.*, 2000; Kohler, 1993; Kohler *et al.*, 2000) and Europe (Leeuw and McGlade, 1997). Complexity Theory in the United States was initiated by interactions among physicists and economists during the late 1980s at the Santa Fe Institute (see Waldrop, 1992). Archaeologists were quickly drawn into the research as the Santa Fe Institute sought to include all social science disciplines in creating a unified scientific theory. In this environment, some of the most deterministic research in archaeology has emerged over the past ten years. A consideration of Complexity Theory highlights the distinction between complete and incomplete determinism in current processualist thought.

One of the most influential researchers in Complexity Theory in Archaeology today is Kohler (1993, 2000). His current research is primarily based on computer simulations of ancient societies in the American Southwest. In these studies, environments are simulated using known archaeological data. Agents, in this case households, are created and populated using random uniform distributions across age and sex ranges.[1] These agents are programmed to make choices such as to marry or migrate. These choices are sometimes made for the agents, although in many cases they are based on 'random' selections. Households, however, are the primary decision-making entity. In Kohler's words:

[1] The definition of an agent bears an aside discussion here as many scholars define 'agents' in very different ways. In the words of Bak (1994: 492), "one can choose either a single cell, a single individual, such as an ant, the ant's nest, or the ant as a species, as the adaptive unit. In a human social system, one might choose an individual, a family, a company, or a country as a unit." The question becomes; where does agency fit into this type of definition? Although the agent generally denotes a single human being for anthropologists (*e.g.* Hodder, 2000), some social scientists advocate the study of larger scales of group agency (Burns and Dietz, 1992; Connerton, 1989; Crozier and Friedberg, 1980; Dobres, 2000; Hindess, 1986; Sewell, 1992; Touraine, 1971, 1985; McGuire, 1992). Aggregates of social agents, or meta-agents (Holland, 1995), that have some form of agency are what Axelrod (1995) terms 'new political agents.' Although new political agents are composed of people whose membership in the group can fluctuate, the defining characteristic of such an agent is that the sum of the individual actions within the group do not equal the action of the agent. "[B]ecause the actions of individuals have population consequences that are difficult to intuit, group consequences do not follow in any simple way from individual intent" (Bettinger and Richerson, 1996: 226-227). Agency at this scale emerges from smaller scale interaction. For

> Landscape detail includes an annual model of paleoproductivity, soils, vegetation, elevation, and water resource type and location. Individuals within households reproduce and die; households farm, relocate, and die; children within households marry and form new households. Household location is responsive to changing productivity (depleted in some scenarios) and, in some scenarios, water resources (Kohler *et al.*, 2000: 145).
>
> Action in such models takes place through agents, which are processes, however simple, that collect information about their environment, make decisions about actions based on that information, and act (Kohler, 2000: 2).

While Kohler (2000: 3) is quick to dispel notions that this work negates views that incorporate vitalistic notions of free will, his thought is implicitly deterministic. In fact, he (Kohler, 2000:13) goes as far as to link his 'bottom-up' approach (bottom-up in the sense the focus of study is on the decision-making of agents rather than on the broad-scale processes of 'top-down' systems studies) with the views of Giddens (1979) and the humanistic approach to social science, which generally adheres to the philosophy of free will, whether compatibilistic or libertarian. The idea that a researcher can hold the majority of programmed behaviors of simulated social agents constant while 'tuning' one behavior to assess its role in the decision-making process (see also Epstein and Axtell, 1996), however, unequivocally demonstrates a deterministic world-view. Like Wolfram's (2002) deterministic studies of cellular automata, to which Kohler links his research, the computer simulation of social phenomena expresses a belief that the social world, while dynamic and complex, is based on universal laws and is completely deterministic. Kohler is only attempting to shift the focus of study from the major influences on deterministic systems to an examination of how people or groups of people make decisions within a deterministic systemic context. Thus, while the decisions of the programmed 'agents' are arguably complex in Kohler's research, his agents do not exhibit real intention.

The problems for studying natural autonomy and decision-making in Kohler's deterministic approach are twofold and demonstrate the difficulties

---

instance, the sum of the individual actions of a nation-state's population do not equal the action of the nation state. This illustration can be co-opted by biologists to demonstrate that the human body is an aggregation of cells whose individual actions do not equate with the actions of the person. The emergent consciousness of the person or the emergent behavior of a nation-state are more that the sum of the actions of the smaller scale agents that compose them. This is why reductionist explanations of behavior have not been well-received by the scientific community (Anderson, 1972). There are links and tensions among all scales of organization, but each scale behaves differently.

of this line of thinking in the social sciences. First, while Kohler aspires to a model of complete determinism in the real world, his methodology is fundamentally based on incomplete determinism as only a limited number a variables are employed. The appeal of such simulations, like any model, is that one can control a reasonable amount of data and not be overwhelmed. The results, however, do not mirror real world complexity. Kohler and his colleagues run the risk of falling into the same trap as environmental 'determinists' by not only examining the role of single or multiple factors, but by assuming the primacy of some factors over others.

A second problem is that the quantification of variables in such simulations is subjective. For example, take economics, where despite various assumptions, there is an academic perception that economic models are more easy to simulate than archaeological models, because hard numbers for GNP's and other indicators are available. Yet even in economics, how does one quantify variables such as bandwagon effects or snobbery in modern financial behavior? (see Rosser, 1993) Such problems are acute in archaeology, because it is impossible to quantify, for example, the feelings of kinship among ancient Pueblo household members, especially from their trash. Programming peoples decision-making with our own assumptions of how they should behave renders such approaches problematic. The problems of simplification and quantification hinder the possibility of complete prediction in archaeology. Ironically, it is multidisciplinary work in Chaos and Complexity Theory by Kohler's colleagues at the Santa Fe Institute and other institutions that bring this problem into focus. They argue that even the slightest changes can ripple through a systems causing huge effects. The classic example is the butterfly flapping its wings and causing a hurricane (see Waldrop, 1992). If such phenomena exist, how can simulations accurately inform us of human behavior and the decisions people make?

Some studies in artificial life reflect these same problems. Many studies of supposed artificial life are computer simulations that are programmed with fundamental assumptions about how the simulated life should behave (see Doran, 2000). These computer-generated life forms are often called artificial life, but they are not thinking entities. They behave like life, because they are programmed to do so (see Dreyfus, 1992; Laing, 1989; Langton, 1989). There are, however, interesting developments towards eliminating such assumptions that have potential bearing on Kohler's research. Programs such as Holland's (1995) classifier systems and genetic algorithms are coming much closer to developing artificial life where programs emerge without the assumptions of

the programmer. Yet even if these programs are successful, they will not be like human systems. They may be informative, but they will not predict human behavior. What they may give us is a better understanding of how cognitive models of biological organisms evolve. If researchers are correct in arguing that neurological programs and cognitive structures in living organisms today are the result of evolutionary processes that include selection, mutation, and adaptation (*e.g.* Edelman, 1987, 1989), then we may be more capable to better understand the links between the modern human consciousness, structure, and the historical particularities of the physical domain by observing these adapting computer programs. Until these programs are successfully created, though, analogies between artificial and natural cognition, if such a distinction is appropriate, remain speculative.

Agents and Agency, Postprocessualists and Humanism

> *In part this is a debate about free will and determinism* (Shanks and Tilley, 1987: 123).
>
> *One of the most common tendencies in discussions of agency is the treatment of it as a synonym for free will* (Ahearn, 2001:114).

If processualists are the disciples of science, prediction, and universal laws, postprocessualists are the bearers of the torch of free will, agency, and contemporary humanism. Despite the inclusion of many lines of thinking in postprocessualist thought such as gender and postcolonial studies, the genesis of postprocessualism in archaeology during the 1980s clearly lies in a return to actor-based studies in other social science disciplines. Studies of agency were first proposed by Hodder and others as an alternative to processualism (*e.g.* Hodder, 1986; Shanks and Tilley, 1987). Like processualist thought, however, postprocessualism experienced an almost immediate transformation and reinterpretation and has now evolved well beyond its anti-processualist beginnings (see Preucel, 1995). Many recent postprocessualist studies have been influenced heavily by Hermeneutics, Phenomenology, and Semiotics.

Although the recent focus on agency in archaeology has many sources, Giddens' (1979, 1984) work has been very influential. Giddens subsumed his work on human agency under what he termed Structuration Theory. The primary thrust of his argument is that to comprehend human behavior, we must understand that people are knowledgeable social agents. Matthew Johnson (1989: 191) states that "Giddens proposed an analytical framework

within which the social actor was assumed to know a great deal about the way in which society operated, and to be more or less capable of reasserting, manipulating, or transforming those rules within a given social situation." In short, social agents impact social change within the context of an environment populated, in part, by other social agents.[2] In contrast to most processual studies, individuals are paramount in analysis for Giddens. The emphasis of study is not on a system composed of automatons unable to impact social change, where the decisions of social agents are placed in a black box, but on the ability of social agents to make decisions within the context of an overarching structure of social interaction that has historical depth (see also Blau, 1977). Within the context of any given physical environment, social agents are enabled and constrained by that structure. In other words, social agents both shape and are shaped by structure; the duality of structure between society (object) and the individual (subject) (Giddens, 1984). Such a view characterizes cognition as dynamic and constantly being resituated as agents move through and experience time and space. Importantly though, unlike the assumptions of neoclassical economic theory, optimal foraging theory, and traditional game theory, social agents do not always behave in rational fashions. They may think and act, but they may not make 'optimal' decisions in our, or their, terms. Social agents are neither completely rational, nor omniscient. Further, regardless if any one decision is rational or not, in light of the data known to the social agent and in accordance with their internal model of rationality, once an action is taken, the consequences of that action may not be expected. Thus, unintended consequences of actions are important (see Dobres and Robb, 2000 for varied definitions of agency).

It is important to note that the definition of agency just presented does not include the concept of free will. This definition is focused on the decisions of individuals, which sets it apart from most processualist research, but it does not assume whether the decisions of individuals are or are not determined by the entire antecedent history of the universe, which includes themselves.

[2] Giddens (1984) tends to minimalize the physical world, however. For example he states that "memory (or recall) is to be understood not only in relation to the psychological qualities of individual agents but also as inhering in the recursiveness of institutional reproduction." (Giddens, 1984: 261) This completely leaves out biological studies that have been done on memory, as well as a consideration of the physical world in general. As I will seek to explain further in the paper, such a view removes the human species from the physical universe and contributes to vitalistic conceptions of human consciousness. This is a major contribution to the proliferation of the concept free will in humanistic studies.

In fact, contradicting Shanks and Tilley (1987: 123) and Dornan's (2002) acknowledgement of free will in agency theory, VanPool and VanPool (2003: 90), following Dobres and Robb's (2000: 4-5) discussion of the core elements of practice theory, state that agency theorists "generally reject concepts such as free will and individual volition, partly because they argue humans cannot choose the social and material contexts of action and are therefore constrained in their behavior, and partly because the behavior of individuals is influenced by the social structure within which they operate (*e.g.* Wobst, 2000: 47-48)." Forgetting for the moment that VanPool and VanPool cite Dobres and Robb's discussion of the core elements of practice theory as a proxy for agency theory, their statement appears to define action and choice as determined by material and structural constraints. While such a Hobbesian view may be held by some agency theorists, as demonstrated below, others do not agree with such an assessment. For them free will is implied in the definition of agency described above. Given that agency theory has strong roots in humanism (see Thomas, 2000) and that humanism has strong leanings towards the philosophies of free will, this should not be surprising.

