

Evolutionary Approaches in Archaeology

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Two evolutionary approaches in contemporary archaeology, selectionism and processualism, are compared in terms of their theoretical perspectives, methodologies, and empirical contributions. Selectionism is a tightly focused approach that aims to apply a strict Darwinian framework to the study of cultural evolution. The selectionists view cultural evolution as a shift in the relative frequencies of cultural traits; the evolutionary mechanism that brings this about entails undirected variation followed by selection in a manner analogous to biological evolution. Processualism is a more flexible approach that acknowledges the importance of variation and selection but employs these concepts in a broader framework that recognizes fundamental differences between cultural and biological evolution. Among them are the central roles played by directed variation and the hierarchical operation of selection in cultural evolution. As we enter the late 1990s, the selectionists appear comfortably ascendant while the processualists often seem in disarray—they appear less confident, more embattled, more internally diverse. This diversity and dynamism, however, may harbor great potential for further growth and development. It is suggested that processualism's ongoing ferment will spawn the evolutionary archaeology of the future.

KEY WORDS: evolutionary theory; cultural evolution; political evolution; complexity; hierarchy; chiefdom; state.

What the science of history requires above all is a tractable way to study directional processes.

Gould (1988, p. 333)

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INTRODUCTION

In the December 1989 issue of the *Anthropology Newsletter*, James Hill predicted that “the next 10 years will see archaeologists focusing increasingly on long-term evolutionary change...[with]...increased effort put into refining our evolutionary theories, and attempts to test them” (1989, p. 20). Coming at a time when postprocessualism was rife in archaeology—and evolutionary approaches faced the possibility of wholesale rejection for the second time in a century—this prognosis struck some as implausible. Yet, from the standpoint of the late 1990s, Hill’s view seems prescient: there are unmistakable signs that the evolutionary perspective is alive and well. In this review I do not address the full range of ongoing cultural evolutionary scholarship but, instead, focus on the work of two salient and influential groups of contemporary researchers—let us call them the *selectionists* and the *processualists*.

Selectionism (a.k.a. cultural selectionism) emerged as a distinctive orientation in archaeology during the 1980s. The recent collection of papers edited by Teltser (1995a) shows that the selectionists have built upon previous achievements and established themselves as a formidable intellectual coalition. The selectionists are notable for the disciplined, coherent perspective they have maintained over the past decade and a half. Their goal, as they have explicitly and repeatedly stated, is to apply a strict Darwinian framework to the archaeological study of culture change. To the selectionists, culture is composed of cultural traits, shifts in the relative frequencies of which constitute cultural evolution, in much the same way as shifts in gene frequencies define biological evolution. Selectionists assume that variation in cultural traits is generated in an undirected fashion; this variation is then acted upon by selection. Selectionists reject social taxonomies and all directional, progressive frameworks of long-term cultural change. Aside from random drift, they see selection as the predominant cause of cultural order or change, with no major role played by any other principles or laws of cultural organization. To a selectionist, “chance caught on the wing” (Monod, 1971) is the essence of both biological and cultural evolution.

Processual evolutionism in archaeology has a longer, more convoluted—and more controversial—history. Its origins as a theoretical framework lie in the “new archaeology” of the 1960s and 1970s, but its roots go deeper still; moreover, the perspective has undergone considerable evolution itself over the past quarter-century, partly in response to the vigorous debate it has sparked. Contemporary processualists are a disparate and often fractious lot. Not prone to the unity of viewpoint that characterizes the selectionists, they defy tidy definition; tendencies are the best

we can do. Processualists tend to draw upon a much broader intellectual tradition than the selectionists, in part because they sense that Darwinism by itself is limited or incomplete, especially when applied to cultural evolution. Processualists tend to see culture not as a collection of traits but as a system populated by willful human actors who are organized into a nested set of organizational levels, such as the family, lineage, village, and regional polity. Processualists tend to view cultural evolution as an exceedingly complex phenomenon that involves not only quantitative shifts in the relative frequencies of behavioral traits, but also the emergence of qualitatively different strategies of adaptation, control, regulation, and political advancement. Often these developments are seen to be associated with important changes in the patterns of interaction between levels of cultural organization. Most processualists recognize the existence of both undirected and directed cultural variation, with the latter often generated by the conscious, purposive strategies that individuals and groups pursue in order to further their own interests. And while selection is acknowledged as an essential mechanism of evolutionary change, it is seen to operate in a complex, often hierarchical fashion, structured and conditioned by other factors such as agency, factional competition, self-organization, developmental trajectory, and historical contingency. The processualists are generally more willing than the selectionists to find a use for social taxonomy and to entertain the possibility that directionality may sometimes be an integral—not merely accidental—part of the cultural evolutionary process.

