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EVIDENCE AND METAPHOR IN EVOLUTIONARY ARCHAEOLOGY

Douglas B. Bamforth

Evolutionary theory and terminology are widely used in recent archaeological work, and many evolutionary archaeologists have argued that the integration of such theory and terminology is essential to the future of our field. This paper considers evolutionary archaeology from two perspectives. First, it examines substantive claims that archaeology can study the operation of Darwinian evolution, either through dependence on optimal-foraging theory or by linking the process of natural selection to archaeological data. It concludes that there are serious problems with both of these claims on Darwin: the relation between evolution and foraging theory has never been documented, and midrange arguments linking selection and archaeological data are unsustainable. Second, it argues that archaeologists rely metaphorically on evolutionary terminology to help make sense out of archaeological data. Although the use of evolutionary metaphor can be, and has been, problematic, it also offers a powerful conceptual framework for our research. However, this framework is only of one of a number of comparable frameworks that have been offered to our field, as a comparison of systems archaeology and evolutionary archaeology shows.

La teoría y terminología evolucionarias son usadas ampliamente en el trabajo arqueológico reciente, y muchos arqueólogos evolucionarios han argumentado que la integración de dicha teoría y terminología es esencial para el futuro de nuestro campo. Este escrito considera la arqueología evolucionaria desde dos perspectivas. Primero, examina pretensiones substantivas de que la arqueología puede estudiar el funcionamiento de la evolución Darwiniana, ya sea a través de la confianza en la teoría del abastecimiento óptimo o enlazando el proceso de la selección natural a los datos arqueológicos. Concluye que hay serios problemas con estos dos alegatos sobre Darwin: la relación entre evolución y la teoría del abastecimiento nunca ha sido documentada, y los argumentos de mediano alcance enlazando la selección y los datos arqueológicos son insustanciales. Segundo, a pesar de eso, también los arqueólogos metafóricamente confían en la terminología evolucionaria para mejorar la comprensión de los datos arqueológicos. Aunque el uso de la metáfora evolucionaria puede ser, y ha sido, problemático, igualmente ofrece un marco conceptual poderoso para nuestra investigación. Sin embargo, este armazón ideológico es sólo una de varias estructuras de pensamiento comparables que han sido ofrecidas a nuestro campo, conforme un cotejo entre la arqueología de sistemas y la arqueología evolucionaria nos muestra.

Many archaeologists (and many other social scientists) lately have drawn heavily on theoretical frameworks derived from Darwinian research in biology. This is not the first time our field has appealed to Darwin (see, for example, Childe 1951), and explanatory frameworks rooted in Darwinian theory (notably optimal-foraging theory) have been widespread in archaeology since the 1970s (Jochim 1976; Wilmsen 1973). However, many of these recent appeals (i.e., Dunnell 1978, 1980; Lipo et al. 1997; Lyman and O’Brien 1998; O’Brien and Holland 1990; and many others) go beyond past work, often arguing that archaeology’s future as a science depends on adopting an explicitly Darwinian perspective. My goal here is to consider some of the very different kinds of claims on evolutionary theory that archaeologists have made recently. As is true in all sciences, every step of archaeological research relies inevitably on theoretical arguments and constructs, and the development and refinement of such arguments and constructs is critical to progress in our field. However, archaeologists, Darwinian or otherwise, include a variety of different kinds of generalizations under the term “theory,” and evolutionary archaeology exemplifies this.

Darwinian thought has expanded through the social sciences (including archaeology) in at least two distinct ways. First, social scientists are increasingly trying to identify the ways in which the process of biological evolution by natural selection has shaped and, presumably, continues to shape human ways of life (I discuss some of the anthropological research

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on this topic in a later section). Work in this area thus attempts to generate general, empirically testable knowledge comparable to that generated in any empirical science. Second, Darwinian thought is increasingly viewed as a useful and even essential framework for thinking about processes of nonbiological change (see Dawkins [1976:203–215] for an early example of this). This kind of expansion of Darwinian thought rests not on empirical documentation that this view of the world is correct, but rather on programmatic statements that have more to do with how we should think about the world than with what the world is like.

Evolutionary archaeology has made both of these kinds of claims on Darwin, and I argue here that it is important to distinguish between them because they depend on very different kinds of support and have very different implications for our practice. If archaeology can claim Darwinian theory in the narrow biological sense, we have the potential to integrate our work with an increasingly important body of work that examines an important topic in many disciplines. However, I argue here that no archaeological claims that have been made on Darwinian process in this sense are sustainable (although much of the research that makes these claims offers important insights into the settings in which evolution occurs). Recognizing this, I turn to consider the more programmatic claims archaeologists have made on Darwin. I argue that this second kind of claim is fundamentally metaphorical and that, although metaphors are powerful and widely used sources of insight in many areas of science, it is important to recognize both their potential and their limits. Finally, I argue that, while evolutionary thought offers important tools for archaeological research, the emphasis on this thought during the 1990s, and especially the more metaphorical aspects of this thought, represent the most recent version of a recurrent process of conceptual development in our field.

I begin by briefly considering Darwinian process in the narrow biological sense. Human evolutionary theory is clearly in a period of rapid development and intense and complex debate (see, for example, Cronk et al. 2000; Rose and Rose 2000). My goal here is not to review or synthesize this debate, although recent developments in evolutionary thought may have important implications for archaeology, and archaeology ought to be important to at least some of these developments. Instead, with this brief discussion as background, I focus specifically on two streams of thought that have been the main source of evolutionary thought in archaeology (cf. Boone and Smith 1998; Broughton and O’Connell 1999; Neff 2000). The first is our field’s widespread reliance on optimization models, particularly foraging models, drawn from behavioral ecology, that are often asserted to rely on Darwinian theory. The second is a more uniquely archaeological body of evolutionary thought that is generally referred to as “selectionist” archaeology. As I discuss below, each of these streams of thought makes both substantive and metaphorical claims on Darwin, and recognizing this helps to clarify what they do and do not offer to our field.

Evolution Defined

The theory of Darwinian evolution developed in the specific context of biology as the basis for understanding the processes that created the earth’s marvelous diversity of plant and animal species. My starting point is, therefore, the universally understood meaning of “evolution” and associated terms in a modern biological context. In this context, “evolution” refers most fundamentally to changes through time in the relative frequency of genes in a given biological population, and this is the sense in which I use it here. I stress that I do this not because it cannot mean something more general but because using this narrow definition helps to identify important limits on archaeology’s access to evolutionary process.