The concept of free will, however its implication might be intended in the above definition of agency by some postprocessualists, really becomes associated with agency in archaeology through tangential discussions of Structuration Theory in Giddens' (1984) often cited work.[3] Unlike Bourdieu whose concept of habitus in practice theory is overly deterministic (1977; see also Chazel, 1994:152-156; Ritzer and Gindoff, 1994: 7-8; Sewell, 1992; Throop and Murphy, 2002), Giddens (1984) advocates an explicit free will position.

> To look for sources of 'structural constraint' is presumed to be more or less the same as looking for the law-governed conditions that put limits on the bounds of free action. This, for many writers, is exactly where 'sociology' finds its role as a distinctive endeavor among the other social sciences. But according to the view suggested here, it produces a form of reified discourse not true to the real characteristics of human agents (Giddens, 1984: 179).

Despite his emphasis on structure, rules, and resources, Giddens implicitly advocates free will by thoroughly attempting to deny the possibility of determinism in human choice throughout his work and by making direct reference to free action as demonstrated above. As Dornan (2002: 304) notes

[3] As Ahearn (2001) notes, the use free will is more common in the action theory literature.

in reference to agency in archaeology, "[i]n general, the birth of agency theory has reflected a desire to counter deterministic models of human action by acknowledging that people purposefully act and alter the external world through those actions." Again, determinists like Hobbes do not deny purposeful action in their philosophical models of the universe. Yet Dornan's statement reflects a belief among some, not all, postprocessualists that purposeful (intentional) action, another definition for agency, contradicts determinism and is thus an acknowledgement that free will exists.

While the assumption of free will generally remains implicit in some postprocessual discussions, the explicit free will position taken by some followers of Giddens and humanism in archaeology can be summed up in a statement made by Meskell (1996; see Shanks and Tilley, 1987 for an alternate postprocessual view). In a discussion of the benefits of masculinist studies in anthropology, Meskell (1996: 6, emphasis in original) states:

> An embodied body represents, and is, a lived experience where the interplay of irreducible natural, social, cultural and psychical phenomena are brought to fruition through each individual's resolution of external structures, embodied experience and choice. In part, this may relate to Frank's (1991: 48-9) trilateral composition of the body: *institutions*, *discourses* and *corporeality*. Thus, subjective bodily experience is mitigated by factors such as social constraints, practicality, contingency and free will: this dialectical position potentially circumvents the determinism associated with extreme social construction, Cartesianism and essentialism.
>
> It [masculinist studies] brings fresh insights into construction of identities, individuals and embodied, personalized experience: all of this adds to the social dimensionality of postprocessual archaeology (Meskell, 1996: 6).

Following the idea that an essential characteristic of embodiment is existential indeterminacy, a common theme in Postmodern studies of the body (Csordas, 1990, 1994), Meskell's position is explicitly on the side of free will.

While Meskell chooses to explicitly use the term free-will, archaeologists must be wary not to appropriated Moore's (1911; see also Nozick, 1995) phrase 'acting otherwise' to imply the existence free-willed decisions in the past. This phrase can be used as a proxy for free will in discussions of agency, often in an implicit manner. Interestingly, Moore's concept of 'acting otherwise' is actually compatible with causal determinism, although not with fatalism. Yet 'acting otherwise' has libertarian associations for some, and a meaning closer to natural autonomy for others (see Messer-Davidow, 1995).

The use of such poorly defined phrases such as 'acting otherwise' is part of the problem in understanding the concept of free will in postprocessualist

thought. Agency theorists who discuss the concepts of determinism and free will have not well-defined their versions of agency and determinism. While the analytical focus on individual choice and action is clearly laudable, if agency counters determinism in this line of thinking, then what is determinism? What is free will? Definitions of agency that implicitly or explicitly include free will do not explain it leading one to wonder what exactly some agency theorists are trying to get at by linking the concepts of anti-determinism and free will to agency theory. These scholars fail to adequately address how intention or cognition (cognitive in the sense that a mental choice is made in decision) can operate outside of deterministic systems. They assume that the free will (as agency) of the individual to some degree counteracts the self-reproduction of structure. Yet in a Hobbesian sense, if one extends structure to include not only the social realm, but the physical domain, time, and space (see also Gosden, 1994; Hägerstrand, 1976, 1985; Pred, 1977), literally everything, how does individual decision-making occur outside of all of this? This is not a question of the individual *vs.* society, but of the individual *vs.* the universe. What is the source of free will in this scenario? As Kane (1985: 11) states, such a "libertarian idea of self-determination suggests the image of Baron Von Münchhausen pulling himself from a ditch by his own bootstraps." And, as Shanks and Tilley (1987: 123) astutely note, arguing for free will or determinism "may amount to little more than 'taking sides.'" The omission of a clear definition of free will in any discussion of agency theory leaves some conceptions of agency rather ambiguous.

Part of the problem lies with a general conflation of conceptions of incomplete and complete determinism in Anthropology. While Giddens (1984) and some postprocessualist archaeologists emphatically deny the possibility of social determinism, they do so by critiquing arguments of incomplete determinism (compatibilism). An example would be the critique of environmental 'determinism.' From a complete deterministic standpoint, these critiques attack arguments in the *guise* of determinism; arguments that are fundamentally compatibilist in their methodological construction. Neither environmental nor social determinism are complete determinism. The environment or social structure are variables which, in regards to humans, affects people's decisions, but neither can completely determine future outcomes on their own from a completely deterministic standpoint. As the quote above implies, though, while Giddens' may have a valid point about the improper use of social determinism in academics, his intention appears to be to deny determinism altogether. To propose such an hypothesis, Giddens' would need to

tackle Hobbes' argument concerning the entire antecedent universe. Unfortunately, we are left to read critiques of incomplete determinism. Even Shanks and Tilley (1987: 122-125), who acknowledge the free will versus determinism problem in archaeology, frame it not in terms of the philosophic questions concerning the role of the antecedent universe, but in terms of the duality between the individual and society. In their view, society can determine action because actions are forced, habitual, or involve interests and values. Such conceptions of determinism, while important for addressing some social questions, do not encompass complete determinism. Turning now to a consideration of the antecedent universe, I shall devote the second half of this paper to demonstrating the impossibility of knowing whether free will, determinism, or some form of compatibilism exist, while revealing how the recent emphasis on free will in archaeology is both unproductive and potentially dangerous.

Can We Identify the Source of Free Will?

> *The problem here turns on difficult philosophical issues about the nature of intentionality, which insistently demand attention even though they tax our competence* (Ingold, 1987: 10).
>
> *Intentionality and agency raise the fundamental question of how people activate the cortical processes that characterize the exercise of agency and lead to the realization of particular intentions. In addition to explaining how people bring about thoughts and actions is the intriguing question of how people occasion self-perceiving and self-reflecting activities* (Bandura, 1986: 18).

The first part of this paper has been dedicated to introducing definitional issues and illustrating the problem. This problem is that the concept of free will is often implicitly wedded to definitions of agency in archaeology. Although the link between agency and free will is not clearly articulated, it does exist in some postprocessualist writings. Substantive questions generated by a focus on 'acting otherwise,' but also not adequately addressed by postprocessualists, concern the nature of cognition and decision-making among humans. Just because there is a perception of choice does not mean that, in a Hobbesian fashion, the universe does not monolithically and deterministically shape decision-making. How can we know how human consciousness and intention articulates with free will? Are some postprocessualists correct in assuming such a linkage?

To responsibly link the conception of free will with humans, or as some might argue among other forms of life, we should be able to answer the question how we have free will. As I will argue at the end of the paper, to leave this question as an unaddressed assumption in archaeological theory invites ideological problems in regards to archaeology's role in contemporary society. In this section I need to demonstrate the impossibility of proving free will; or more specifically the impossibility of demonstrating that the two possible sources of free will, vitalism and randomness, exist. Following Mrozowski's (1991, 1993; contra Leone *et al*., 1987; Shanks and Tilley, 1987; see also MacFarlane, 1987; Thomas, 1983) suggestion that postprocessual archaeology needs to account more for the environmental and biological factors, I take a naturalistic look at free will and agency in deep-time. From this perspective, two primary questions arise from an examination of the existence and possible origins of free will. Both center around the concept of consciousness, the cornerstone of decision-making. First, how and when did consciousness, or as Dennett (1995) would argue the ability to have agency, occur in the general nonlinear evolution of the physical universe? Second, how did consciousness articulate with the physical and emergent structural domains? The current genesis story of science suggests that through the evolution of complex physical systems on Earth, matter behaving according to rules of physics and chemistry formed and transformed various complex adaptive systems that we call life (*e.g.* Buss, 1987; Kauffman, 1993; Sagan and Druyan, 1992). Somewhere among transformations of matter, consciousness, as we typically conceive it, developed as an emergent property.[4] This is an important point if we claim to study conscious human agents who at least perceive that they make decisions, and thus I would argue, have agency. In this section, I briefly comment on the current knowledge we have of the historical evolution of consciousness from five billion years ago to the transition to anatomically

[4] Giddens (1984:171) seeks to reject the concept of emergence defined by Durkheim (1982: 39-40) who compared the fusing of metals to create an alloy to features (*e.g.* institutions) which emerge from human interaction. Giddens dismisses such arguments by simply stating that "human actors, as recognizable 'component agents,' do not exist in separation from one anther as copper, tin, and lead do. They do not come together *ex nihilo* to form a new entity by their fusing or association." He further states that references to group action are nothing more than shorthand for the actions of the individuals. I believe through that Giddens dismisses a useful concept by assuming that 'interactions' of 'agents' can only form emergent properties through physical fusion. There are varied forms of interactions at numerous scales which produce behavior, that is not the sum of individual behavior and human interaction should be considered as such to avoid Giddens' reductionism.

modern humans. This exercise is presented to demonstrate that we cannot know that free will emerged from the deterministic universe that many believe once existed. Moreover, even if a completely deterministic universe never existed, we cannot prove that it never existed nor can we prove that free will exists.

The Origins of the Universe and the Search for Randomness

To look for randomness in the universe, it is prudent to review what we know about the origins of the physical universe. According to many physicists, about five billion years ago the solar system was a spinning cloud of gas and dust that slowly collapsed upon itself forming the sun and other large bodies of matter (Sagan and Druyan, 1992). Scientific consensus is that natural law was paramount; whether it behaved in uniform fashions at all points in time and space or not. Thus, the scientific community's general rejection of decision-making structures existing at this time leaves little room for agency and/or free will. Two relatively recent bodies of knowledge, Quantum Physics and Chaos Theory, however, have been used to suggest that random behavior may have existed prior to the rise of life. If random behavior existed at this early period, can the origins of free will be traced back to fundamental properties of the physical universe? Could this randomness have given rise to free will?