ROOTS

Academic archaeology and anthropology were born at a time when evolutionism—then youthful too—had seized the agenda in the biological and social sciences (Darwin, 1859; Morgan, 1877; Spencer, 1863; Tylor, 1871, 1881). Then, as now, evolution was a double-faceted concept, referring not only to a sequence of forms that had evolved over time, but also to the causal mechanisms that produced the sequence (Rambo, 1991, p. 26). Both are contained in Darwin's conception of descent with modification brought about by natural selection, although he devoted most of his attention to explicating the operation of selection. Whether Darwin saw a role for directionality in the evolutionary process has been a subject of debate. The more commonly held view is that Darwin gave little credence to directional or progressive trends in evolution (Carneiro, 1972; Dunnell, 1980, 1988; Gould, 1988; Rindos, 1984). Others, however, have found clear progressionist assumptions in Darwin's writings (Richards, 1988; Ruse,

1988), pointing to passages where Darwin revealed a belief that the operation of natural selection would, over time, lead to progress. In one such statement, he suggested that "as natural selection works solely by and for the good of each being, all corporeal and mental endowments will tend to progress toward perfection" (Darwin, 1859, p. 489).

Herbert Spencer, in contrast, placed considerably more emphasis on evolution as a sequence of forms and made directional change the centerpiece of his definition of evolution: "a change from an indefinite, incoherent homogeneity, to a definite, coherent heterogeneity; through continuous differentiations and integrations" (1863, p. 216). Spencer, to be sure, acknowledged "survival of the fittest" as a causal mechanism (1866, p. 444), but it was the progression of forms, the simple giving rise to the complex according to fundamental principles of change, that was for him the essential feature of evolution. Morgan's savagery-barbarism-civilization scheme (1877) also embodied this concern, while Tylor, for his part, asserted that "...wherever there are found elaborate arts, abstruse knowledge, complex institutions, these are results of gradual development from an earlier, simpler, and ruder state of life. No stage of civilization comes into existence spontaneously, but grows or is developed out of the stage before it. This is the great principle which every scholar must lay firm hold of, if he intends to understand either the world he lives in or the history of the past" (1881, p. 20).

Although their work went out of fashion in anthropology with the rise of historical particularism, the classical evolutionists raised two issues that still concern archaeologists. The first, of course, is the relationship between biological and cultural evolution. Can cultural change be usefully viewed as "descent with modification" shaped by natural selection? If so, how does selection operate on cultural behavior? How is variation in cultural behavior generated? Can there be cultural change without selection? If so, what other forces are implicated?

The second issue concerns directionality in cultural change. Archaeologists have long recognized the existence of developmental parallels in numerous independent cultural sequences. How are we to understand recurrent patterns of directional change in human history? Are they simply the result of accidental variation winnowed by selection—a mechanism that most understand to operate in the here and now, blind to future consequences? Or might there be underlying principles of cultural organization and change that structure the variability on which selection operates, so that directionality is imparted to the process of long-term cultural evolution?

PROCESSUAL EVOLUTIONISM: EMERGENCE AND EARLY ACHIEVEMENTS

It is fair to say that an archaeologist played a leadership role in the revival of evolutionism in 20th-century anthropology. In *Man Makes Himself*, V. Gordon Childe took a decidedly directional view of cultural evolution when he maintained that "...there is an analogy between organic evolution and progress in culture. Natural history traces the emergence of new species each better adapted for survival, and more fitted to obtain food and shelter, and so to multiply. Human history reveals man creating new industries and new economies that have furthered the increase of the species and thereby vindicated its enhanced fitness" (1983, p. 12). In this book, and in *Social Evolution* (1951), Childe proposed a general developmental scheme for human history that saw food-gathering societies becoming food producers in a Neolithic Revolution and then village farming societies evolving into civilizations in an Urban Revolution. Although Childe drew obvious inspiration from the 19th-century evolutionists, he took care to acknowledge divergent historical episodes, as well as the importance of human agency—as seen in the very title of *Man Makes Himself*—so that his approach, while indisputably progressive, is nevertheless not so unilineal and deterministic as is sometimes claimed (see Sanderson, 1990, pp. 79–82). Childe explicitly recognized natural selection as "the mechanism of evolution" (1983, p. 13) and argued that it operated in the cultural arena as well as the biological (1983, pp. 14–28).