Changes in the genetic makeup of a given population result from a variety of processes. The best known of these processes, and the process that gives its name to the “selectionist” stream of evolutionary thought in archaeology, is natural selection. Theoretical analysis and empirical documentation make it clear that natural selection works primarily through the differential reproductive success of the individual organisms carrying a given set of genes. Some researchers have argued that selection also operates at the level of the individual gene (i.e., Dawkins 1976), although many evolutionary geneticists find this argument unconvincing (i.e., Dover 2000; Jones 1999). In addition, there is an emerging consensus that selection can also operate at the level of the group (Sober and Wilson 1998), although the supporting work acknowledges the simultaneous, and perhaps greater, importance of selection at the indi-
vidual level. Evolution also works through genetic drift, in which a portion of a population’s genetic variation is geographically isolated in a small population, and through adaptively neutral processes that drive evolution at the molecular level of genetic change (Dover 2000; Kimura 1983). History also strongly conditions the evolutionary process, both through unforeseen accidents (for example, some mass extinctions) and because a species’ developmental and evolutionary background closes off possibilities for future developments (Gould 2000).

While genetic change measures evolution, simply observing such change is only one step toward understanding the process(es) that caused it. The mechanisms of genetic change are ultimately mediated through the process by which individual organisms reproduce themselves, and the core problem for evolutionary analysis lies in sorting out the many behavioral, environmental, historical, and other forces that affect reproductive success. This success, in turn, depends on surviving to reproductive age and ensuring that one’s offspring also survive. Survival and reproduction are thus linked, but it is important to recognize that they are not the same thing—many organisms survive well but reproduce poorly. Recognizing this difference clarifies important issues within the general domain of evolutionary anthropology and archaeology, a point I return to below (also see Merrell 1994:17).

With these issues in mind, for the remainder of this paper I use the terms “fitness” to mean the reproductive success of individual organisms and “selection” to mean the process by which differences among organisms result in different rates of reproduction. Again, this is not the way these terms are often used in evolutionary archaeology (e.g., Lyman and O’Brien 1998:616), but I repeat that one of my points here is to examine how we get from the core meaning of these terms to the ones that are currently in relatively wide use.

The narrow biological definition of evolution highlights two critical problems that anthropology has struggled with. First, because so little of what humans do is genetically determined, the study of evolutionary process in human populations demands an understanding of how non-genetic mechanisms—that is, behavior or, perhaps, “culture”—are related to differences in individual reproductive fitness. Second, because it is not obvious that every non-genetically determined aspect of human behavior/culture contributes to reproductive fitness, it is necessary to find a way of identifying those aspects of our behavior/culture that do and do not make such contributions. There are many modes of evolutionary research applied to modern humans that address these problems, ranging from direct genetic research to the search for universal biological or behavioral characteristics of modern humans that may reflect our common evolutionary heritage. Furthermore, evolutionary theory and concepts enter into the study of human beings in many different ways. For present purposes, I focus on evolutionary claims in archaeology that rely in one way or another on evidence and evolutionary claims that rely mainly on terminology.

**Evidence and Evolution in Archaeology**

It is clear that large-scale evolutionary changes in the hominid lineage are manifest in the archaeological record and that archaeology has contributed to the study of these patterns for decades and will continue to do so indefinitely. Traditional paleoanthropological approaches to such changes focus on morphological alterations in past species that are visible in human and proto-human skeletons and that presumably resulted from population-level genetic change. Archaeology provides a crucial means of expanding this kind of research by supplying additional information on ancient human and proto-human behavior that cannot be obtained simply from the study of fossils themselves. However, this work stands in stark contrast to the bulk of recent evolutionary archaeology, which hopes to use changes in artifact assemblages to illuminate the operation of natural selection in anatomically modern human populations. Archaeological approaches to this take several forms.

**Foraging Theory and Natural Selection**

The consequences of natural selection of genotypes, for the life history of populations and species, depend in detail on the particular biology of the species and its form of interaction with others. No empirical generalizations seem possible. . . . At the very least, we must say that the price of optimality arguments is eternal vigilance [Lewontin 1979:21].

One set of links to Darwinian process relies on the claimed evolutionary component of optimal-foraging theory. Foraging theory is one part of a rich and diverse research domain referred to as evolu-
tionary or behavioral ecology. Behavioral ecology’s view of behavior in terms of a balance of costs and benefits is potentially applicable to essentially any domain of human action, but archaeology has focused largely on optimization studies of diet and foraging behavior, and my discussion here focuses on this work. (Bettinger [1991:83–112], Kaplan and Hill [1992], Kelly [1995], Smith and Winterhalder [1992], and Winterhalder and Smith [1980] summarize optimization theory and its applications in anthropology; see Bamforth and Bleed [1997] and Torrence [1989] for other archaeological applications of optimization perspectives.)

Archaeologists have relied heavily on foraging theory for decades with little or no comment on its Darwinian roots, and we have benefited significantly from its conceptual clarity and rigor. As Bettinger (1991:107–110) notes, the balance of costs and benefits that optimization theory makes explicit underlies virtually all ecological thought in anthropology, including that purporting to reject optimization reasoning. Optimization theory in general, and the empirically well-supported foraging models in particular, clearly illuminate important aspects of human behavior and have greatly enhanced archaeological analyses of human-environment interactions (Bamforth 1988; Broughton 1994; Glassow and Wilcoxen 1988; Jochim 1976, 1998; O’Connell et al. 1982; and many others).

Foraging theory developed in evolutionary biology in response to the difficulty of studying differential reproduction and genetic change in natural populations (Grafen 1984; Lewontin 1979). Recognizing the importance of survival, and especially of obtaining food, to reproductive success, evolutionary biologists argued that foraging success should serve as an adequate proximate measure of fitness: organisms that cannot maintain themselves somatically clearly cannot produce viable offspring, and proper functioning of an organism’s reproductive system (and of its other systems) depends very strongly on its nutritional state. Foraging theory’s links to Darwin are thus indirect and depend on asserting or assuming that natural selection ought to favor organisms that rely on the kind of economic rationality that underlies optimization models. Just how selection might favor these organisms, or how it might have favored them in the past, has never been a central question that foraging theorists have addressed; instead, research in this area has emphasized the ways in which variable environmental conditions are linked to variable phenotypic and behavioral responses.

It is not obvious that foraging theory’s benefits derive from its ability to document evolutionary process: somatic and reproductive success are different things, and while foraging theory illuminates the first of these, it does not necessarily tell us anything about the second. As Kacelnik and Krebs (1997:22; also see Lewontin 1979:6–10) argue:

Although optimality models use an evolutionary logic, they are not constructed to test the hypothesis that evolution has occurred. Nor do individual studies test the principle of making predictions about behavior using the notion of “design by natural selection.” . . . The output of [optimization] research is a mechanistic understanding of social dynamics . . . . We do not gain much further knowledge about human evolution, but we learn a lot about what current humans do.