To answer this question we must make a distinction between random and chance, two terms whose conflation in many branches of science have led to a considerable degree of confusion over their meaning in Quantum Physics and Chaos Theory. Random behavior is not *deterministic* while chance behavior is not *predictable*. Here I am decoupling the concepts of determinism and predictability (see also Goldstein, 1996), two terms that are sometimes conflated in processualist archaeology and its critiques, as well as quantum theory itself (see Dickson, 1998). This is an important distinction, because a process may be unpredictable, but completely deterministic. Take Quantum Physics, where the behavior of minute particles is measured through probabilistic studies. Although taken as evidence for true randomness and free will by some (*e.g.* Compton, 1935; Eccles, 1994; Eddington, 1929; Margenau, 1984; Penrose, 1989 y 1994; Zohar, 1996; Hodgson, 1991, 2002; Popper, 1956, 1959, 1983; Stapp, 1993), it is not that particles necessarily exhibit random behavior that researchers employ such methodologies, but that the behavior of the components of such particles cannot be adequately measured to predict the behavior of the whole (see Huckfeldt, 1990: 415; Walter, 2001: 23-25). The

historical particularities of the variables are out of the 'sight' of the researcher leading van Fraassen (1980: 72) to state: "I wish merely to be agnostic about the existence of the unobservable aspects of the world described by science." Any degree of randomness is only assumed, because the variables cannot be measured. Like a coin toss where, if the social agent knows all the variables involved, they can predict the outcome, Quantum Physics is characterized by chance. Studies of Quantum Physics, like a normal observation of a coin toss, rely on incomplete data. Although this argument, like Einstein's objection to the 'dice-playing god,' has been questioned (Popper, 1983), proof of random quantum behavior has not been adequately marshaled. Further, hypotheses that such random behavior could impact our decision-making have not been adequately formed and tested.

A similar argument has been made for Chaos Theory (see Bishop, 2002), a field that has been consistently mischaracterized as providing evidence for true randomness. According to chaos theorists, there are certain thresholds where the behavior of systems appear to become chaotic and our understanding of them diminishes (see Brock *et al*., 1991; Brown, 1995; Schuster, 1987). The trajectory of a system can be understood up to a point, but after a bifurcation in that trajectory, the system becomes unpredictable. In the words of Lee (1997: 22), "[t]he mathematical equations used are nonlinear, meaning that the dependent variable changes at rates that are not simply first-order powers of change in the independent variable. Furthermore, those coefficients are not dependent exclusively on value change in the independent variable but also in change in the 'boundary conditions' or parameters of the model." In other words, the model is dynamic, constantly changing due to the behavior of the variables (agents). At certain thresholds often called the 'edge of chaos,' mathematical models demonstrate that some systems undergo unpredictable behavior. Yet it is because the interactions of the system are too complex for a standard mathematical solution that researchers cannot predict them. This is not to say that such interactions do not follow deterministic patterns, only that the patterns are too complex and dynamic for a full understanding using current approaches (see also Crutchfield, 1994: 516-517). As studies of cellular automata demonstrate, even very simple rules in a deterministic universe can generate complex and dynamic patterns (Langton, 1989; Wolfram, 2002). The phrase 'deterministic chaos' illustrates the importance of decoupling determinism from predictability in the study of these patterns. The main significance of Chaos Theory is "that it implies that if any detail of the initial conditions is uncertain, then it will eventually become impossible to predict the behavior

of the system" (Wolfram, 2002: 13). While a minority of chaos theorists still argue for the possibility of indeterminism (Polkinghorne, 1996; see also Prigogine and Stengers, 1984), there is no evidence that random, rather than chance, behavior existed prior to the rise of life on Earth. And, if it does exist, we do not know how randomness would impact decision-making (see Vandervert, 1997). In fact, I would doubt that agency theorists would adhere to the belief that if Quantum Physics or Chaos Theory could prove the existence of randomness, free will would derived solely from the random movements of subatomic particles. This is just as dehumanizing as deterministic systems theory.

The findings of Chaos Theory have two implications for determinism and free will in archaeology. First, it mitigates the findings of systems-theory, or complexity research of processualists by demonstrating that unless the model completely mimics reality, the changes could very much bias the results. Second, along with Quantum Theory, it takes away one of the two sources of free will; randomness. Without another body of theory to prove the viability of randomness, these findings reduce its existence to mere speculation leaving us only with the possibility of exploring vitalistic sources of free will.

Life and the Search for Vitalism

If we can agree that there is no current evidence of true random, rather than chance behavior, the only alternative to prove the existence of free will is to search for a source for vitalism. To approach this issue, it is prudent to consider the origin and evolution of life since we will have to identify how a vitalistic source for free will came to be divorced from the properties of the physical universe through the development of conscious thought. Although the topics of when consciousness and agency developed have been discussed by archaeologists,[5] neither the issue of vitalism nor an extensive consideration of non-hominid organisms have been directly addressed in the literature.

Unfortunately, our understanding of the transition to the first forms of what we call life have not preserved in the fossil record, rendering theories on

[5] Some researchers believe that consciousness (self-awareness for some) does not occur until anatomically modern humans evolved during the Upper Paleolithic (see Chater and Heyes, 1994; Heyes and Dickson, 1990), and its existence has been hotly debated among primates (see Gallup, 1982). Outside of Anthropology, others believe that all forms of life including bacteria have some form of consciousness (Margulis and Sagan, 1995; Norris, 1998). This is partly a reflection of different definitions of what constitutes consciousness, but the resistance to non-human consciousness or cognition can be traced back to a long-standing tradition of separating humans from other forms of life, a theme I will return to later in the paper.

the origins of life varied and speculative. Once popular hypotheses that RNA formed in primeval pools have lost widespread support due to the low probabilities that RNA could have formed in such environments (Dyson, 1985; Kauffman, 1993; Sagan and Druyan, 1992). Kauffman (1993) and Farmer *et al*. (1986) provide compelling arguments that life may have formed through the autocatalytic replication of polymers where self-replicating chemical reactions may have formed the first cycles of 'life' and food chains. Others suggest that life may have first formed on clay crystals (Tamayo and Hartman, 1989). Although these hypotheses are not well-supported by geological data, none of the current scenarios rely on explanations outside of deterministic chemical and physical processes. Decision-making is not a process considered in the first formations of life. It should be noted though, that however this transition may have occurred, the physical domain (raw materials), as well as time and space both enabled and constrained the behavior of life. The question remains though; could life have divorced its behavior from these raw materials?

The first known life forms that have been identified in the fossil record are stromatolites (see Lovelock, 1979: 29-30; Morowitz, 1992). These are not individual life forms, but successive layers of sediment generated by mats of bacteria. There is speculation that individual organisms, possibly rudimentary forms of bacteria, developed prior to the formation of such collectives, but hard evidence does not yet exist. This betrays a major gap in our understanding of how life formed. Yet even without this critical information, can we identify free will in the bacteria that composed stromatolites? Although this question remains open, I would surmise that most scholars would deny them decision-making capacities through comparisons to similar modern organisms (Thorpe, 1974; Margulis and Sagan, 1995; Norris, 1998). Despite having developed A, C, G, and T nucleotides and DNA codes, similar organisms in the modern world seem to react to the environment like automatons following the genetic instructions, or Darwinian algorithms (see Cosmides and Tooby, 1987), inherent in their physical structure. Learning does not appear to occur and the existence of memory is not suggested except for the information stored in the genetic codes themselves. While some scholars suggest that such organisms have some form of 'small-scale' consciousness (Dennett, 1995; Sagan and Druyan, 1992; Popper *et al*., 1993), there is very little evidence to suggest that their behavior is more than anything but responsive.[6] In any event, a vitalistic source for free will cannot be identified.

[6] It must be noted, however, that genetic 'determinism' is not complete determinism as the exact behavior of any organism at any given moment is influenced by other variables.

If free will cannot be attributed to single-celled life, then the natural laws of the physical universe must still have applied. Could agency have developed when different types of single-celled organisms began to live together in symbiotic relationships, eventually leading to the development of multi-celled organisms (see Buss, 1987; Fontana and Buss, 1994a)? Could the rise of functionally differentiated cellular collectivities, including ourselves, have produced biological structures that allowed for free-willed decision-making? None of the cells in a human body make the kind of decisions that the social agent as a whole does. Those individual cells do not appear to have emotions or reflexive thought in the same fashion as the whole collectivity. Did the evolution of an emergent consciousness that 'governed' the behavior of the corporate organism, as cells are born and die throughout the life of the corporate organization, 'free' those organisms from the principles of physics and chemistry? Or, is consciousness, memory, and the ability to make decisions just an extension of those principles?

In a recent discussion I had with a biologist working in the Yucatán Peninsula, I asked whether the multi-cellular organisms he studies ever exhibit what he would consider free will. To my amazement, given that most of the biological works I have read have been penned by researchers who adhere to genetic and environmental 'determinism,' he said yes. His reason was that many of the individuals, birds in this case, acted in innovative ways when faced with changes in their environments. I found this reasoning interesting because it equates innovation, and thus the flexibility of the mind, with free will. But does flexibility of the mind and the ability to innovate that characterize multi-cellular organisms indicate that there is an agency characterized by free will, or is flexibility a built-in part of the genetics and can it somehow be attributed to deterministic forces?

Humans, and many other organisms, have two types of internal models of the universe; models based on genetics and models based on learning (nature *vs.* nurture). It is the ability for such organisms to learn a behavior and transpose its application to novel situations that appear to distinguish the behavior of 'complex' organisms from more 'simple' forms of life. Granted, humans have a greater capacity for learning, but we are not unique (*e.g.* Waal, 1989; King *et al.*, 1998; but see Anderson, 1983). Is it this cognitive capacity, enabled by certain forms of mental architecture, that engenders agency and/or free will?

This is a difficult question to answer, because our understanding of brain functions and mental architecture is limited (see Deacon, 1997: 341). For instance, great strides have been made in linking the firing pattern of neurons

in the hippocampus with the memory of places (Bostock *et al*., 1991; Foster *et al*., 1989; Jung and McNaughton, 1993). Yet we are no closer to understanding how or whether 'contending subroutines' of brain patterns impact our decisions to move through space (see also Krakow, 2002). The truth is that we do not yet know enough about how brain functions relate to the physical universe to determine whether free will exists. While we might debate the 'scale' of consciousness (see Donald, 1991, 1993a, 1993b; Dunbar, 1990; Marshack, 1989; Mithen, 1996a) or the use of the concept of agency decoupled from free will with a bit more certainty, the use of agency as free will remain highly speculative.

As discussed in further detail later in the paper, some archaeologists suggest that humans are fundamentally different than all other organisms in that we can experience the world (Thomas, 1996). While this assertion is debatable, is there something about the transition to fully modern humans that enables us to have free will? This question invites a second: how can we be absolutely sure that human cognitive capacity was as developed as modern capacity at 30,000 BP? Arguing that cognitive capacity was fully developed at this time assumes that the internal organization of the brain was static over at least the last 30,000 years. We should at least admit that there is a possibility that the internal structure of the brain could have changed, if only slightly, during this time without affecting the bone structure of the brain-case (see Falk, 1987). I believe Mithen (1996a, 1996b, 2000; see also Mellars, 1991) would argue that changes in material culture would clue us in to these changes, but that line of thinking also assumes a one-to-one correlation between material culture and changes in brain structure, or more precisely, ways of thinking. It is not clear if or to what degree this assumption is valid (see Gibson, 1996; Renfrew, 1996; Zubrow, 1994). If we were to take differences in material culture as evidence for major shifts in cognition between hominid populations on either side of the 30,000 BP date, how do we explain the differences in material culture between Australian aborigines and New Yorkers during the 18th century? Donald's (1993b) point that 'latent cognitive capacity' (*e.g.* the Australian aborigines) can exist suggests that the relationship between material culture and cognition is not so simple. As studies of genetic algorithms have demonstrated, internal software (*e.g.* ways of thinking) can evolve without major changes in the hardware (the brain) (Holland, 1995). Further, Leeuw (1994; see also Kuhn and Sarther, 2000; Thomas, 2000: 148-149) notes that cognitive processes may vary between and within modern populations. This added dimension further complicates our understanding of cognition in the past leading him to, following Delbrück

(1986), state that if cognitive universals exist, they must exist in how the brain works rather than in what it achieves. Yet if modern cognitive capacity is so important to assess agency, where do we draw the line? And, even if we can agree on a line, we still have not been able to identify the source of free will. Randomness does not seem to be the source, leaving us only to explore vitalism as a possibility. Yet where is the evidence that our consciousness detached it self from the properties of the physical universe?