Given the diachronic nature of their data, we might expect archaeologists to respond warmly to evolutionary ideas, and this is precisely what happened as evolutionism gained prominence in anthropology as a whole in midcentury (Carneiro, 1962, 1967, 1970, 1972; Fried, 1967; Sahlins, 1958, 1960, 1972; Sahlins and Service, 1960; Service, 1960, 1962, 1975; Steward, 1949, 1955; White, 1943, 1945, 1949, 1959). By the late 1960s, cultural evolutionism was solidly established as an organizing principle for archaeological research, especially among those who were sympathetic to the processual (or "new") archaeology movement (e.g., Adams, 1966; Binford, 1968; Flannery, 1966, 1968a, 1969, 1970, 1972a–c, 1973, 1976a; Flannery *et al.*, 1967; Johnson, 1973; MacNeish, 1964, 1972; Sanders, 1968, 1972; Sanders and Marino, 1970; Sanders and Price, 1968; Wright, 1969).

The processualist research programs had borne abundant empirical fruit by the early 1980s, especially in highland Mesoamerica. Sanders *et al.* (1979) published *The Basin of Mexico*, which used data from regional settlement pattern surveys (Parsons, 1971, 1974), site surveys (Millon *et al.*, 1973), and excavations (Santley, 1977) to document 3000 years of cultural evolution in that central valley. A few years previously, the final reports of

the Tehuacán Archaeological-Botanical Project laid out a detailed, phase-by-phase view of 10 millennia of cultural development in the arid Valley of Tehuacán (Byers, 1967; Johnson, 1972; MacNeish *et al.*, 1967, 1970, 1972). Another long-term research project in the Valley of Oaxaca yielded *The Cloud People* (Flannery and Marcus, 1983), a landmark volume that applied a model of phylogenetic evolution to the development of the Zapotec and Mixtec peoples from the end of the Pleistocene through the Spanish Conquest. Like the research in Tehuacán and the Basin of Mexico, the Oaxaca Prehistory and Human Ecology Project employed an evolutionary research design that called for regional survey (Blanton *et al.*, 1982; Kowalewski *et al.*, 1989), site survey (Blanton, 1978), and excavation (Drennan, 1976a; Flannery, 1986a; Whalen, 1981) spanning the entire sequence of cultural development in the region.

Drawing on data supplied by these and similar projects, processualists addressed theoretical issues related to the origins of agriculture and sedentary life (Binford, 1968; Flannery, 1968a, 1969, 1972b, 1973), the rise of ranked societies (Carneiro, 1981; Flannery, 1968b, 1972c; Johnson, 1978, 1982; Peebles and Kus, 1977), and the evolution of the state (Carneiro, 1970; Flannery, 1972c; Flannery and Marcus, 1976a, 1983, pp. 79-83; Johnson, 1973; Sanders, 1974; Sanders *et al.*, 1979; Spencer, 1982; Wright, 1977, 1978; Wright and Johnson, 1975). As Willey and Sabloff (1980, pp. 181-210) have pointed out, underlying these contributions was a theoretical foundation that combined an interest in cultural evolution with a positivist approach to explanation and a systems-theoretic view of culture. Political evolution came to be seen as a change in the way cultural systems are regulated, that is, how information is processed and decisions are made and implemented (Flannery, 1972c; Johnson, 1973, 1978, 1982; Spencer, 1979, 1982; Wright, 1977, 1978; Wright and Johnson, 1975).

Kent Flannery emerged as a major advocate of the application of systems theory to cultural evolution. His models of the evolution of agriculture in Mesoamerica (1968a, 1973) and the Near East (1969) showed how certain minor shifts in the highly varied procurement systems of hunting and gathering societies led to a deviation-amplifying process (Maruyama, 1963) of directional change, culminating in the appearance of sedentary agricultural villages. In another paper, Flannery (1972c) used a stagewise framework of progressive change (band-tribe-chiefdom-state) to characterize cultural evolution, arguing that the explanation of this phenomenon requires one to distinguish among the processes of evolutionary change, the mechanisms that bring about these processes, and the socioenvironmental stresses to which the mechanisms are a response. Although the socioenvironmental stresses (population growth, warfare, exchange, etc.) vary significantly from case to case, the processes and mechanisms are found in

all cultural systems—indeed, in all living systems (Miller, 1978). Two important processes of evolutionary change, according to Flannery, are segregation, the amount of differentiation among the subsystems of a general system, and centralization, the degree of linkage between the various subsystems and the highest-order controls of a cultural system. These processes are the result of the operation of evolutionary mechanisms, two of which are promotion and linearization. Promotion occurs when an institution rises to a higher position in the control hierarchy, often taking on a more general regulatory function, for example, when a temporary headman becomes a permanent chief (Johnson, 1978). Linearization takes place when lower-order institutions are regularly bypassed by higher-order institutions, such as when a state bureaucracy intervenes in the local administration of a rural village (Wright, 1969).