The imprecision of foraging theory’s links to evolutionary mechanisms highlights this issue. Foraging theorists particularly do not distinguish between the possibility that selection once favored organisms with the cognitive ability to make something approximating optimal choices and the claim that ongoing selection continues to favor such organisms. In the first case (suggested, for example, by Broughton and O’Connell’s [1999:154] assertion that “evolutionary ecology assumes only that natural selection has designed organisms to behave in ways that tend to enhance fitness”), this claim would be something like evolutionary psychology’s assertion that selection produced a more-or-less fixed cognitive architecture at some time in the past. Such a claim would essentially assert that some form of economic rationality is a normal part of human cognitive abilities, but it would not necessarily assume any ongoing relation between foraging and fitness. However, other usages, particularly the fundamental assumption that variables like foraging efficiency measure “fitness-correlated pay-offs” (Smith 2000:34), imply just such an ongoing relation.

The assumption that measures of food intake or foraging efficiency can be taken as a proximate measure, or correlate, of fitness is problematic a priori: as noted above, we all know that many individuals survive well, presumably foraging and eating, but do not reproduce. Adequate nutrition is obviously essential to reproductive success, but simply being well-
nourished does not guarantee such success. Taking the existence of evidence documenting the beneficial effects of improved nutritional status on reproductive functioning as evidence that, as one reviewer of this paper put it, “the relationship between food and fitness appears to be quite strong” is deeply confused—all that such research indicates is that the link between food and reproductive capacity is quite strong. Fitness, and evolutionary process driven by fitness, depends on actual reproduction, and this does not depend only on what we eat or on how we forage for what we eat.

Documenting the links among foraging, food, and fitness would require evidence showing that better foragers and/or better-nourished individuals have greater reproductive success than other individuals, and relying on such evidence in an archaeological context would require a reason to suppose that such a pattern is cross-culturally valid. The concept of “correlates of fitness” presumably implies that the variables analyzed in place of fitness—for example, foraging efficiency and caloric intake—vary predictably with fitness and might even imply that this can be, or has been, documented empirically. It is certainly clear that the kinds of variables that foraging theory examines must be related in some way to successful reproduction, if only because it is necessary to obtain and consume food in order to survive and reproduce. However, foraging theorists have simply made this common-sense observation and then asserted that the variation they document in caloric intake or foraging efficiency predicts comparable variation in reproductive fitness, without ever looking to see if this is actually the case. The (limited) available evidence suggests that it is not.

The only aspect of human behavior that has been shown to be a cross-culturally valid predictor of fitness—that is, the only empirically documented correlate of fitness—is individual male status. At least in tribal societies, higher-status men seem universally to have higher reproductive success than lower-status men (Barkow 1977; Chagnon 1979, 1988; Cronk 1989a, 1989b; J. Hill 1984; Hill and Hurtado 1996; Irons 1979; Kaplan and Hill 1985a). Routes to high status are culturally diverse and include hunting success among the Ache of Paraguay, ferocity and political acumen among the Yanómamó of Brazil, and wealth among the Turkmen of Turkmenistan. In these cases, the benefits of high status regularly appear to include increased reproductive success (Barkow 1989; Betzig 1986; Flinn 1997; Perusse 1993).

Furthermore, although there are currently no systematic tests of the assumed relation between fitness and foraging behavior, data derived from research among the Ache are inconsistent with it. Although the Ache illuminate some of the limitations on optimization models, it is clear that, overall, they are impressively optimal foragers (Hawkes et al. 1982; K. Hill 1988; Hill et al. 1984, 1987). However, it is equally clear that the Ache optimize as a group; the data showing that their behavior conforms, for example to the diet-breadth model, were aggregated from the activities of all Ache foragers whose behavior could be observed, as is usual in optimization studies. It is also clear that there is great variation in the foraging behavior of Ache individuals, including differences both between men and women and, most significantly here, among men, who do not all pursue the same resources or pursue them equally effectively. Foraging behavior is linked indirectly to reproductive fitness among the Ache, both because the most productive male hunters have more reproductive opportunities and because the offspring of these hunters have higher survival rates than offspring of other men (Hill and Hurtado 1996; Hill and Kaplan 1988a, 1988b; Hill et al. 1987; Kaplan and Hill 1985a; Wood and Hill 2000).

The link in the Ache data between foraging and reproductive success violates the assumption that explicitly underlies general optimization thought in anthropology, that is, that natural selection should prefer foragers who optimize, with optimization generally conceived as maximizing the efficiency of resource acquisition. Among the Ache, better hunters tend to hunt longer than other men (Hill and Hawkes 1983), thereby disproportionately increasing their contribution to the food supply, and it is this pattern that provides the mechanism driving evolutionary process in this case. Reproductively successful hunters among the Ache do not appear to optimize; instead, it may be more accurate to say that they maximize, and they often do this by ignoring resources that should be in the optimal diet. The full range of resources that should be in the optimal diet is taken by less skilled and less reproductively successful men (Kaplan and Hill 1985a).

The Ache also do not offer much support for the assumption that higher food intake correlates with greater fitness; essentially all the food the Ache bring in, particularly the hunted food that provides 87 per-
cent of the total calories the Ache consume in the forest, is pooled without regard to family relationship. Data on diet prior to settling on a reservation show no detectable interfamilial variation in food intake (Kaplan and Hill 1985b; Kaplan et al. 1984), and the available pre-reservation data for women show no relation between nutrition and fertility (Hill and Hurtado 1996). Despite this, as I note above, there is substantial variation in individual reproductive fitness—better hunters (termed “showoffs” by Hawkes [1991]) have more children and higher survival rates among their children than other men (variation in female fertility is less clearly understood). This pattern also highlights the complexity of the evolutionary process and the great variation of the ways in which selection can operate in different situations: among the Kubo of Papua New Guinea, more successful hunters do not have higher reproductive success than less successful hunters (Dwyer and Minnegal 1993).

The assumption that food intake is a reasonable proximate measure of reproductive fitness rests on the unexceptional observation that adequate nutrition is necessary for successful reproduction. However, the association in the Ache case between minimal to nonexistent variation in nutritional status and substantial variation in reproductive success shows that, beyond this simple level of biological necessity, it is not possible to assume a priori that we know how food and fitness are linked in any given case. Furthermore, the Ache’s contrast with the Kubo suggests that links between foraging behavior and fitness vary from society to society, mirroring the point that Lewontin (1979:13–21) made regarding optimization theory long ago. Working within an optimization framework derived from behavioral ecology thus has many benefits, but it does not necessarily imply that we have illuminated the operation of Darwinian process in any substantial way.

Mid-Range Theory and Natural Selection

Where foraging theory claims Darwin through the assumed links between optimization models and evolutionary process, other work, including that grounded in optimization thought, focuses more specifically on the problem of recognizing evolutionary process in archaeological data. That is, it attempts to build links between artifacts and evolution at the level of archaeological (or mid-range) theory.