Discussion: Ways of Knowing

Although major questions remain, how can the genesis story of science inform us of determinism and free will? First, there is no clear evidence of random behavior in physical systems that could explain free will. Second, while major cognitive and behavioral changes occurred during the evolution of life, there is no current evidence that any of these changes are divorced from the physical domain, time, space, and emergent structural realms. Each varied form of life behaves differently. There is no evidence to suggest, however, that some form of Hegelian world spirit or Kroeberian superorganic (see Kroeber, 1917) for example, provides freedom in such an account. Without evidence of how decision-making derives from random principles or can be detached from the physical domain, emergent structure, time, and space, how can we 'know' (see Bell, 1994) that free will exists?

Some critics might counter with the argument that this positivist account does not account for a 'Being-in-the-world' in the sense outlined by Heidegger (1962) and other philosophers (see Varela, 1998). What about our perception of free will and our ability to make decisions? The perception of free will and our ability to engender action are tangential to the debate. Beyond the problem of qualia (Crick and Koch, 1990: 264),[7] in this case whether we all have the same sense of Being, any feeling that we have free will may have nothing to do with the existence of free will, but could instead be a product of Walter's (2001) natural autonomy. Studying a 'sense of being' about free will gets us no closer to resolving the dilemma than did processualism, unless evidence that proves a purely physical universe never existed in the deep past is eventually brought to light. Phenomenologists and existenialists, ironically following Descartes' lead, invoke vitalistic elaborations on the mind/brain dualism (Bowes, 1971; see also Churchland, 1984: 7-22), but they cannot prove

[7] Whether the experiences of different people are actually the same.

the assumption that reflexive intuitions inform us of the existence of free will. As Hegel pointed out concerning the philosophy of his contemporary Schelling, Heidegger's (1985) primary inspiration for free will: "Schelling has made known a single treatise on freedom. It is of a deep *speculative* nature, but it stands alone." (cited in Heidegger, 1985: 13, emphasis mine) I contend that this speculation engenders ideological problems in the field. It is to these problems that I now turn.

The Problems of Vitalism and Methodological Individualism

> *For in arguing that humans are fundamentally different from all other species* (Shanks and Tilley, 1987: 55).
>
> *This simply maintains the view that man sits supreme at the center of the universe* (Mithen, 1989: 491).

In the seventeenth century Descartes declared 'I think, therefore I exist' suggesting that human introspection accorded our species a special place in the world (see Sagan and Druyan, 1992: 164-171). While all other organisms were mere automatons, humans possessed a consciousness, a memory, a soul. This was a form of vitalism that held that there was something over and above the dynamic architecture of the organism (see also Chalmers, 1996; Kohler, 2000: 3; Langton, 1989; Monod, 1972). Such views, also espoused by the likes of Rousseau and Marx, as well as early Christian philosophers such as St. Augustine, have propagated the unfounded notion that humans represent a higher form of life that is completely distinct from all others. Even Chomsky (1966) defended this idea leading him to state that it is pointless to study the evolution of human languages from simpler animal systems (Chomsky, 1972). Although all species are unique, these views place special emphasis on ideological notions that humans are 'above' all other species because of our cognitive capacities. Furthermore, they emphasize that social analysis should focus on humans as intentional subjects and not as organisms (see Ingold, 1987: 5). Even as recently as the 1990s, researchers have attempted to dispel such notions by reporting on studies that demonstrate the lack of structural and functional differences of neurons and synapses between humans and other species of mammals (e.g. Dupré, 1996; Griffin, 1976, 1978, 1992; Roitblat *et al.,* 1984). These studies suggest that mental experiences among some mammals are similar to humans, although perhaps those experiences are different in scale. Furthermore, a high-

level of self-awareness has been demonstrated for several primate species (Gallup, 1982; see also Gibson, 2002). This work is of importance to social scientists, as we might be wise to question whether the 'meaning of things' is a uniquely human characteristic, an implicit anthrocentric bias of some humanistic studies (see also Feher, 1989: 11; Haraway, 1991: 151-154). Granted, we study humans. But, it may be our intense focus on our own species and our relatively 'advanced' cognition (and all the baggage that comes with it) that engenders an undertone that we are not just different from other species, but somehow special. Phenomenologists have taken this idea further by portraying the world of human experience, our constituted world, as the only legitimate reality, excluding non-human perceptual experiences and even in some cases physical existence where humans are not present to experience it. This often leads to a subtle assumed vitalism that lurks just below the surface of some humanist studies, including those in archaeology.

As Huckfeldt astutely notes, the proliferation of the determinism/free will debate is often tainted by ideological beliefs. "The often torturous debate over determinism within the social sciences frequently transcends the practice of empirical science and addresses instead a theological dichotomy between Calvin's determinism (predestination) and Luther's free will" (Huckfeldt, 1990: 414). While Huckfeldt's example is well taken, it is only one of many ideological dilemmas created by propagation of this debate in the social sciences; the existence of a vitalistic force that operates beyond the constrains of the physical domain, or dare I say a soul, being another. Ironically, Giddens (1984: 193) echoes this very theme in the context of describing existential contradiction.

> There is, one might say, an antagonism of opposites at the very heart of the human condition, in the sense that life is predicated upon nature, yet is not of nature and is set off against it. Human beings emerge from the 'nothingness' of organic nature and disappear back into that alien state of the inorganic. This might seem to be an unabashedly religious theme and as such to be the proper province of theology rather than social science. But I think it to be in fact of great analytical interest, although I shall not attempt to develop that contention here.

While I do not believe that Giddens necessarily meant to forward this definition to describe his work, as he then touches upon a discussion of existential contradiction in 'tribal' societies, it well characterizes his worldview outlined in it, that humans are, in a vitalistic sense, special.

Thomas (1996), following Heidegger (1962), attempts to demonstrate that the Cartesian mind-body dualism is not present in Phenomenological thought.

Descartes sought to distinguish humans as rational animals, as opposed to the automatons of the rest of the animal kingdom, by conceptualizing humans as standing outside of nature and endowing us with souls that resided apart from the body. Heidegger (1962: 131; see also Giddens, 1984) argues that we can never be completely separated from nature as Descartes argues, but his Phenomenological thinking continues a duality which propagates both vitalistic thinking and a dismissal of agency in other forms of life. As Bowes (1971) notes, it is the focus on consciousness rather than matter which contributes to the Phenomenological elaboration on vitalistic Cartesian dualism rather than standing in opposition to it. Unless randomness is invoked, a belief in free will creates an inherent duality, that ironically, some postprocessualists go through extreme measures to critique in regards to Descartes' brand of dualism. I concur with the likes of Heidegger and Giddens that the concepts of the mind and body should be connected. Descartes defined a situation which no cognitive scientist would dare condone. To replace Descartes' idea with a tacit vitalistic dualism based on the idea of free will, however, does not help the situation.

As the discussion in Thomas (1996; but see Alexandri, 1995; Ingold, 1988) illustrates, this Phenomenological dualism continues to propagate the human/animal disjunction in archaeology. "For what is most important about human bodies is that they represent the medium through which a different kind of Being from animal existence is enacted…Nothing in the world 'shows up' in a meaningful way for any kind of creature which is not human. It is only through human beings that the world gains its intelligibility" (Thomas, 1996: 17). Yet how can we know this? Are we so anthrocentrically arrogant as to think that the human experience is the only legitimate source of meaning in the world?

Phenomenologists, however, are not the only archaeologists propagating the idea that humans are special in this sense. For example, Cowgill's (1996, 2000) uneasiness at speculating on the role agency prior to 30,000 years ago and Mithen's (1996a) rejection of 'true' consciousness in nonhuman organisms, suggests that some archaeologists believe agency is somehow unique to humans, regardless of whether they connect agency with free will. While human behavior is certainly different and arguably more complex than other organisms, there is a wide body of literature in other fields refuting such claims (see Sagan and Druyan, 1992). Some archaeologists engaged in this debate have not addressed this literature, but argue that only humans are conscious or have agency. These are open questions that invite multidisciplinary research. Yet if agency is wedded to free will in these debates, they will continue to be tainted with problematic assumptions.

While the problem of vitalism is present in some postprocessualist writings, it rarely manifests in an explicit manner. A more widespread problem linked to the idea of free will in archaeology, at least from an agency perspective, is methodological individualism. This critique has been most recently flushed out by Gillespie (2001) in regards to conceptions of individuals in archaeology, rather than in regards to the use of free will. Yet the same critique is applicable here. Gillespie argues that many studies of agency have focused on the actions of individuals, or on the intentions of past social agents (see also McCall, 1999: 16-17). In her view, this focus is problematic.

> Ortner (1984:151) characterized practice approaches in anthropology as a whole as dominated by a concept of motivation derived from 'interest theory,' based on an 'essentially individualistic, and somewhat aggressive, actor, self-interested, rational, pragmatic, and perhaps with a maximizing orientation as well.' This theory has been heavily criticized and is too narrowly focused on rationality and 'active-ness'.
>
> It assumes pragmatic rationality as the universal dominant motivation for action, in contrast to agency theory (Gillespie 2001: 79).

Citing several works in Mesoamerican archaeology which take this approach (Clark and Blake, 1994; Joyce and Winter, 1996; Marcus and Flannery, 1996), Gillespie goes on to suggest that the problem originates with the idea that the Western concept of the individual is universal. This idea has influenced many recent archaeological models by focusing on the transformative power of individual, and stereotypical, "big-man" aggrandizers.

While this is not the place to engage in a full discussion of Gillespie's critique, I suggest that the problem not only lies with the Western idea of the individual, but that this idea of the individual is often tied to the Western concept of free will, especially in contexts where action is the focus of study. In this tradition the individual seems to be treated as able to transform the social world because they have intentions that function outside the social and physical milieu in which they are situated. In archaeology this has led to models focused solely on the conspicuous actors of the past: the leaders, aggrandizers, and accumulators who through the magical force of personality have the power to change the world around them. As Gillespie (2001: 79) notes, this goes against the goals of agency theory. Yet in my opinion, it is the deleterious impact of the age old correlation of free will with individual action that has led to such studies. As reflected in the quote by Allen (1982) at the beginning of this article, archaeologists interested in agency are prone to focus on these individuals not only because they were arguably the most

influential, but because one half of Western philosophy has a penchant for looking for the powerful social actors who have ability to shape history by force of (free) will. Ironically, the implicit focus on the free-willed actions of such imagined individuals in archaeology has been deleterious to studies of agency in the past.