To apply this approach to prehistoric sequences, researchers had to find ways to recognize political and religious institutions in the archaeological record. In a pair of seminal papers, Flannery and Marcus (1976a, b) showed how this could be done by examining public buildings and ritual paraphernalia in Oaxaca, paying particular attention to how they changed in form, quantity, or distribution at various key points in the prehistoric sequence. In a similar vein, Drennan (1976b) used ritual artifacts to explore the relationship between religious and political evolution in Formative Mesoamerica, Johnson (1973) and Wright (1969) examined administrative technology (mainly clay seals and public architecture) in their studies of the rise of the state in prehistoric Iran, and Spencer (1979) used public architecture to analyze political evolution in the Valley of Tehuacán.

Directional evolutionary change was the theme of two innovative papers by Gregory Johnson (1978, 1982). In the first, he presented a model for the development of decision-making organizations in which “increasing organization complexity is generated...through continued increment in the number of information sources integrated” (1978, p. 91). In the second paper Johnson made a distinction between “sequential” and “simultaneous” decision-making hierarchies, arguing that the former were more characteristic of what have been called “egalitarian” societies, while the latter were more characteristics of chiefdoms or ranked societies. He proposed several conditions that could favor a shift from sequential to simultaneous hierarchy in a given evolutionary sequence (1982). In both papers, the evolution of complex, hierarchical decision-making organizations emerged as a logistic process, a conclusion that agreed with Flannery’s proposition that: “A new institution will appear only after some critical threshold in need for information-processing is reached; thus, evolution appears step-like” (1972c, p. 423).

CRITICAL REACTION TO PROCESSUAL EVOLUTIONISM

It was not long before the drumbeat of criticism—never truly quiet in archaeology—diverted attention from these contributions, and the processualists found themselves under withering attack. A common criticism saw the use of the Service–Fried frameworks as nothing more than a misguided reversion to the obsolete notions of classical evolutionism (Dunnell, 1980; Shanks and Tilley, 1987b, p. 145; Wenke, 1981). Shanks and Tilley stated that “the current popularity of evolutionary theory in archaeology seems to be indicative of the discipline being unable to break free from the shackles of its nineteenth-century origins” (1987b, p. 144).

Processualists also were accused of neglecting the great diversity of human cultures in their zeal to pigeonhole societies into a handful of sociopolitical types (Feinman and Neitzel, 1984; Hodder, 1982; Lewis, 1968; McGuire, 1983; Upham, 1987). Cultural change, it was argued, was a continuous and gradual process, not appropriately interpreted with the stagewise schemes employed by many processualists (e.g., Flannery, 1972c; Sanders and Marino, 1970; Sanders and Price, 1968; Wright, 1977). Lewis asserted that “typologies are static by their nature and cannot yield productive insights into matters of process and development” (1968, p. 103). Dunnell objected specifically to the use of the comparative method in defining the typological frameworks of Service, Fried, and others.

Even if one grants the observational validity of “bands,” “tribes,” “chiefdoms,” etc., in some statistical sense, this “reality” does not establish their significance in evolutionary or any other explanatory framework...In a very real sense, attributing evolutionary significance to such an array of units has less validity than attempting to use yesterday’s weather report to predict the Pleistocene. (Dunnell, 1980, p. 47)

Likewise, Leonard and Jones argued that the processual approach “is essentialist and, in concert, is typological at an inappropriate scale” (1987, p. 200).

A related criticism held that the processualists’ fondness for developmentalist schemes caused them to engage in comparative analyses that gave short shrift to the role of specific history in human affairs (Friedman, 1987; Hodder, 1982, 1985, 1986, 1987; Kohl, 1984; Legros, 1977; McGuire, 1992; Yoffee, 1979). Hodder (1982, p. 5), for example, argued that

the evolutionary perspective has emphasized adaptive relationships at different levels of complexity, but it has not encouraged an examination of the particular historical context...The uniqueness of cultures and historical sequences must be recognized. Within the New Archaeology there has been a great concern with identifying variability. But in embracing a cross-cultural approach, variability has, in the above sense, been reduced to sameness.

McGuire called for archaeologists to abandon the concept of evolution as an organizing principle for research and turn instead to a particularizing historical analysis, the object of which is to identify all the “prior conditions, actions and consequences we should examine to understand change in a particular case” (McGuire, 1992, p. 172).