Two aspects of nonarchaeological research into the operation of selection in modern or recent societies are important in this context. First, with fairly direct access to information on reproductive success, many Darwinian ethnographers have been able to study empirically the ongoing process of selection in modern groups in some detail. Second, whatever the role of group selection among humans may be, the studies that are currently available highlight the importance of selection at the level of the individual. In contrast, archaeologists cannot directly observe the actual processes of evolution that operated in the past; instead, we are forced to infer the operation of these (and other) processes from patterns in material culture. Furthermore, archaeological data pertain in virtually every case to the activities of groups of human beings whose social and/or familial relations are unknown, and this is especially true for analyses that aggregate data from sites scattered over large regions and long spans of time.

These points highlight archaeology’s similarity to paleontology, whose success in studying evolution is undoubted. Like archaeologists, paleontologists study evolution indirectly by examining its outcomes as they are manifest in the remains of groups of organisms. However, while these broad disciplinary similarities illuminate some aspects of the general character of archaeological inference, in the case of evolutionary research they are superficial and profoundly misleading. The primary data that paleontologists study are observations of the skeletal remains of past organisms. Even evolution that operates entirely through the role of individual-level selection is ultimately manifest in population-level genetic changes, and, although skeletal morphology is not completely determined by such changes, its study clearly informs us concretely about biological and evolutionary process. The problem of linking temporal patterns of change in paleontological data to evolution essentially does not arise because the link is obvious and relatively well-understood. Outside of research on the archaeology of human ancestors, archaeological data consist of observations made on the artifacts and features left behind by a single, largely unchanging species. In contrast to skeletal morphology, the links between material culture and evolutionary process are essentially unknown.

Broadly speaking, our field tends to solve the general problem of building links from things to people in one of two ways. First, we often rely on some form
of systematic evidence linking artifacts and behavior, often experimental or ethnoarchaeological evidence. Second, in the many cases where such evidence is not available, we rely on reasoned arguments about what these links ought to be like. This second form of framing argument essentially proposes plausible but untested hypotheses about the relations between things and people and uses those hypotheses to make sense out of archaeological data. Although such hypotheses are often correct, the recent history of our field offers many cases where evidence, particularly ethnoarchaeological evidence, indicates that they were wrong: ceramic styles do not monitor postmarital residence rules in the ways that some archaeologists once proposed that they ought to; recurrent spatial associations among different classes of tools do not necessarily imply that those tools formed a functionally integrated toolkit; and flaked stone tools are not exclusively men’s tools.

The core selectionist claim on Darwin rests on the assertion that we can see “evolution in action” because specific kinds of patterns in the archaeological record either monitor natural selection or show that selection is not operating. However, no study documents this claim empirically, and, in some cases, the patterns claimed as evolutionary in the strict Darwinian sense are clearly incorrect. For example, some studies (i.e., Larson et al. 1996; Leonard and Reed 1993) equate population growth and evolution. However, as Bamforth and Bleed (1997; also see Smith 1991:34) note, this equation is incorrect: populations can grow with or without differential reproduction and selection can operate, while population is stable, growing, or shrinking.

There have been no attempts to document the evolutionary significance of archaeological patterns in a well-understood setting. Instead, archaeologists have simply asserted this significance for a given kind of pattern, often basing this assertion on examples of patterns documented for genetic evolution. This is clearest for the body of research that argues that specific patterns of change in archaeological trait frequencies over time reflect the operation of natural selection, in contrast to other patterns (for example, the smooth battleship-shaped curves produced in a successful ceramic seriation), that are said to reflect selectively neutral (or “stylistic”) processes (Dunnell 1978, 1980; Lipo et al. 1997; Niemann 1995; O’Brien and Holland 1990, 1992; Shennan and Wilkinson 2001). As Niemann (1995:8) put it, “variation along a dimension is stylistic when the fitness values associated with each variant (the expected reproductive success they confer on their bearers) are effectively the same, rendering the variants selectively neutral. Variation is functional when different variants have effectively different fitness values.”

This dichotomy is oversimplified—as Shennan and Wilkinson (2001:578) point out, many, and perhaps most, archaeological cases are probably neither purely neutral nor purely selected—but more importantly, the link between particular patterns of archaeological change and particular evolutionary interpretations rests on assertion and, as discussed in a later section, an implicit metaphor, rather than on demonstration.

Selectionist analyses often seem to assume implicitly that selection operates primarily to create permanent, essentially unidirectional changes in the archaeological record. However, as Shennan and Wilkinson (2001:578) observe, fluctuating selection can produce fluctuating evolutionary responses, a point that the best-known example of the operation of natural selection on a biological population illustrates clearly: the gradual patterns of change in the frequency of peppered moths in industrial England from the mid-nineteenth to the late twentieth centuries leave no doubt that selection can produce battleship-shaped curves to rival any archaeological ceramic seriation (i.e., Majerus 1998:97–156). Analogous, archaeologically visible, patterns of fluctuating selection are probably common. For example, construction of fortifications can hardly be explained except as an attempt to protect oneself and one’s family from attack. In the Middle Missouri region of the northern Great Plains, horticultural communities dated between A.D. 900–1500 appear to have fortified themselves primarily during episodic periods of sustained drought, and towns built between droughts generally lack defensive structures (Bamforth 2001). That is, there is no sustained pattern in the Middle Missouri prior to Euroamerican contact in which construction of fortifications “begin[s] at some arbitrary point above zero and increase[s] in frequency at a steadily decelerating rate toward some optimal value” (O’Brien and Holland 1992:49), as they should if selectionist arguments linking archaeological and evolutionary change are correct.

Neff (2000) and Nieman (1999) have recently backed away from the argument that the archaeological patterns selectionists have focused on moni-
tor evolutionary process directly. These authors argue that the kinds of archaeological changes that they examine (mainly changes in ceramic design that, as Niemann [1995:18] notes, are a priori very unlikely to have any utilitarian significance) occur too rapidly to attribute to the process of biological evolution. The “selection” involved in archaeological changes is not natural selection but, rather, some form of “cultural” selection. However, this argument fails to distinguish between the rate at which selective conditions change and the rate at which changes in selective conditions generate evolutionary outcomes.

There is no doubt that most population-level genetic changes in long-lived species (like humans) develop gradually over relatively long periods of time. The selective conditions that drive such changes can shift very rapidly, and human behavioral flexibility allows us to respond rapidly to such changes. For example, the correlates of male reproductive fitness among the Ache changed in a single generation, from hunting prowess in the pre-reservation period to wealth on the reservation (Hill and Hurtado 1996). As O’Brien and Holland (1992:38) note, “because of [the human] ability to transmit information inter-generationally, the historical development of adaptations may be short-lived.” If rapid changes in lifeways occurred in the past and had material correlates, they would presumably produce just the kinds of rapid archaeological changes to which Neff and Neiman refer. Furthermore, the selectionist argument linking patterns of change to evolutionary process is potentially applicable to longer-term changes in artifact frequencies to which Neff’s and Niemann’s arguments are not relevant.