Conclusions

While the use of Agency Theory in archaeology has been varied, its widespread adoption by many archaeologists marks a significant paradigm shift from systems-centered studies to studies that acknowledge the actions of social agents. This shift has met with mixed criticism as researchers not only acknowledge the faces of the past (Tringham, 1991), but sometimes impose faces on the past due to the near impossibility of trying to ascertain intention, one of the most elusive aspects of human behavior (Boehm, 1978, 1993; Gladwin and Murtaugh, 1980; Hill, 1994; Ortiz, 1967; Parcero, 1995; see also Fleming, 1995, 1999). Although postprocessualist approaches have been productive in providing a useful lens for modeling archaeological data, the problematic conflation of agency and free will in the professional arena by some postprocessualist scholars remains. While I may be misreading the meaning of free-will as used by some postprocessualists due to the lack of explicit definitions in the literature, given the hostility to the concept of determinism in postprocessualist writings, I believe the evidence suggests these terms to mean that decisions are not completely determined by an antecedent universe. Thus, as in other subfields of Anthropology (Ahearn, 2001), the linkage between agency and free will appears to present agency as some sort of vitalistic force, a concept that cannot be proven, but which implies an external source for decision-making.

This puts us on dangerous ground. As Giddens (1984) himself notes, we participate in the structure we study. Archaeology is social practice (Hamilakis, 1999; Leone, 1986; Leone *et al*., 1987; Shennan, 1986) and our actions and interpretations have influence on others. For instance, speculations on free will or determinism can be co-opted by others with sociopolitical agendas. The speculation of free will could be used to propagate the view that we can actively change culture to solve social problems, or to actively destroy it or dominate others. Alternately, the speculation of determinism could be used to legitimize existing power relations or religious ideas of predestination,

while free will might legitimize the existence of a vitalistic soul, or, as amply discussed in theosophical circles, the existence of evil (Worsley, 1996), a very germane topic given current world events. My point here is that we should not professionally engage in this philosophical issue, implicitly or otherwise, if our field is to be free of such sociopolitical agendas. Whether we consciously or unconsciously adopt one view or the other, or whether our views have intended or unintended consequences, our interpretations help to shape popular cultures, as popular cultures shape our interpretations (see Cooney, 2001). Determinism and free will are fundamentally different world-views; fundamentally different belief systems. And, the belief systems bring with them millennia of ideological baggage. Not only should agency be better defined in Anthropology, but conceptions of determinism and free will should be dropped from the theoretical agenda. As the implicit correlation of individual action and free will in some studies of stereotypical actors in ancient Mesoamerica have shown (see Gillespie, 2001), the implicit adoption of free will can actually hinder the application of agency theory in archaeology.

My point has been to illustrate the irresolvable nature of the debate between free will and determinism. The recent linkage of free will and agency by Giddens (1984) and some postprocessualist archaeologists, raises questions concerning why the linkage occurs in the first place. As Hays (1994: 64, emphasis in original) astutely notes, "[s]ociologists use of the term agency, however, is a bit more tendentious. Their intention is generally to proclaim loudly that people are *not* mere automatons habitually following a precise all-encompassing pattern dictated by social structure." It is a faith, in one side or the other, that drives such proclamations. And, one's faith, whether it be in religion, politics, or philosophy, is often treated as a sacred cow to be defended tooth and nail. While I cannot speculate why individual researchers take professional sides on this debate, the conflation of free will and agency introduces ideological dilemmas into the field. Furthering the problem, postprocessual attacks on determinism provide an academic mechanism for free will supporters to exclude determinist scholars from exploring agency conceived as natural autonomy by labeling them determinists, a label accurately describing their world view, but not necessarily any particular methodology they might employ.

The *possibility* for determinism in this critique is very narrowly defined. This is an important point as deterministic explanations of phenomena have often relied on only one or a limited number of factors. To turn the tables, this is one reason why explicit discussions of determinism in the social sciences

fall short. We cannot possibly control all the variables necessary to account for complete determinism, if a deterministic universe exists at all. The fact is that you would need to be an omniscient being to prove that determinism existed, because if the chaos theorists are right, the slightest change in the 'system' can throw everything off and into an environment of unpredictability, a problem for Kohler's (Kohler *et al*., 2000) methodology. If we cannot reach complete predictability, how can we be sure complete determinism exists? Granted, some shopkeepers can roughly predict that during the weekends they will have more business, because they can roughly control knowledge of several variables such as general trends in people's work habits. They would never be able to predict, though, at exactly what time each person will enter their shop. Neither can we. As Wittgenstein (cited in Dilman, 1999: 234) remarks, science does not yet have the tools to dazzle us into believing in determinism. So while we may explore the dynamics of how certain variables influence our decision-making and talk about patterning, determinist arguments should not rest on incomplete data that are marshaled to 'prove' the existence of universal laws.

In conclusion, agency does not have to be married to free will. Agency is the study of decision-making and action. To continue employing the term free will, implicitly treating the phrase 'acting otherwise' as free will, or critiquing compatibilist arguments as determinism without engaging in the debate over determinism and free will can only further the problem.

Acknowledgements

I would like to thank Michael Adler, George Bey, Harvey Bricker, Catherine Cameron, David Freidel, Karen Holmberg, Scott Hutson, Kit Nelson, James Skibo, and four anonymous reviewers for comments on previous versions of this paper.

The text also benefited from discussions with Jessica Conroy, Lidoine Echavarrieta Albiter, Jeffrey Glover, Monica V. Hernández Beccera, Robert D. Moore, and Jamie Rotenberg.

Any flaws that remain are my sole responsibility.

REFERENCES

ADLER, MORTIMER J.
1958 *The Idea of Freedom: A Dialectical Examination of the Conceptions of Freedom*. Doubleday Co., Garden City, New Jersey.

AHEARN, LAURA M.
2001 Language and Agency. *Annual Review of Anthropology* 30: 109-137.

ALEXANDRI, ALEXANDRA
1995 The origins of meaning. Ian Hodder, Michael Shanks, Alexandra Alexandri, Victor Buchli, John Carman, Jonathan Last and Gavin Lucas (eds.) *Interpreting Archaeology: Finding Meaning in the Past*, Routledge, London: 57-67.

ALLEN, PETER M.
1982 The Genesis of Structure in Social Systems: the Paradigm of Self-Organization. Renfrew C., Rowlands M., J. and Segraves B. A. (eds.) *Theory and Explanation in Archaeology: The Southampton Conference*, Academic Press, New York: 347-374.

ANDERSON, JOHN R.
1983 *The Architecture of Cognition*. Harvard University Press, Cambridge.

ANDERSON, PHILIP W.
1972 More is Different: Broken Symmetry and the Nature of the Hierarchical Structure of Science. *Science* 177: 393-396.

AXELROD, ROBERT
1995 A Model of the Emergence of New Political Actors. Nigel Gilbert and Rosaria Conte (eds.) *Artificial Societies: The Computer Simulation of Social Life*, University College Press, London: 19-39.

BAK, PER
1994 Self-Organized Criticality: a Holistic View of Nature. George A. Cowan, David Pines and David Meltzer (eds.) *Complexity: Metaphors, Models, and Reality*, Santa Fe Institute Studies in the Sciences of Complexity, Addison-Wesley Publishing Company, Reading, Mass: 477-495.

BANDURA, ALBERT
1986 *Social Foundations of Thought and Action: A Social Cognitive Theory*. Prentice Hall, Englewood Cliffs, New Jersey.

BELL, JAMES A.
1994 Interpretation and Testability in Theories about Prehistoric Thinking. Colin Renfrew and Ezra B. W. Zubrow (eds.) *The Ancient Mind: Elements of Cognitive Archaeology*, Cambridge University Press, Cambridge: 15-21.

BETTINGER, ROBERT L. AND PETER J. RICHERSON
1996 The State of Evolutionary Archaeology: Evolutionary Correctness, or the Search for the Common Ground. Herbert D. G. Maschner (ed.) *Darwinian Archaeologies*, Plenum Press, New York: 221-231.

BINFORD, LEWIS R.
1962 Archaeology as Anthropology. *American Antiquity* 28: 217-225.
1965 Archaeological Systematics and the Study of Culture Process. *American Antiquity* 31 (2): 203-210.
1972 *An Archaeological Perspective,* Seminar Press, New York.
2001a Where Do Research Problems Come From? *American Antiquity* 66 (4): 669-678.
2001b *Constructing Frames of Reference: An Analytical Method for Archaeological Theory Building Using Hunter-Gatherer and Environmental Data Sets*. University of California Press, Berkeley.

BISHOP, ROBERT C.
2002 Chaos, Indeterminism, and Free Will. Robert Kane (ed.) *The Oxford Handbook of Free Will*, Oxford University Press, Oxford:111-124.

BLAU, PETER M.
1977 *Inequality and Heterogeneity: A Primitive Theory of Social Structure*. Free Press, New York.

BOBZIEN, SUSANNE
1998 *Determinism and Freedom in Stoic Philosophy,* Clarendon Press, Oxford.

BOEHM, CHRISTOPHER
1978 Rational Preselection from Hamadryas to *Homo sapiens*: The Place of Decisions in Adaptive Process. *American Anthropologist* 80: 265-296.
1993 Egalitarian Behavior and Reverse Dominance Hierarchy. *Current Anthropology* 34 (3): 227-254.

BOSTOCK, ELIZABETH, ROBERT U. MULLER AND JOHN L. KUBIE
1991 Experience-Dependent Modifications of Hippocampal Place Cell Firing. *Hippocampus* 1: 193-206.

BOURDIEU, PIERRE
1977 *Outline of a Theory of Practice,* Cambridge University Press, Cambridge.

BOWES, PRATIMA
1971 *Consciousness and Freedom: Three Views*. Methuen and Co., LTD, London.

BROCK, WILLIAM A., DAVID HSIEH AND BLAKE LEBARON
1991 *Nonlinear Dynamics, Chaos, and Instability: Statistical Theory and Economic Evidence*. MIT Press, Cambridge.

BROWN, COURTNEY
1995 Chaos and Catastrophe Theories. *Quantitative Applications of the Social Sciences* 107: 8-11.

BRUMFIEL, ELIZABETH M.
1992 Distinguished Lecture in Anthropology: Breaking and Entering the Ecosystem N Gender, Class, and Faction Steal the Show. *American Anthropologist* 94: 551-567.

BURNS, TOM R. AND THOMAS DIETZ
1992 Cultural Evolution: Social Rule Systems, Selection and Human Agency. *International Sociology* 7: 250-283.

BUSS, LEO W.
1987 *The Evolution of Individuality*. Princeton University Press, Princeton.

CARNEIRO, ROBERT L.
1970 A Theory of the Origin of the State. *Science* 169: 733-739.

CHALMERS, DAVID J.
1996 Facing up to the Problem of Consciousness. Stuart R. Hameroff, Alfred W. Kaszniak and Alwyn C. Scott (eds.) *Towards a Science of Consciousness: The First Tuscon Discussions and Debates*, MIT Press, Cambridge: 5-28.

CHATER, NICK AND CECILIA HEYES
1994 Animal Concepts: Content and Discontent. *Mind and Language* 9: 209-246.

CHAZEL, FRANÇOISE
1994 Away from Structuralism and the Return of the Actor: Paradigmatic and Theoretical Orientations in Contemporary French Sociology. Piotr Sztompka (ed.) *Agency and Structure: Reorienting Social Theory*, Gordon and Breach, New York: 143-163.

CHOMSKY, NOAM
1966 *Cartesian Linguistics*. Harper and Row, New York.
1972 *Language and Mind*. Harcourt Brace Jovanovich, New York.

CHURCHLAND, PAUL S.
1984 *Matter and Consciousness: A Contemporary Introduction of the Philosophy of Mind*. MIT Press, Cambridge.