The processualists’ reliance on systems theory was criticized for harboring an adaptationist premise that regarded cultural evolution as a series of problem-solving responses to stress. From this viewpoint, it was argued, the origins of change are assumed to lie outside the cultural system and the adaptive responses are thought to bring benefits to the culture as a whole—dubious propositions at best (Gailey and Patterson, 1987; McGuire, 1992; Shanks and Tilley, 1987b, pp. 139–140). In a similar vein, Hallpike (1988, p. 98) argued that current utility is not a cogent explanation of historical origin and challenged evolutionists to come up with a “general theory which can at least explain in principle why we should expect adaptive institutions to be the rule rather than the exception...without such a theory, the sociological use of adaptationist argument becomes the empty assertion that whatever is, is necessary.”

A fatal weakness of systems theory, according to some critics, was that the approach was ultimately incapable of explaining change.

Why change should occur becomes a very real problem in a systemic perspective because the system has been defined in such a way that stability is a norm. In other words, systems theory, as utilized in archaeology, has a theoretical structure describing how a system is maintained but not how it is transformed. (Shanks and Tilley, 1987b, p. 139)

This criticism, however, can be fairly seen to have stemmed from an inadequate understanding of systems theory. Key theorists such as Maruyama (1963) and Holland (1975) had *explicitly* promoted a view of systems as dynamic, ever-changing entities, and this perception underlay several uses of systems theory to provide systemic explanations of evolutionary culture change (Flannery, 1968a, 1972c, 1986a; Johnson, 1978, 1982; Reynolds, 1984, 1986; Spencer, 1982; Wright, 1977).

A more cogent argument held that processualism had difficulty explaining change because human agency did not figure importantly in this approach. Critics maintained that processualists paid insufficient attention to the competition for power and resources among individual agents and groups, surely a powerful force of change in many contexts (Brumfiel, 1983; Brumfiel and Earle, 1987b; Cowgill, 1975; Friedman, 1974, 1975, 1979; Gailey and Patterson, 1987; Giddens, 1979, 1984; McGuire, 1992; Spriggs, 1984). Hodder lamented the “passive” conception of humanity he saw in processual theories (1985, pp. 1–2) and argued that “within most systems analyses, individuals play little part in the theories—they only appear as

predictable automata, driven by covering laws" (1986, p. 23). Shanks and Tilley made a similar point: "The needs of the social system cannot be independent of the actors which make it up so any notion of system function or subsystem function or the function of rituals or other institutionalized practices is entirely irrelevant and misplaced" (1987b, p. 139). Elsewhere, they deplored the view of the individual as a "plastic, malleable cultural dope incapable of altering the conditions of his or her existence and always subject to the vagaries of external non-social forces beyond mediation or any realistic form of active intervention" (1987a, p. 56). Agency also was a key concern of Giddens (1984), who used it as one of the dual cornerstones (with structure) of his theory of structuration, which he presented as an alternative to evolutionism.

From other quarters, processual evolutionism was disparaged for supposedly adhering to an extreme cultural materialism that led the processualists to ignore ideological and religious factors completely or relegate them to mere epiphenomenal status (Conrad and Demarest, 1984, pp. 191–226; Demarest, 1989; Hodder, 1986, pp. 18–25; Miller and Tilley, 1984, pp. 1–15). This argument, however, was misguided and need not concern us here; the truth is that ideology, religion, and ritual have long been—and continue to be—among the central research interests of more than a few processualists (e.g., Aldenderfer, 1993; Bard, 1992; Binford, 1962; DeMarrais *et al.*, 1996; Drennan, 1976b, 1983; Flannery, 1972c, 1976b; Flannery and Marcus, 1976b; Ford, 1968, 1971; Marcus, 1978, 1983a–c, 1989, 1994; Marcus and Flannery, 1978, 1994; Rappaport, 1968, 1971a, b; Renfrew, 1985, 1994a, b; Renfrew and Zubrow, 1994; Spencer, 1979, 1982).

Of greater significance were the vigorous criticisms directed at the processualists by other archaeologists with an interest in evolution. Prominent among them was Robert Dunnell (1980), who disapproved of the directional, progressive aspects of processual evolutionism, asserting that the processualists drew their main inspiration from the developmentalist philosophies of Herbert Spencer, Lewis H. Morgan, and Edward B. Tylor, and not from the selectionist position of Charles Darwin. The Darwinian perspective, said Dunnell, allows no role for directionality in the evolutionary process. Any observed evolutionary trends are just that: empirical, post hoc observations about the record of change; they are not to be considered evolutionary forces or mechanisms.