Selectionist links between archaeological patterns and Darwinian process are incorrect, not because of the speed of archaeological change but because of the difference between the individual level at which selection is known to operate among human beings and the aggregate, or group, scale at which archaeologists observe past humans. Most patterned, archaeologically visible temporal changes that can be shown to have had practical effects on people’s lives have those effects because they enhanced survival. Given the scale at which archaeologists work, we know only that such changes enhanced the lives of what are often very vaguely defined groups of humans. Such changes may reflect the greater reproductive success of a segment of a given population, as selectionists have often argued. However, such changes may also represent widespread shifts made by many reproductive groups within one or more societies. If archaeologists cannot distinguish these different processes from one another, we cannot link our data to evolutionary process. This, and not the rapidity of some archaeological changes, is the key reason why the selectionist argument is incorrect.

The likelihood that selection sometimes operates at the level of the group as well as at the level of the individual does not necessarily solve this problem. Empirical studies in nonhuman organisms appear to document the effects of group selection (i.e., Goodnight and Stevens 1997), although they also document the simultaneous role of individual selection. However, while the importance of individual-level selection is well established for human beings, evidence for group selection among human beings is rare at present. Soltis et al. (1995) show that group-level benefits can foster the spread of behavioral/cultural adaptations, but these authors are careful to distinguish the processes they consider from the process of evolution by natural selection. Wilson (1998) suggests that food-sharing among hunters and gatherers documents group selection, but his discussion is strongly tied to foraging theory and relies on the same assumed, and problematic, link between food and fitness as does that body of work (also see below). However, regardless of what ongoing research may document about the role of group selection among modern humans, such selection does not eliminate the difficulty of identifying individual selection archaeologically. Recent attention to group selection argues not that individual selection does not occur, but rather that selection operates on both individuals and groups. Integrating group selection into evolutionary archaeology thus complicates rather than eliminates the middle-range issue: if archaeology is to study evolutionary process, we need both to develop more realistic ways of recognizing when archaeological changes are driven by selection rather than by some other process and also of distinguishing between individual and group selection.

Mid-range problems like these are potentially solvable: optimization theorists could focus their attention on the links between foraging and selection, and selectionist archaeologists could do more than simply assert relations between material culture and evolutionary process. All of the claims on Darwin I have considered so far are subject to the same kinds of examination as any scientific claim: we can
see whether or not they measure up against the available evidence, and we can work to improve them if they do not. However, evolutionary archaeology also calls on Darwin in another way, largely by extending biological terminology to refer to nonbiological processes. This is a very different use of Darwin, and it helps to situate evolutionary archaeology in the larger history of theoretical development in our field.

**Metaphor and Evolution in Archaeology**

The concepts on which evolutionary archaeology relies (concepts like fitness, selection, etc.) derive directly from the study of biological evolution, and a second kind of evolutionary thought extends these concepts beyond the specific biological context in which they were first defined. Scholars regularly generalize theories and concepts, including evolutionary theory and concepts, from one domain of inquiry to another, often (although not always) with great success; archaeology has a long and, as Gumerman and Philips (1978) point out, not entirely distinguished history of this. However, it is important to understand how this process of generalization operates and particularly to distinguish between the demonstration that superficially different processes actually are examples of the same process and the assertion that truly different processes can be thought of as if they are examples of a single process.

In contrast to the process of generalizing a theory by showing empirically that it has a wider scope than was initially thought, evolutionary archaeology often generalizes Darwinian concepts by reconstituting the meanings of terms like “fitness” and “selection”; it relies on argument, not on demonstration. The outcome of this is that evolutionary terms and concepts take on profoundly different meanings in archaeology (and, in practice, in foraging theory; see below) than the meanings they have in evolutionary theory. The use of one word to assert an identity between very different things is the essence of metaphor, and I therefore turn to consider metaphorical arguments in general as a background to several important evolutionary metaphors.

**Metaphors**

Metaphors are literary devices, and I begin with an example from Shakespeare’s *Macbeth* (Act V, Scene III):

> My way of life is fallen into the sere, the yellow leaf.

A metaphor like this evokes a kind of intuitive comparison on the part of the reader, and it is possible to find many meanings in this comparison. Macbeth may be telling us that he is an old man with little to look forward to except the end (or, perhaps, the “winter”) of his life, or he may be suggesting that his crimes have sucked the life out of him. The metaphor also trivializes Macbeth’s life by comparing it to a single leaf, one of tens of thousands on a single tree, each scarcely distinguishable from the others—perhaps it tells us that Macbeth is striving to leave a unique existential mark, no matter how hateful a mark, on the world in the face of such meaninglessness. Or, perhaps Shakespeare had none of these meanings in mind. Regardless of Shakespeare’s intent, this example demonstrates several important properties of literary metaphors. In particular, metaphors can be read in a number of different ways, and they operate by deepening the reader’s emotional understanding of the metaphor’s subject. In this case, metaphors help us to see Macbeth’s essential humanity despite the enormity of his crimes.

Academic writing also uses metaphor. Analyses of academic metaphor (often specifically with reference to the uses of Darwinian concepts in the social sciences—Maasen et al. 1995) identify at least three different ways in which metaphors are used. These are “illustrative,” “heuristic,” and “constitutive”:

Metaphors are illustrative when they are used primarily as a literary device, to increase the power or conviction of an argument, for example. Although the difference between the illustrative and the heuristic function of metaphors is not great, it does exist: metaphors are used for heuristic purposes whenever differences of meaning are employed to open new perspectives and to gain new insights. In the case of “constitutive” metaphors they function to actually replace previous meanings by new ones (Maasen et al. 1995:2).

The distinction between constitutive and other kinds of metaphors is particularly important here. The example from *Macbeth* can be seen as illustrative or, perhaps, heuristic: Shakespeare was using words to illuminate his character by suggesting similarities between very different things. However, whatever Shakespeare’s own construction of the meaning of this metaphor might have been, we can be sure that he did not intend this as an example of a constitutive metaphor. He was suggesting that Macbeth was like a leaf, not that Macbeth was a leaf. We
are not intended to conclude that Macbeth’s choices were caused by a seasonal deficiency of chlorophyll in his system, or that we need to be familiar with plant physiology in order to make sense out of the play.