CICERO, MARCUS TULIO
1960 *De Oratore, de Fato, Paradoxa Stoicorum, de Partitione Oratoria*. Harris Rackham (trad.) Heinemann, London.

CLARK, JOHN E. AND MICHAEL BLAKE
1994 The Power of Prestige: Competitive Generosity and the Emergence of Rank Societies in Lowland Mesoamerica. Elizabeth M. Brumfiel and Jonathon W. Fox (eds.) *Factional Competition and Political Development in the New World*, Cambridge University Press, Cambridge: 17-30.

COMPTON, ARTHUR H.
1935 *The Freedom of Man*. Yale University Press, New Haven.

CONNERTON, PAUL
1989 *How Societies Remember,* Cambridge University Press, Cambridge.

CONRAD, MICHAEL
1996 Percolation and Collapse of Quantum Parallelism: A Model of Qualia and Choice. Stuart R. Hameroff, Alfred W. Kaszniak and Alwyn C. Scott (eds.) *Toward a Science of Consciousness: The First Tuscon Discussions and Debates*, MIT Press, Cambridge: 469-492.

COONEY, GABRIEL
2001 Bringing Contemporary Baggage to Neolithic Landscapes. Barbara Bender, and Margot Winer (eds.) *Contested Landscapes: Movement, Exile, and Place*, Berg, Oxford:165-180.

COSMIDES, LEDA AND JOHN TOOBY
1987 From Evolution to Behavior: Evolutionary Psychology as the Missing Link. John Dupré (ed.) *The Latest on the Best: Essays on Evolution and Optimality*, MIT Press, Cambridge: 276-306.

COWGILL, GEORGE L.
1993 Distinguished Lecture in Archaeology: Beyond Criticizing New Archaeology. *American Anthropologist* 95 (3): 551-573.

1996 Population, Human Nature, Knowing Actors, and Explaining the Onset of Complexity. Daniel A. Meyer, Peter C. Dawson and Donald T. Hanna (eds.) *Debating Complexity*, Proceedings of the 26th Annual Chacmool Conference, Archaeological Association of the University of Calgary, Calgary: 16-22.

2000 "Rationality" and Contexts in Agency Theory. Marcia-Ann Dobres and John E. Robb (eds.) *Agency in Archaeology*, Routledge Press, London: 51-60.

CRICK, FRANCIS AND CHRISTOF KOCH

1990 Towards a Neurobiological Theory of Consciousness. *Seminars in the Neurosciences* 2: 263-275.

CROZIER, MICHEL, AND ERHARD FRIEDBERG

1980 *Actors and Systems: The Politics of Collective Action.* University of Chicago Press, Chicago.

CRUTCHFIELD, JAMES P.

1994 Is Anything Ever New? Considering Emergence. George A. Cowan, David Pines and David Meltzer (eds.) *Complexity: Metaphors, Models, and Reality*, Proceedings Volume XIX, Santa Fe Institute Studies in the Sciences of Complexity, Addison-Wesley Publishing Company, Reading, MA: 515-533.

CSORDAS, THOMAS J.

1990 Embodiment As a Paradigm for Anthropology. *Ethos* 18: 5-47.

1994 Introduction: The Body as Representation and Being-in-the-World. Thomas J. Csordas (ed.) *Embodiment and Experience: The Existential Ground of Culture and Self*, Cambridge University Press, Cambridge: 1-24.

DEACON, TERRENCE W.

1997 What Makes the Human Brain Different? *Annual Review of Anthropology* 26: 337-357.

DEAN, JEFFREY S., GEORGE J. GUMERMAN, JOSHUA M. EPSTEIN, ROBERT L. AXTELL, ALLAN C. SWEDLUND, MILES T. PARKER AND STEVEN MCCARROLL

2000 Understanding Anasazi Culture Change Through Agent-Based Modeling. Timothy A. Kohler, and George J. Gumerman (eds.) *Dynamics in Human and Primate Societies: Agent-Based Modeling of Social and Spatial Processes*, Oxford University Press, Oxford: 179-205.

DELBRÜCK, MAX

1986 *Mind from Matter: An Essay on Evolutionary Epistemology*. Blackwell Scientific Publications, Inc., Oxford.

DENNETT, DANIEL C.
1978 *Brainstorms: Philosophical Essays on Mind and Psychology*. MIT Press, Cambridge.
1995 *Darwin's Dangerous Idea: Evolution and the Meanings of Life*. Touchstone book, Simon & Schuster New York, New York.

DICKSON, MICHAEL M.
1998 *Quantum Chance and Non-Locality: Probability and Non-Locality in the Interpretation of Quantum Mechanics*. Cambridge University Press, Cambridge.

DILMAN, 0LHAM
1999 *Free Will: An Historical and Philosophical Introduction*. Routledge, London.

DOBRES, MARCIA-ANN
1995 Gender and Prehistoric technology: On Social Agency of Technical Strategies. *World Archaeology* 27: 25-49.
1999 Of Paradigms and Ways of Seeing: Artifact Variability as if People Mattered. Elizabeth S. Chilton (ed.) *Material Meanings: Critical Approaches to the Interpretation of Material Culture*, University of Utah Press, Salt Lake City: 7-23.
2000 *Technology and Social Agency: Outlining a Practice Framework for Archaeology,* Blackwell Publishers Ltd., Oxford.

DOBRES, MARCIA-ANN, AND JOHN E. ROBB
2000 *Agency in Archaeology: Paradigm or Platitude?* Routledge Press, London.

DOBRES, MARCIA-ANN AND CHRISTOPHER R. HOFFMAN
1994 Social Agency and the Dynamics of Prehistoric Technology. *Journal of Archaeological Method and Theory* 1: 211-258.

DONALD, MERLIN
1991 *Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition*. Harvard University Press, Cambridge.
1993a Human Cognitive Evolution: What We Were, What We Are Becoming. *Social Research* 60: 143-170.
1993b Hominid Enculturation and Cognitive Evolution. *Archaeological Review from Cambridge* 12: 5-24.

DORAN, JIM
2000 Trajectories to Complexity in Artificial Societies: Rationality, Belief, and Emotions. Timothy A. Kohler and George J. Gumerman (eds.) *Dynamics in Human and Primate Societies: Agent-Based Modeling of Social and Spatial Processes*, Oxford University Press, Oxford: 89-105.

DORNAN, JENNIFER L.
2002 Agency and Archaeology: Past, Present, and Future Directions. *Journal of Archaeological Method and Theory* 9: 303-329.

DOUBLE, RICHARD
1991 *The Non-Reality of Free Will*. Oxford University Press, New York.

DREYFUS, HUBERT L.
1992 *What Computers Still Can't Do: A Critique of Artificial Reason*. The MIT Press, Cambridge.

DUNBAR, ROBIN I. M.
1990 Ecological Modelling in an Evolutionary Context. *Folia Primatologica* 53: 235-246.
1993 Coevolution of Neocortical Size, Group Size, and Language in Humans. *Behavioral and Brain Sciences* 16: 681-735.

DUPRÉ, JOHN
1996 The Mental Lives of Nonhuman Animals. Marc Bekoff and Dale Jamieson (eds.) *Readings in Animal Cognition*, MIT Press, Cambridge: 323-336.

DURKHEIM, EMILE
1982 *The Rules of Sociological Method.* McMillan, London.

DYSON, FREEMAN J.
1985 *Origins of Life.* Cambridge University Press, Cambridge.

EARLE, TIMOTHY K. AND ROBERT W. PREUCEL
1987 Processual Archaeology and the Radical Critique. *Current Anthropology* 28: 501-538.

ECCLES, JHON C.
1970 *Facing Reality: Philosophical Adventures by a Brain Scientist*. Springer-Verlag, New York.
1994 *How the Self Controls its Brain*. Springer, Berlin.

EDDINGTON, ARTHUR STANLEY
1929 *The Nature of the Physical World*. Dent, London.

EDELMAN, GERALD M.
1987 *Neural Darwinism: The Theory of Neuronal Group Selection*. Basic Books, New York.
1989 *The Remembered Present: A Biological Theory of Consciousness*. Basic Books, New York.

EPSTEIN, JOSHUA M. AND ROBERT AXTELL
1996 *Growing Artificial Societies: Social Science from the Bottom Up*. The Brookings Institution, MIT Press, Cambridge.

FALK, DEAN
1987 Hominid Paleoneurology. *Annual Review of Anthropology* 16: 13-30.

FARMER, J. DOYNE, STUART A. KAUFFMAN, AND NORMAN H. PACKARD
1986 Autocatalytic Replication of Polymers. *Physica D* 22: 50-67.

FEHER, MICHEL
1989 Introduction. Michel Feher (ed.) *Fragments for a History of the Human Body, Part I*, Zone, New York: 10-17.

FLANNERY, KENT V.
1972 The Cultural Evolution of Civilizations. *Annual Review of Ecology and Systematics* 3: 399-426.

FLEMING, ANDREW
1995 A Tomb with a View. *Antiquity* 69: 1040-1042.
1999 Phenomenology and the megaliths of Wales: A dreaming too far? *Oxford Journal of Archaeology* 18: 119-125.

FONTANA, WALTER AND LEO W. BUSS
1994a The Arrival of the Fittest: Toward a Theory of Biological Organization. *Bulletin of Mathematical Biology* 56: 1-64.
1994b What Would Conserved if "the Tape Were Played Twice?" George A. Cowan, David Pines and David Meltzer (eds.) *Complexity: Metaphors, Models and Reality*, Proceedings Volume XIX, Santa Fe Institute Studies in the Sciences of Complexity, Addison-Wesley Publishing Company, Reading, MA: 223-236.

FOSTER, TOM C., CARL A. CASTRO AND BRUCE L. MCNAUGHTON
1989 Spatial Selectivity of Rat Hippocampal Neurons: Dependence on Preparedness for Movement. *Science* 244: 1580-1582.

FOUCAULT, MICHEL
1979 *Discipline and Punish.* Penguin, Harmondsworth.

FRAASSEN, BAS VAN
1980 *The Scientific Image*. Oxford University Press, Oxford.

FRANK, ARTHUR W.
1991 For a Sociology of the body: An analytical review. Mike Featherstone, Mike Hepworth, and Brian S. Turner (eds.) *The Body: Social Processes and Cultural Theory*, Sage, London: 36-102.

GALLUP, GORDON G. JR.
1982 Self-Awareness and the Emergence of Mind in Primates. *American Journal of Primatology* 2: 237-248.

GIBSON, KATHLEEN R.
1996 The Biocultural Brain, Seasonal Migrations, and the Emergence of the Upper Paleolithic. Paul Mellars and Kathleen Gibson (eds.) *Modelling the Early Human Mind*, The McDonald Institute for Archaeological Research, Cambridge: 33-46.
2002 Customs and Cultures in Animals and Humans: Neurobioilogical and evolutionary considerations. *Anthropological Theory* 2 :323-339.

GIDDENS, ANTHONY
1979 *Central Problems in Social Theory: Action, Structure, and Contradiction in Social* Analysis. University of California Press, Berkeley.
1984 *The Constitution of Society: Outline of the Theory of Structuration*. University of California Press, Berkley.

GILLESPIE, SUSAN D.
2001 Personhood, Agency and Mortuary Ritual: a Case Study from the Ancient Maya. *Journal of Anthropological Archaeology* 20:73-112.

GLADWIN, HUGH AND MICHAEL MURTAUGH
1980 The Attentive-Preattentive Distinction in Agricultural Decision Making. Peggy F.Barlett (ed.) *Agricultural Decision Making: Anthropological Contributions to Rural Development*, Academic Press, New York: 115-136.