The directionality that is subjectively identified as improvement...is the product of natural selection operating within constraints imposed by persistent conditions of competition...Apparent progress, like any other kind of change, can be explained by evolutionary theory. Evolution is not, however, progressive, nor is progress an evolutionary concept or part of evolutionary theory...To view progressive evolution

as science, the apparent basis for its incorporation into the new archaeology, is completely without foundation. (Dunnell, 1980, p. 42)

A similar point was made by Blanton *et al.*, who asserted that “cultural evolution, like biological evolution, probably moves opportunistically, solving only today’s problems, proceeding rather blindly, without predetermined course, into the future....we know that neither biological nor cultural evolution proceeds *necessarily* from the simple to the complex” (1981, p. 13; italics in original). Leonard and Jones maintained that the processualist viewpoint “implies progress where only change exists” (1987, p. 201).

Dunnell also decried the lack of attention paid to natural selection in evolutionist writings, noting that “the word only occurs twice in the whole of *Evolution and Culture*...and then as an uncomfortable synonym of adaptation in an innocuous context” (1980, p. 49). Leonard and Jones asserted that “as a consequence of having a minimal and mostly implicit role for natural selection, Culture Evolution [their label for what I am calling early processual evolutionism] fails to distinguish between the processes that generate variation and those which select for particular variates” (1987, p. 201).

Dunnell argued that the transformational view of change was closely linked to the substitution of selection by adaptation as the major mechanism of cultural change for the processualists.

Cultures are thus said “to adapt,” allowing, even requiring, that causation be sought within culture and compelling a transformational view of change. External mechanisms like natural selection and the role of variation are lost. Human perception and intention, either as individual or collective attributes, drive the process of change. This is perhaps the most subtle, though unintentional deception of cultural evolution. It provides the superficial appearance of being evolutionary while denying the basic assumptions and mechanisms of evolution. Culture is reserved for explanation in cultural terms alone. (Dunnell, 1980, pp. 49–50)

Rindos likewise criticized the use of adaptation in evolutionist theory, insisting that it required an unacceptable Lamarckian view of directed variation, whereby “variation becomes the adaptive response to the environment (*one-step evolution*)” (1984, p. 72; italics in original). Modern evolutionary theory did not allow a role for directed variation, said Rindos, through human intentionality or any other mechanism.

It is fundamental to the Darwinian view of evolution that the appearance of a new adaptation is unrelated to the environmental conditions at hand and is not to be seen as a response to them: the *appearance* of a trait is unrelated to the *need* for it. Mutation—the appearance of a new trait—is random, an unpredictable event not tied to demands for survival. (Rindos, 1984, p. 71; italics in original)

Like Dunnell, Rindos held that the the study of cultural evolution could be made truly scientific only through a strict Darwinian methodology, which obviously called for natural selection to be brought onto center stage.

THE RISE OF SELECTIONISM

Dunnell surely deserves much of the credit for promoting the selectionist approach to cultural evolution. In 1978, he used a Darwinian framework to reinterpret the distinction that archaeologists often draw between stylistic and functional variation. At the same time, he outlined the basic features of "evolutionary archaeology," which he defined as "an explanatory framework that accounts for structure and change evident in the archaeological record in terms of evolutionary processes (natural selection, flow, mutation, drift) either identical to or analogous with these processes as specified in neo-Darwinian evolutionary theory" (Dunnell, 1978, p. 197). Because this viewpoint requires that initial variation be undirected, "the specific origin or invention of new elements becomes a trivial inquiry" (1978, p. 197). The truly important question, said Dunnell, is how new elements become "fixed" and therefore part of the behavioral repertoire (and archaeological record) of the human group undergoing change. The answer he gave was unequivocal: "The overridingly important evolutionary mechanism in this process is natural selection" (1978, p. 197).

In singling out selection as the predominant mechanism of evolution, Dunnell did not ignore the ongoing debate in biological circles concerning the persistence of selectively "neutral" traits in evolving populations (Gould *et al.*, 1977; King and Jukes, 1969; Lewontin, 1974). Instead, he proposed that a traditional distinction in archaeology—style vs. function—might be rephrased in evolutionary terms. Style, he suggested, refers to "forms that do not have detectable selective values"; function, in contrast, denotes "forms that directly affect the Darwinian fitness of the populations in which they occur" (Dunnell, 1978, p. 199). Stylistic traits, he argued, would be more likely to manifest random behavior over time, whereas functional traits would be shaped by natural selection and thus exhibit more orderly diachronic variability (1978, p. 199).

Over the past decade and a half, the selectionist approach to cultural evolution has grown in popularity among archaeologists (e.g., Braun, 1985, 1987, 1990; Drennan, 1991a; Dunnell, 1988, 1989, 1992, 1995; Feathers, 1989, 1990; Graves and Ladefoged, 1995; Jones *et al.*, 1995; Leonard, 1989; Leonard and Jones, 1987; Neff, 1992, 1993, 1995; Neiman, 1990, 1995; O'Brien, 1987; O'Brien and Holland, 1990, 1992, 1995; O'Brien and Wilson, 1988; O'Brien *et al.*, 1994; Ramenofsky, 1995; Rindos, 1980, 1984, 1985, 1986, 1989a, b; Teltser, 1988, 1995a–c; Wenke, 1981). Teltser recently heralded selectionism as a new paradigm in archaeology, one that has brought about a "reorientation of specific archaeological questions"; she singled out Rindos's work on the origins of agriculture (1980, 1984) as the "most well-developed example" of selectionist research (Teltser, 1995b, p. 4).