Heuristic metaphors are powerful devices for illuminating patterns in the world, for directing our thought in fruitful directions and our attention to possibilities and evidence that we might not otherwise consider. Implicitly or explicitly, they are widely used in anthropology and many other disciplines, and they often provide the basis for influential views of our field that support substantial bodies of research and analysis; the organic analogy that drove much of British social anthropology in the first half of the twentieth century is a good example of this. It is also clear that metaphors have been central to the development of modern evolutionary thought. Ceccarelli (2001:13–60), for example, shows that Dobzhansky’s (1937) use of metaphor (particularly the notion of an “adaptive landscape”) was central to his ability to frame Darwinian theory in a way that allowed geneticists and naturalists to understand how their differing approaches to biology could be brought together to form the modern synthesis of evolutionary thought. However, while metaphors can play an important role in developing an empirical understanding of the world, they do not substitute for such an understanding, and they are useful only to the extent that they open profitable avenues for our thought (as in Dobzhansky’s case) instead of closing or misdirecting them.

Evolutionary Metaphor in Archaeology

The assertion, implicit or otherwise, of a real identity between two different things—the third, or constitutive, usage of metaphor—is common in Darwinian archaeology and anthropology. While metaphor can be a powerful source of insight, its use carries with it the possibility of transferring theories and concepts from one domain that misrepresents processes in another domain and of distorting the meaning of these theories and concepts to make them fit their new uses. Evolutionary archaeology and anthropology illustrate both the problems and the potential of scientific uses of metaphor.

For example, one of the least-clarifying arguments in recent evolutionary work grows from the claim (Rindos 1985; also see Cohen 1981; Hurt et al. 2001) that nongenetic (that is, behavioral or cultural) variation has to be generated randomly with respect to adaptive need in order for change based on that variation to qualify as evolutionary. This is a particularly good illustration of the problem of drawing theory developed to account for one kind of phenomena and applying it to account for entirely different phenomena. The requirement of randomness derives, obviously, from the synthetic theory, but in its original context it is not part of an abstract theoretical definition. Rather, it is an inference derived from empirical research into the causes of genetic mutation.

This transformation of evolutionary theory into a nongenetic context illustrates the limitations that the uncritical, and probably unrecognized, use of metaphor can put on our understanding. It is certainly possible that variation in human behavior arises without respect to need, but assuming at the outset that this is so ignores the possibility that we generate inventions in patterned ways (as Dawkins [1982:112], for example, suggests we might), perhaps in response to perceived needs or during periods of time when the costs of experimental failure are low. In fact, we do not know whether or not humans generate innovations randomly with respect to need, systematically in response to need, or in both of these ways. Human beings are clearly the products of genes, but we are not the same as genes, and metaphorically equating us obscures this difference and may blind us to important processes we need to see in order to build a theory about the phenomena we are actually interested in.

Usage of the term “fitness” by foraging theorists also illustrates the constitutive use of metaphor. Formal models of foraging (and other) behavior are abstractions whose heuristic value derives from their rigorous analysis of the relations among some set of mathematically well-defined variables. However, the links between these analytic variables and aspects of the real world are not inherent in any mathematical definition. In the cases where optimization models are subjected to systematic empirical test, their component variables are made meaningful by sets of measurements made on real-world data. In other cases, though, their component variables are given meaning simply by assigning them names. The process of naming variables in optimization models provides a particularly clear example of evolutionary metaphor.

In many cases, the absence of any evidence for a constant relation between food intake and repro-
ducive fitness (discussed above) is at the heart of this problem. In particular, the dependent variable in many recent optimization models is labelled “fitness” in cases where it is not at all clear that the model actually considers anything that resembles fitness. For example, Wilson (1998) uses food-sharing within a group as a way of arguing for the importance of group selection. Despite the specific meaning of fitness in biology, Wilson (1998:75, 77, 79) quite explicitly assumes an equation between meat intake and fitness, and asserts that by sharing meat “hunters increase the fitness of everyone in the group.” However, nowhere in Wilson’s discussion does he provide any support for this assumption and, as I discuss above, it is problematic at best since inter familial food (and meat) intake among the forest-era Ache varied hardly at all, but reproductive success varied significantly. The equation of food and fitness in recent theoretical work is so strong that Winterhalder (1997:139) actually seems to treat food as a clear measure of fitness and reproductive success as problematic. He repeatedly refers without comment to the fitness benefits of eating more, but describes as “elusive” the fitness benefits of the mating opportunities obtained by good Ache hunters. This usage is particularly striking because of the well-documented absence of any discernable relation between nutritional intake and fitness among the Ache, discussed above. Optimization models offer important insights into the benefits of behavior patterns like food-sharing, but they do not do this, at least to date, by documenting the effects of these patterns on Darwinian fitness.

Many other metaphors in evolutionary archaeology grow from the use of genetic models to understand archaeological patterns. For example, the term “phenotype” in a biological context refers to the outcome of an interaction between the information included in an organism’s genes and the environment that organism occupies. Expanding this term to include artifacts as part of an “extended phenotype” (i.e., Neff 1992:141), perhaps as a result of the influence on some evolutionary thinking of Dawkins’s (1976, 1982) notion of a “meme” (Neff 2000; but see Dean 1996:27–28), metaphorically equates the information required to produce an artifact with genetic information. Similarly, Lipo et al. (1997) refer to ceramic “lineages” as part of an analysis that draws its conceptual basis directly from the study of genetic variation (also see Nieman 1995), semantically equating historically related sequences of changes in artifact design with biologically related families of human beings. None of these equations depends on evidence showing the similarities of genetic and behavioral processes; rather, they assume or assert these similarities and rely on biological terms and models to clarify archaeological data, direct our thought in interesting ways, and justify the transfer of analytic tools and concepts from the study of genetics to the study of archaeological trait frequencies.

In this view, evolutionary theory is “too big a theory to be confined to the narrow context of the gene” (Dawkins 1976:205) or to the study of the biological process by which life on earth has diversified over time. Instead, it is about “the means by which definable entities change from one form into another” (Cohen 1981:201; also see Lyman and O’Brien 1998; Neff 1992). Translated specifically into archaeology, this view asserts that change in material culture is better viewed as the result of the differential persistence of one form of an artifact over another than as the transformation of one way of life into another. That is, humans choose differentially from a range of available behavioral or material options over time in response to changing external conditions, and the result of such differential choices is an archaeologically visible pattern that can be seen as evidence of a kind of evolution. Viewing archaeological change from a selectionist perspective, at least at this general level, fits naturally both with the recognition that we all make choices about our actions based on external circumstance and with the fact that archaeological change is often manifest as changes in the relative frequencies of different classes of artifacts. However, such arguments, implicitly or explicitly, treat archaeological traits as essentially equivalent to genes, and this highlights both the strengths and the potential limitations of scientific metaphor.

Variability is the stuff of which evolution is made, and Darwinian theory offers the best-developed framework for thinking about variability and change known to science. However, drawing analytic tools and concepts from the study of biological, and particularly genetic, evolution and applying them to study archaeological data can both guide our attention to some important issues and make it more difficult to focus on other equally important issues. Recent attention to the concept of “neutral variation” in ceramic design (for example, Lipo et al. 1997; Nie-
mann 1995; Shennan and Wilkinson 2001) illustrates this clearly. This work draws heavily on analyses of the ways in which selectively neutral genetic variation contributes to evolutionary change in biological populations.