GOLDSTEIN, JEFFREY
1996 Causality and Emergence in Chaos and Complexity Theories. William Sulis and Allan Combs (eds.) *Nonlinear Dynamics in Human Behavior*, Stu-

dies of Nonlinear Phenomena in Life Sciences, vol. 5, World Scientific, Singapore: 161-190.

GOSDEN, CHRISTOPHER
1994 *Social Being and Time*. Blackwell, Oxford.

GOULD, STEPHEN JAY
1989 *This Wonderful Life*. W.W. Norton, New York.

GRIFFIN, DONALD R.
1976 *The Question of Animal Awareness: Evolutionary Continuity of Mental Experience*. Rockefeller University Press, New York.
1978 Prospects for a cognitive ethology. *Behavioral and Brain Sciences* 1: 527-538.
1992 *Animal Minds*. University of Chicago Press, Chicago.

HÄGERSTRAND, TROSTEN
1976 *Innovation as a Spatial Process*. University of Chicago Press, Chicago.
1985 Time-geography: Focus on the corporeality of man, society and environment. Shuhei Aida (ed.) *The Science and Praxis of Complexity*, United Nations University, Tokyo: 193-216.

HAMILAKIS, YANNIS
1999 La trahison des archéologues? Archaeological practice as intellectual activity in postmodernity. *Journal of Mediterranean Archaeology* 12: 60-79.

HARAWAY, DONNA J.
1991 *Simians, Cyborgs and Women: The Reinvention of Nature*. Routledge, New York.

HAYS, SHARON
1994 Structure and Agency and the Sticky Problem of Culture. *Sociological Theory* 12: 57-72.

HEIDEGGER, MARTIN
1962 *Being and Time*. Blackwell, Oxford.
1985 *Schelling's Treatise on the Essence of Human Freedom*. J. Stambaugh (trad.)Ohio University Press, London.

HEYES, CECILIA AND ANTHONY DICKINSON
1990 The Intentionality of Animal Action. *Mind and Language* 5: 87-104.

HILL, JAMES N.
1994 Prehistoric Cognition and the Science of Archaeology. Colin Renfrew and Ezra B. W. Zubrow (eds.) *The Ancient Mind: Elements of Cognitive Archaeology*, Cambridge University Press, Cambridge: 83-92.

HINDESS, BARRY
1986 Actors and Social Relations. Mark L. Wardell and Stephen P. Turner (eds.) *Social Theory in Transition*, Allen and Unwin, London: 113-126.

HOBBES, THOMAS
1958 *Leviathan*. Bobbs-Merrill, Indianapolis.

HODDER, IAN
1982 Theoretical Archaeology: a Reactionary View. Ian Hodder (ed.) *Symbolic and Structural Archaeology*, Cambridge University Press, Cambridge: 1-16.
1986 *Reading the Past*. Cambridge University Press, Cambridge.
2000 Agency and Individuals in Long-Term Processes. Marcia-Ann Dobres and J. E. Robb (eds.) *Agency in Archaeology*, Routledge Press, London: 21-33.

HODGSON, DAVID
1991 *The Mind Matters*. Clarendon Press, Oxford.
2002 Quantum Physics, Consciousness and Free Will. R. Kane (ed.) *The Oxford Handbook of Free Will*, Oxford University Press, Oxford: 85-110.

HOLLAND, JOHN H.
1995 *Hidden Order: How Adaptation Builds Complexity*. Perseus Books, Reading, MA.

HONDERICH, TED
1993 *How Free Are You?: The Determinism Problem*. Oxford University Press, Oxford.

HUCKFELDT, ROBERT
1990 Structure, Indeterminacy and Chaos: A Case for Sociological Law. *Journal of Theoretical Politics* 2: 413-433.

HUDSON, HUD
1994 *Kant's Compatibilism*. Cornell University Press, Ithaca, New York.

HUTSON, SCOTT R.
2001 Synergy Through Disunity: Science as Social Practice. *American Antiquity* 66: 669-678.

INGOLD, TIM
1987 *The Appropriation of Nature: Essays on Human Ecology and Social Relations*. University of Iowa Press, Iowa City.
1988 The Animal in the Study of Humanity. Tim Ingold (ed.) *What is an Animal?,* Unwin Hyman, London: 84-99.

JOHNSON, M. H.
1989 Concepts of Agency in Archaeological Interpretation. *Journal of Anthropological Archaeology* 8: 189-211.

JOYCE, ARTHUR AND MARCUS WINTER
1996 Ideology, Power and Urban Society in Prehispanic Oaxaca. *Current Anthropology* 37: 33-47.

JUNG, M. W. AND MCNAUGHTON, B. L.
1993 Spatial Selectivity of Unit Activity in the Hippocampal Granular Layer. *Hippocampus* 3: 165-182.

KANE, ROBERT
1985 *Free Will and Values*. State University of New York Press, Albany.

KANT, IMMANUEL
1958 *Critique of Pure Reason*. N. K. Smith (trad.) Macmillan, London.

KAUFFMAN, STUART A.
1993 *The Origins of Order: Self-Organization and Selection in Evolution*. Oxford University Press, Oxford.

KING, JAMES E., DUANE M. RUMBAUGH AND E. SUE SAVAGE-RUMBAUGH
1998 Evolution of Intelligence, Language, and Other Emergent Processes for Consciousness: a Comparative Perspective. Hameroff, S. R., Kaszniak, A. W., and Scott, A. C. (eds.) *Toward a Science of Consciousness II: The Second Tuscon Discussions and Debates,* The MIT Press, Cambridge: 383-395.

KOHLER, TIMOTHY A.
1993 News from the Northern American Southwest: Prehistory on the Edge of Chaos. *Journal of Archaeological Research* 1: 267-321.
2000 Putting the Social Sciences Together Again. An Introduction to the Volume Kohler, T. A. and Gumerman, G. J. (eds.) *Dynamics in Human and Primate Societies: Agent-Based Modeling of Social and Spatial Processes*, Oxford University Press, Oxford:1-18.

KOHLER, TIMOTHY A., JAMES KRESL, CARLA VAN WEST, ERIC CARR AND RICHARD H. WILSHUSEN
2000 Be There Then: a Modeling Approach to Settlement Determinants and Spatial Efficiency Among Late Ancestral Pueblo Populations of the Mesa Verde Region, U.S. Southwest. Kohler, T. A. and Gumerman, G. J. (eds.) *Dynamics in Human and Primate Societies: Agent-Based Modeling of Social and Spatial Processes*, Oxford University Press, Oxford:145-178.

KRAKOW, IRVING
2002 *Why the Mind-Body Problem Cannot Be Solved: Some Final Considerations in the Philosophy of Mind*. University Press of America, Lanham, MD.

KROEBER, ALFRED
1917 The Superorganic. *American Anthropologist* 19: 163-213.

KUHN, STEVEN L. AND CATHERINE SARTHER
2000 Food, Lies, and Paleoanthropology: Social Theory and the Evolution of Sharing in Humans. Schiffer, M. B. (ed.) *Social Theory in Archaeology*, University of Utah Press, Salt Lake City: 79-96.

LAING, RICHARD
1989 Artificial Organisms: History, Problems, Directions. Langton, C. (ed.) *Artificial Life*, Proceedings Volume VI, Santa Fe Institute Studies in the Sciences of Complexity, Addison-Wesley Publishing Company, Reading, PA: 49-61.

LANGTON, CHRISTOPHER G.
1989 Artificial Life. Langton, C. (ed.) *Artificial Life*, Proceedings Volume VI, Santa Fe Institute Studies in the Sciences of Complexity, Addison-Wesley Publishing Company, Reading: 1-47.

LEE, MARY E.
1997 From Enlightenment to Chaos: Toward a Nonmodern Social Theory. Raymond A. Eve, Sara Horsfall and Mary E. Lee (eds.) *Chaos, Complexity, and Sociology: Myths, Models, and Theories*, Sage Publications, London: 15-29.

LEONE, MARK
1986 Symbolic, Structural and Critical Archaeology. Meltzer, D. J., Fowler, D. and Sabloff, J. A. (eds.) *American Archaeology Past and Future*, Smithsonian Institution Press, Washington, D. C.: 415-438.

LEONE, MARK, PARKER POTTER AND PAUL SHACKEL
1987 Toward a Critical Archaeology. *Current Anthropology* 28: 283-302.

LEEUW, SANDER E. VAN DER
1994 Cognitive Aspects of 'Technique.' Colin Renfrew and Ezra B. W. Zubrow (eds.) *The Ancient Mind: Elements of Cognitive Archaeology*, Cambridge University Press, Cambridge: 135-142.

LEEUW, SANDER E. VAN DER AND JAMES MCGLADE
1997 Structural Change and Bifurcation in Urban Evolution: a Non-linear Dynamical Perspective. Leeuw, S. E. and McGlade, J. (eds.) *Time, Process, and Structured Transformation in Archaeology*, Routledge, London: 331-372.

LOVELOCK, JAMES E.
1979 *Gaia: A New Look at Life on Earth*. Oxford University Press, Oxford.

LUCAS, GAVIN
1995 Interpretation in Contemporary Archaeology: Some Philosophical Issues. Ian Hodder, Shanks, M., Alexandri, A., Buchli, V., Carman, J., Last, J. and Lucas, G. (eds.) *Interpreting Archaeology: Finding Meaning in the Past*, Routledge, London: 37-44.

MACFARLANE, ALLAN
1987 *The Culture of Capitalism.* Basil Blackwell, Oxford.

MARCUS, JOYCE, AND K. V. FLANNERY
1996 *Zapotec Civilization: How Urban Society Evolved in Mexico's Oaxaca Valley*. Thames and Hudson, London.

MARGENAU, HENRY
1984 *The Miracle of Existence*. OxBow, Woodbridge, CT.

MARGULIS, LYNN, AND DORION SAGAN
1995 *What is Life?* Simon & Schuster, New York.

MARQUARDT, WILLIAM H.
1992 Dialectical Archaeology. *Archaeological Method and Theory* 4: 101-140.

MARSHACK, ALEXANDER
1989 Evolution of the Human Capacity: The symbolic evidence. *Yearbook of Physical Anthropology* 32: 1-34.

MCCALL, JOHN
1999 Structure, Agency, and the Locus of the Social: Why Post-Structural Theory is Good for Archaeology. John Robb (ed.) *Material Symbols: Culture and Economy in Prehistory*, Southern Illinois University Press, Carbondale: 16-21.

MCGUIRE, RANDALL H.
1992 *A Marxist Archaeology*. Academic Press, San Diego.

MELLARS, PAUL
1991 Cognitive Changes and the Emergence of Modern Humans in Europe. *Cambridge Archaeological Journal* 1: 63-76.

MESKELL, LYNN
1996 The Somatisation of Archaeology: Institutions, Discourses, Corporeality. *Norwegian Archaeological Review* 29: 1-16.

MESSER-DAVIDOW, ELLEN
1995 Acting Otherwise. Gardiner, J. K. (ed.) *Provoking Agents: Gender and Agency in Theory and Practice*, University of Illinois Press, Chicago: 23-51.