Rindos's perspective on the origins of agriculture emphasized the patterns and processes of interaction between humans and plants. Rather than viewing agriculture as a human-directed adaptive strategy, he focused on the range of variability in the interaction between plants and people (planting, protecting, harvesting, etc.) and asked how that variability might have been differentially transmitted over time. He pointed out that selection would favor the coevolution of certain plants and people if both benefited from the interaction. A selective advantage would be conferred on those plants that are the beneficiaries of the human activities of plowing, weeding, and protecting (Rindos, 1984, p. 184). Humans would benefit from increases in the productivity and reliability of harvests (Rindos, 1984, p. 188).

Rindos proposed "cultural selectionism" as a label for the strict Darwinian approach to cultural evolution. He defined it as follows:

Cultural selectionism is a biological approach to the study of cultural events that accepts the primacy of variability, heritability, and differential fitness in explaining the cultural evolution of organisms (especially *Homo sapiens*). (Rindos, 1984, p. 74)

Rindos acknowledged that "human behavior is determined by the interaction of two inheritance systems—the genetic and the cultural" (1984, p. 75), but he was careful to distinguish cultural selectionism from sociobiology (e.g., Alexander, 1974; Dawkins, 1976; Van den Berghe and Barash, 1977; Wilson, 1975, 1978), asserting that cultural selectionism was primarily concerned with behavioral, not genetic, variation among humans.

Although human cultural behaviors may enhance biological survival, the specific processes determining cultural traits have acted largely within the cultural, and not the genetic, inheritance system. Hence [cultural selectionism] differs from sociobiology in the emphasis it gives to learned behaviors transmitted within the cultural context. Cultural selectionism denies the importance of genes for the direct control of specific cultural acts or that a correlation must exist between genes and culture such that changes in fitness may best be modeled solely at the genetic level. (Rindos, 1984, p. 75)

Rindos also pointed out four ways in which cultural selectionism differed from other cultural evolutionary perspectives. First, selectionism saw the analogy between cultural and biological evolution not in terms of results (phylogenetic evolution) but, rather, in terms of the mechanisms and processes involved (undirected variation plus natural selection) (1984, p. 75). Second, selectionism recognized natural selection as the only cause of cultural change: "No law governs cultural change other than the differential cultural fitness that specific behaviors may induce" (Rindos, 1984, p. 75). Third, Rindos was adamant that the selectionist approach eschewed all notions of directionality or progress as integral to the evolutionary process; directional trends that do occur are to be seen as the results of selection operating on undirected variation, nothing more.

Cultural selectionism also repudiates essentialistic and typological classifications of culture and culture change. It accepts no dictum of progress in its explanation of cultural change....Directionality and diversification may result from evolutionary change in cultural systems, but they arise from an interactive process, not one of internal, orthogenetic, or self-directed change. (Rindos, 1984, p. 75)

A fourth distinguishing characteristic of Rindos's selectionist perspective was a trait-based view of culture and culture change: "Cultural selectionism places its emphasis upon the fitness induced by specific traits, not on the adaptive and equilibrium processes that *may* result from selection" (1984, p. 76; italics in original).

It can hardly be overemphasized that the concept of undirected initial variation is vital to the cultural selectionist approach. In an article devoted to the topic, Rindos presented three cultural features that he felt were essential to his Darwinian viewpoint (1989a, p. 11). Two are relatively uncontroversial: "that at least some aspect of what we call culture must serve to transmit information between generations" and "that the variations in any culture over space or time, which constitute the raw material for selection, be phenotypic [behavioristic] in origin" (1989a, p. 11). The third feature, however, contains the *sine qua non* of selectionism: "that the phenotypic variants that power selection in the cultural setting be undirected in an evolutionary sense, that is, that selection, rather than the cultural production of new directed variations, be the final arbiter of cultural evolution" (1989a, p. 11).