In a genetic context, selectively neutral variation (for example, the variation that produces differences in hair or eye color) has no effect on reproductive fitness. The specific question that studies of neutral variation ask is essentially whether or not the choice to decorate a pot using one or another of the range of kinds of decorations in use in a particular time and place had any practical effects on people’s lives. This question is a more or less direct translation of the question a geneticist studying neutral variation would ask, and answering it has the potential to inform us about important aspects of social and other processes at work in the past. However, selection affects both the implications of choosing from a range of variation and also the nature of that range (cf. Jones et al. 1995). A geneticist might or might not find it interesting to ask why the range of variation in human hair color does not include, for example, green. However, such a question may be profoundly important in many archaeological contexts. Shennan and Wilkinson (2000:591), for example, note the possibility that the extremely restricted range of decoration on Linearbandkeramik pots during the early stages of agricultural settlement of the Merzbach valley in western Germany represents a deliberate choice—that is, that it represents selection against variation. Their data thus suggest both that it may not have made any difference which of the very limited range of designs a potter chose to use on any given pot, and also that it may have made a big difference if that potter chose a design outside of that range. Such a possibility has important social implications that can be obscured by the direct translation of analytic perspectives from evolutionary genetics.

Archaeology has often tended both implicitly and explicitly to minimize the importance of variability, and evolutionary archaeology’s reliance on a Darwinian framework makes such a minimization essentially impossible. Selectionist archaeology’s emphasis on the differential persistence of one variant over another offers important correctives for such essentialist arguments as Binford’s (1979) equation of overgeneralized technological habits with equally overgeneralized patterns of hunter-gatherer mobility (an equation he made after he himself described important technological variation). Furthermore, as Neff (2000; also see Ladefoged and Graves 2000) suggests, behavioral ecology’s emphasis on evaluating the costs and benefits of such variation almost certainly fills a substantial gap in selectionist thinking, implying that these two domains of research are less distinct than some of their practitioners suggest (i.e., Boone and Smith 1998; Lyman and O’Brien 1998). Evolutionary archaeology’s recognition of the importance of historical contingency also corrects a naive focus on highly abstracted generalizations that are thought to apply to all humans. General processes (evolutionary and other) that affect us do so within the frameworks set by our highly variable historical backgrounds, and these backgrounds affect the ways in which those processes operate. Importantly, a metaphorically Darwinian framework for looking at archaeological change holds these benefits regardless of our ability to identify evolution by natural selection in our data.

Note, though, that all of these benefits refer to potential clarifications in general archaeological thought rather than to empirically verified, or verifiable, expansions of archaeology’s knowledge of past humans. Archaeology has sought to clarify its thinking in many ways at many times in its history, and recognizing the potential value of Darwinian metaphor for archaeological thought highlights the fact that our field has seen great value in other metaphors in the past. Science-fiction writer Samuel Delany (1977:283) once referred to abstract intellectual concepts as “sharpening stones for the blade with which we strike the face of reality,” and evolutionary archaeology’s conceptual framework may well offer us a particularly useful sharpening stone. However, similarities between evolutionary archaeology in the 1990s and the systems archaeology in the 1970s helps to situate recent work in a more historical context.

Evolutionary Archaeology and Systems Archaeology

It is this systemic view of culture with its multivariate approach and emphasis on relationships and variability that should be the interpretive framework of scientifically oriented archaeology. . . .

There is already a voluminous body of literature and laws concerning the nature of systems and processes which is available for application to the archaeological record. . . .
The adoption of systems theory as an interpretive and investigatory framework necessitates modifications in the methods of contemporary archaeology. . . . The assumption of systems theorists that culture and processes are complex until proven otherwise requires that the collection and analysis of data that emphasizes the variability in the archaeological record and attempts to sample its range of variation. . . .

Proper use of the systems approach will enable archaeology to deal with problems of increasingly greater interest and relevance to culture process [Watson et al. 1972:65, 67, 84, 87].

If not a theory, what does [systems theory] offer to the archaeologist? Well, some flashy vocabulary for one thing. . . . A new language does sometimes enable us to look at things in a new way. And if it can do that it is not merely jargon. Nor is it jargon if it can clarify our thinking by reducing imprecision. But we should be wary of trying to apply precisely defined terms outside of their restricted limits. . . . Archaeology will not become scientifically respectable by merely adopting systems theory jargon.

The holistic approach of systems theory also has the healthy effect of reducing tendencies to excessive narrowness in research efforts. For this purpose, however, a brief dose is sufficient and will enable one to avoid the unpleasant side effects of prolonged treatment [Salmon 1978:182].

Thirty years ago, systems theory occupied much the same niche in archaeology that evolutionary theory occupies today. Like evolutionary archaeology, systems archaeology was going to finally make us scientists; like evolutionary archaeology, systems archaeology was going to enable us to draw directly on a well-developed and explicit body of existing explanatory theory; and, like evolutionary archaeology, systems archaeology was going to lead us toward theoretical integration with other academic disciplines. Systems archaeology was also driven substantially by technical terminology and characterized more by polemics and preliminary illustrative studies than by detailed empirical analysis. Systems archaeology generalized a set of concepts that were asserted, but not demonstrated, to characterize relations among the parts of any organized whole in much the same way that evolutionary archaeology generalizes a set of evolutionary concepts that are asserted, but not demonstrated, to characterize most, if not all, processes of temporal change. In doing this, systems theory metaphorically glossed over differences among disparate kinds of “systems” just as evolutionary archaeology metaphorically glosses over differences between biology and behavior.

Neither systems archaeology nor evolutionary archaeology offered a testable, scientific basis for claiming that it is better to view cultural change as adjustments among subsystems or as the product of some form of quasi-Darwinian selection. In fact, the notion of “testing” these claims is essentially meaningless. Such frameworks became widely popular because archaeologists found them to be useful stones for sharpening their thoughts, not because the weight of the evidence indicated that they were preferable to some other way of thinking about our data. Changes in their popularity thus must reflect factors other than their demonstrated ability to account for the processes archaeologists study. Addressing these factors in detail is beyond the scope of this paper, but it seems likely that there are at least two that are particularly important.

First, the kinds of questions archaeologists ask change over time, in part because of changes in our knowledge and in part because of changes in the culture/society of which archaeology is a part. The difference between systems archaeology’s focus on holistic analysis of the ways in which different aspects of human ways of life interact with one another and selectionist archaeology’s narrower focus on the differential persistence of variation may perhaps reflects forces like these. The widespread resurgence of Darwinian thought in the social sciences over the past decade is surely linked to sociocultural as well as to scientific factors (it is certainly, in part, a reaction to the wretched antiscientific excesses of much of postmodernism), as well as to improvements in our understanding of evolutionary process. Second, it also is likely that frameworks like systems archaeology fall out of favor as archaeologists become disillusioned with our ability to link them in more than a very general, programmatic way to detailed archaeological data.