MITHEN, STEVEN
1989 Evolutionary Theory and Post-Processual Archaeology. *Antiquity* 63: 483-494.
1996a *The Prehistory of the Mind: The Cognitive Origins of Art, Religion, and Science,* Thames and Hudson, London.
1996b The Origin of Art: Natural Signs, Mental Modularity and Visual Symbolism. Maschner, H. D. G. (ed.) *Darwinian Archaeologies*, Plenum Press, New York: 197-217.
2000 Mind, Brain and Material Culture: An Archaeological Perspective. Carruthers, P. and Chamberlain, A. (eds.) *Evolution and the Human Mind: Modularity, Language, and Meta-Cognition*, Cambridge University Press, Cambridge: 207-217.

MONOD, JACQUES
1972 *Chance and Necessity*. Collins, Glasgow.

MOORE, GEORGE EDWARD
1991 [1911] *Ethics*. Williams and Norgate, London.

MOROWITZ, HAROLD J.
1992 *The Beginnings of Cellular Life: Metabolism Recapitulates Biogenesis*. Yale University Press, New Haven.

MROZOWSKI, STEPHEN A.
1991 Landscapes of Inequality. McGuire, R. H. and Paynter, R. (eds.) *The Archaeology of Inequality,* Basil Blackwell, Oxford: 79-101.
1993 The Dialectics of Historical Archaeology in a Post-Processual World. *Historical Archaeology* 27: 106-111.

NORRIS, VIC
1998 Bacteria as Tools for Studies of Consciousness. Hameroff, S. R., Kaszniak, A. W. and Scott, A. C. (eds.) *Toward a Science of Consciousness II: The Second Tuscon Discussions and Debates,* The MIT Press, Cambridge: 397-405.

NOZICK, ROBERT
1995 Choice and Indeterminism. O'Conner, T. (ed.) *Agents, Causes and Events*, Oxford University Press, New York: 101-114.

ORTIZ, SUTTI
1967 The Structure of Decision Making Among Indians in Columbia. Firth, R. (ed.) *Themes in Economic Anthropology*, Tavistock, London: 191-228.

ORTNER, SHERRY B.
1984 Theory in Anthropology Since the Sixties. *Comparative Studies in Society and History* 26: 126-166.

PARCERO OUBIÑA, CÉSAR
1995 Elementos para el estudio de los paisajes castreños del noroeste peninsular. *Trabajos de Prehistoria* 52 (1): 127-144.

PEEBLES, CHRISTOPHER S.
1992 Rooting Out Latent Behaviorism in Prehistory. Gardin, J.C. and Peebles, C. S. (eds.) *Representations in Archaeology*, Indiana University Press, Bloomington: 357-384.

PENROSE, ROGER
1989 *The Emperor's New Mind*. Oxford University Press, Oxford.
1994 *Shadows of the Mind*. Oxford University Press, Oxford.

PLOG, FRED T.
1975 Systems Theory in Archaeological Research. *Annual Review of Anthropology* 4: 207-224.

POLKINGHORNE, JOHN
1996 *Beyond Science*. Cambridge University Press, Cambridge.

POPPER, KARL R.
1956 *The Open Universe*. Rowman and Littlefield, Totowa, NJ.
1959 *The Logic of Scientific Discovery*. Harper and Row, New York.
1983 *Realism and the Aim of Science*. Rowman and Littlefield, Totowa, NJ.

POPPER, KARL R., B. INGEMAR, B. LINDAHL AND PETER ARHEM
1993 A Discussion of the Mind-Brain Problem. *Theoretical Medicine* 14: 167-180.

PRED, ALLAN
1977 The Choreography of Existence: Comments of Hägerstrand's Time-Geography. *Economic Geography* 53: 207-221.

PREUCEL, ROBERT W.
1995 The Post-Processual Condition. *Journal of Archaeological Research* 3(2): 147-175.

PREUCEL, ROBERT W. AND ALEXANDER BAUER
2001 Archaeological Pragmatics. *Norwegian Archaeological Review* 34(2): 85-96.

PRIGOGINE, ILYA AND ISABELLE STENGERS
1984 *Order out of Chaos,* Bantam, New York.

RENFREW, COLIN
1993 Cognitive Archaeology: Some Thoughts on the Archaeology of Thought. *Cambridge Archaeological Journal* 3: 248-250.
1996 The Sapient Behavior Paradox: How to Test for Potential? Paul Mellars and Kathleen Gibson (eds.) *Modelling the Early Human Mind*, The McDonald Institute for Archaeological Research, Cambridge: 11-14.

RITZER, GEORGE AND PAMELA GINDOFF
1994 Agency-Structure, Micro-Macro, Individualism-Holism-Relationism: a Metatheoretical Convergence Between the United States and Europe. Piotr Sztompka (ed.) *Agency and Structure: Reorienting Social Theory*, Gordon and Breach, Switzerland: 3-23.

ROITBLAT, HERBET L., THOMAS G. BEVER AND H. S. TERRACE (EDS.)
1984 *Animal Cognition,* Lawrence Erlbaum Associates, Hillsdale, NJ.

ROSSER, J. BARKLEY JR.
1993 Belief: its Role in Economic Thought and Action. *American Journal of Economics and Sociology* 52: 355-368.

SAGAN, CARL AND ANN DRUYAN
1992 *Shadows of Forgotten Ancestors: A Search for Who We Are*. Ballantine Books, New York.

SALMON, MERRILEE H.
1975 Confirmation and Explanation in Archaeology. *American Antiquity* 40: 459-464.

SALMON, MERRILEE H. AND WESLEY C. SALMON
1979 Alternative Models of Scientific Explanation. *American Anthropologist* 81: 61-74.

SANDERS, WILLIAM T. AND DAVID L. WEBSTER
1978 Unilinealism, Multilinealism and the Evolution of Complex Societies. Redman, C. L., Berman, M. J., Curtain, E. V., Langhorn, W. T., Versaggi, N. M. and Wasner, J. C. (eds.) *Social Archaeology: Beyond Subsistence and Dating*, Academic Press, New York: 249-302.

SAXE, A. A. AND GALL, P.
1977 Ecological Determinants of Mortuary Practices: The Temuan of Malaysia. William Wood (ed.) *Cultural-Ecological Perspectives on Southeast Asia*, Ohio University Center for International Studies, Athens, OH: 74-82.

SCHUSTER, HEINZ G.
1987 *Deterministic Chaos.* VCH Verlagsgesellschaft, Weinheim.

SEWELL, WILLIAM H. JR.
1992 A Theory of Structure: Duality, Agency, and Transformation. *American Journal of Sociology* 98: 1-29.

SHANKS, MICHAEL AND CHRISTOPHER TILLEY
1987 *Re-Constructing Archaeology: Theory and Practice,* Cambridge University Press, Cambridge.

SHENNAN, STEPHEN
1986 Towards a Critical Archaeology. *Proceedings of the Prehistoric Society* 52: 327-338.

SKINNER, BURRHUS F.
1969 *Contingencies of Reinforcement,* Appleton-Century-Crofts, New York.

STAPP, HENRY P.
1993 *Mind, Matter, and Quantum Mechanics,* Springer, New York.

TAMAYO, PABLO AND HYMAN HARTMAN
1989 Cellular Automata, Reaction-Diffusion Systems and the Origin of Life. Langton, C. G. (ed.) *Artificial Life*, Proceedings Volume VI, Santa Fe Institute Studies in the Sciences of Complexity, Addison-Wesley Publishing Company, Reading, PA: 105-124.

THOMAS, JULIAN
1996 *Time, Culture and Identity: An Interpretive Archaeology*. Routledge, London.
2000 Reconfiguring the Social, Reconfiguring the Material. Schiffer, M. B. (ed.) *Social Theory in Archaeology*, University of Utah Press, Salt Lake City: 143-155.

THOMAS, KEITH
1983 *Man in the Natural World*. Allen Lane, London.

THORPE, WILLIAM H.
1974 *Animal Nature and Human Nature*. Anchor Press, New York.

THROOP, C. JASON AND KEITH M. MURPHY
2002 Bourdieu and Phenomenology: A Critical Assessment. *Anthropological Theory* 2: 185-207.

TOURAINE, ALAIN
1971 *The Self-Production of Society*. University of Chicago Press, Chicago.
1985 Social Movements and Social Change. Borda, O. F. (ed.) *The Challenge of Social Change*, Sage, London: 77-92.

TRINGHAM, RUTH
1991 Households with Faces: The Challenge of Gender in Prehistoric Architectural Remains. Gero, J. and Conkey, M. (eds.) *Engendering Archaeology: Women and Prehistory*, Basil Blackwell, Oxford: 93-131.

VANDERVERT, LARRY
1997 Understanding Tomorrow's Mind: Advances in Chaos Theory, Quantum theory and consciousness in Psychology. *Journal of Mind and Behavior* 30: 25-35.

VANPOOL, TODD L. AND VANPOOL, CHRISTINE S.
2003 Agency and Evolution: The Role of Intended and Unintended Consequences of Action. VanPool, T. L. and VanPool, C. S. (eds.) *Essential Tensions in Archaeological Method and Theory,* The University of Utah Press, Salt Lake City: 89-113.

VARELA, FRANCISCO J.
1998 A Science of Consciousness as if Experience Mattered. Hameroff, S. R., Kaszniak, A. W. and Scott, A. C. (eds.) *Toward a Science of Consciousness II: The Second Tuscon Discussions and Debates,* The MIT Press, Cambridge: 31-44.

WAAL, FRANS DE
1989 *Peacemaking Among Primates.* Harvard University Press, Cambridge.

WALDROP, MITCHELL M.
1992 *Complexity: The Emerging Science at the Edge of Order and Chaos*. Simon and Schuster, New York.

WALTER, HENRIK
2001 *Neurophilosophy of Free Will: From Libertarian Illusions to a Concept of Natural Autonomy.* Translated by C. Klor, MIT Press, Cambridge.

WEBSTER, DAVID L.
1975 Warfare and the Evolution of the State. *American Antiquity* 40: 464-470.

WHITE, LESLIE
1959 *The Evolution of Culture*. McGraw-Hill, New York.

WOBST, H. MARTIN
1997 Towards an 'Appropriate Metrology' of Human Action in Archaeology. Leeuw, S. E. van der and McGlade, J. (eds.) *Time, Process, and Structured Transformation in Archaeology*, Routledge, London: 426-448.
2000 Agency in (Spite of) Material Culture. Dobres, M. A. and Robb, J. E. (eds.) *Agency in Archaeology,* Routledge Press, London: 40-50.

WOLFRAM, STEPHEN
2002 *A New Kind of Science*. Wolfram Media, INC, Champaign, Chicago.

WORSLEY, RICHARD
1996 *Human Freedom and the Logic of Evil: Prolegomenon to a Christian Theology of Evil*. Palgrave Macmillan, London.

WYLIE, ALISON M.
2002 *Thinking From Things: Essays in the Philosophy of Archaeology*. University of California Press, Berkeley.

ZAMMITO, JOHN H.
2002 *Kant, Herder, and the Birth of Anthropology*. The University of Chicago Press, Chicago.

ZOHAR, DANAH
1996 Consciousness and Bose-Einstein Condensates. Hameroff, S. R., Kaszniak, A. W. and Scott, A. C. (eds.) *Toward a Science of Consciousness: The First Tuscon Discussions and Debates*, MIT Press, Cambridge: 439-450.

ZUBROW, EZRA B. W.
1994 Cognitive Archaeology Reconsidered. Renfrew, C. and Zubrow, E. B. W. (eds.) *The Ancient Mind: Elements of Cognitive Archaeology*, Cambridge University Press, Cambridge: 187-190.