In fact, at the same time that Flannery (1973) was spelling archaeology with a capital S, other archaeologists were finding intellectual sharpening stones in ethnoarchaeological and experimental research, in the development of more effective flotation techniques and of bone-chemistry analysis, and in more careful attention to taphonomic process. These sharpening stones are still with us and will clearly continue.
to be with us. In contrast, systems archaeology is manifest today more in the ways in which it has shaped our thinking than as an explicit body of theory. For example, the ideas of positive and negative feedback underlie more concrete concepts like Flannery’s (1968) concepts of seasonality and scheduling and inform many current ideas about how things change and why they sometimes do not change. Some conceptual frameworks that remain influential—for example, Binford’s (1980) forager/collector continuum—are explicitly rooted in a systems perspective, and archaeological views of the development and operation of complex societies owe a great debt to systems-based analyses (for example, Redman 1978). Increasingly sophisticated use of systems concepts also continues in the study of complex adaptive systems (i.e., Wills et al. 1994), although, like simpler forms of systems thought (and like much of evolutionary archaeology), this work has yet to be linked in any detail to the archaeological record. If nothing else, the essence of archaeological systems theory—that everything is connected to everything else—implicitly justifies our persistent search for linkages between such diverse areas of human endeavor as flaked-stone technology and gender.

Evolutionary archaeology has many of the hallmarks of a systems archaeology for the 1990s. However, like systems archaeology, its current popularity reflects a core of real value; I have noted the importance of evolutionary ecology’s explicit focus on costs and benefits and of selectionist views of change and recognition of the importance of historical context. If we learn nothing else from the recent literature, concepts like these will have clarified our ideas in important ways. However, recognizing these benefits also highlights what evolutionary archaeology does not offer us. Seeing cultural change as the result of the differential “success” of behavioral variants tells us neither how to recognize meaningful variation nor how to measure success, and acknowledging the importance of historical contingency identifies neither important events in human history nor the ways in which they “select” one variant over another. Similarly, systems archaeology’s focus on the interconnectedness of the world told us neither how to identify relevant systems or subsystems nor how the connections among them might operate (Salmon 1978). These benefits sharpen our thinking about the world, but they tell us little of substance about the things in the world that we want to think sharply about. Most concretely, they tell us nothing about how to translate these kinds of issues into the peculiar context of archaeological interpretation.

Conclusions

Much of this discussion can be summed up by distinguishing between two very different questions. The first is whether or not archaeology can examine evolution in the same context as biology examines it, and can therefore use terms like “selection” and “fitness” in the same ways in which biologists use them. Understanding how biological evolution has shaped our species and how the process of natural selection continues to affect us and our ways of life is an important domain of research. If archaeology can devise ways of monitoring the process of evolution by natural selection in the past, our ability to examine long periods of time for which few or no nonarchaeological data exist could make a profoundly important contribution to such understanding. However, I have argued here that archaeology’s essentially universal reliance on aggregate data sets that represent the activities of human groups whose familial and reproductive relations are unknown currently precludes us from making such a contribution. It may be possible to develop modes of analysis that allow us to surmount this problem, but we have certainly not yet accomplished this.

A second and distinct kind of question has to do not with whether we can study evolutionary process directly but with how the analytic concepts developed in the context of evolutionary research can be generalized to help to make sense out of nonbiological processes. Certainly, the word “evolution” is commonly used to mean many different things, and there is no a priori reason why temporal changes in material culture cannot be one of these things. The basic conceptual tools archaeologists have appropriated from evolutionary biology have the broader potential to describe many processes of change in terms of concrete human decision making, and this can be very valuable. If we do better archaeology by conceiving of artifacts as “replicators” rather than as indicators of “mental templates,” then that is what we should do. However, I have argued here that the process by which we extend terms and concepts from one domain of research to another is fundamentally metaphorical, and that recognizing this may help us to avoid using such terms and concepts inappropriately.
The distinction between using archaeological data to study the evolutionary process and using evolutionary concepts to make sense out of archeological data also helps to identify where a more-than-metaphoric evolutionary archaeology might be able to go. We may or may not ever be able to recognize the operation of differential reproduction in ancient human groups; a glance at any recent summary of research in either general or human evolutionary research (i.e., Cronk et al. 2000; Krebs and Davies 1997) will indicate just how far this work is from the kinds of topics archaeology studies effectively. However, archaeological data should have profound implications for other aspects of evolutionary research, particularly such topics as evolutionary psychology’s claim that the human mind evolved once and has subsequently changed little, if at all. Research on ancient human cognition (i.e., Gowlett 1997; Mithen 1990, 1996) is important in this context, as is the possible disjunction between the dates for the appearance of anatomical modernity, indicated by human skeletal material from eastern and southern Africa, and archaeological evidence that may document the much later appearance of behavioral modernity (Klein 1995; but see McBrearty 1999).

Warnings of an impending disciplinary crisis that can be avoided by adopting a particular conceptual framework are not new in archaeology (i.e., Leone 1972; Taylor 1948), and the field has grown past them without universal adherence to any single theoretical perspective. Darwinian theory and ideas drawn from it do not provide the only set of concepts that may illuminate ancient or modern humans, and archaeologists’ status as scientists does not depend on our degree of devotion to evolutionary thought. However, understanding the ways in which evolution has shaped our species is likely to have important implications for our work, and archaeology has the potential to offer a uniquely long-term perspective on this issue. However, we will not realize the benefits of understanding evolutionary process or make meaningful contributions to such an understanding by asserting unsubstantiated connections to evolutionary theory or by simply using Darwinian terminology, regardless of the conceptual benefits such terminology may offer us.

The issues I have considered here are important because evolution is important. The premium our discipline puts on theoretical insight often slights the serious difficulty of translating such insight into meaningful archaeological terms. The links between natural selection and cultural behavior are difficult to sort out, and adding the problem of linking cultural behavior to the archaeological record only increases the complexity. We will not overcome this problem by positing plausible but unsupported rules for interpreting patterns in archaeological data, or by assuming rather than demonstrating the relation between evolutionary process and the phenomena (such as food procurement) that we happen to be most able to study. Rigorous technical analysis and careful consideration both of multiple lines of evidence and of multiple potential explanations for patterns in that evidence are what make us competent scientists, not our commitment to any particular theoretical perspective. Systems archaeology founded in large part because it failed to deal with issues like these, and we are well on our way to seeing whether or not evolutionary archaeology will have the same fate.

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