For Rindos, culture consists of traits, variant forms of which are constantly generated in an undirected fashion, and selection is the only force of change. Over the course of time, "the mean and modal values of traits within a culture will change. The process underlying all such change is selection" (Rindos, 1989a, p. 40). Selectionist explanations, he asserted, required a consideration of the relative selective values of alternative behaviors, which in turn demanded that close attention be paid to the specific historical contexts of cultural change: "Cultures evolve in history, and the study of the history of culture is the basis for Darwinian cultural analysis" (1989a, p. 41). He rejected the "vague metaphysics of cultural evolutionism that forces culture along specific lines of development," insisting that "the study of undirected variation and selection in specific situations, each with its unique selective pressures and conditions, is an empirical one guided by the principles of Darwinian evolutionary theory" (Rindos, 1989a, p. 41).

Rindos applied his approach to MacNeish's (1967) empirical conclusions concerning changes over time in the relative contribution of domesticated plants, wild plants, and animals to the diet in prehistoric Tehuacán. Rindos decided that the observed shift in these relative contributions was

consistent with three conservative feeding strategies in his model; these strategies (Nos. 1, 2, and 5) called for very slow, gradual changes in the mix of domesticated plants relative to wild plants and animals (1984, pp. 248–253). His model also contained three other strategies (Nos. 3, 4, and 6) that involved rapid shifts toward a more complete reliance on domesticated plants, a pattern that he felt did not characterize the Tehuacán data (1984, p. 241). Rindos concluded that the evolution of agriculture in ancient Tehuacán should not be seen as a transformation of human adaptive strategies but rather as a gradual, quantitative, coevolutionary shift in plant–human interactions.

Following Rindos's lead, O'Brien (1987) used a coevolutionary model to explain the patterning in archaeobotanical samples from the Lower Illinois Valley and the Mississippi River Valley, which revealed a trend toward relatively more carbonized seeds from the Archaic through the Late Woodland time periods. It is important to note, however, that the tempo of change in the Midwestern data differed markedly from the languid pace that Rindos reported for Tehuacán. The Middle Woodland period was marked by a major increase in the relative frequency of certain seeds, some showing evidence of domestication. O'Brien saw no difficulty in applying Rindos's model here, arguing that the model allowed for sharp increases in the rate of change. Specifically, he argued that the Middle Woodland period could be what Rindos had called a "takeoff" point, "after which, instead of continuing to increase slowly, the relative contribution of domesticates to the diet skyrockets" (Rindos, 1984, p. 191).

What brings about such sudden change? Rindos stated that the takeoff can occur when people pursue one of his model's three "compensating" strategies, where wild plant foods and animal food undergo a compensatory decline due to the expansion of agricultural production: "In essence, these compensating strategies are the ones that would be used were people *consciously to adopt or invent* agricultural subsistence because these strategies give the fastest returns and are based upon minimizing the contribution of wild plants to the diet" (Rindos, 1984, p. 241; italics added). Two points need to be made here. First, this characterization of agricultural subsistence as something that people "consciously...adopt or invent" sharply contradicts Rindos's many denials of a role for human intentionality in shaping evolutionary change (e.g., 1984, pp. 2, 22, 27, 30, 32, 72, 86, 91, 93, 95, 97, 285, 1989a, pp. 14–16). Second, underlying this contradiction is a more profound—and I think more interesting—difficulty: the evident inability of the selectionist approach to provide convincing explanations of very rapid, "punctuational" culture change without abandoning the approach's basic principles (Hallpike, 1988, pp. 41–42; Rosenberg, 1994, p. 310). In Hallpike's (1988, p. 41) words: "If social evolution were really the result

of a random shuffling of myriads of little traits, we should also expect the process of gradual, almost imperceptible change, but an obvious feature of human history is the extreme *rapidity* with which major changes often occur." In his critique of selectionism, Rosenberg asserted that it "precludes the possibility of sudden, systemic cultural reorganization" (1994, p. 310). To address adequately such rapid, transformational change, argued Rosenberg, we need a theoretical orientation that takes us beyond the narrow precepts of selectionism (1994).

The selectionist approach also has been applied to the study of prehistoric ceramics (Braun, 1985, 1987; Dunnell and Feathers, 1991; Feathers, 1989, 1990; Neff, 1992, 1993, 1995; Neiman, 1990, 1995; O'Brien and Holland, 1992; O'Brien *et al.*, 1994). Underlying much of this research has been Dunnell's (1978) distinction between functional (selected) traits and stylistic (selectively neutral) traits. In an effort to relate this distinction to the concept of adaptation, O'Brien and Holland (1992, p. 55) argued that "functional traits are those that affect adaptedness, but *only* those with a history shaped by selection are considered adaptations. On the other hand, style is regarded as more than merely the absence of function. A stylistic trait is one that neither affects adaptedness nor is under selective control." To illustrate their position, O'Brien and Holland considered changes in the frequency of Midwestern pottery vessels tempered with grit, shell, and limestone. Grit and shell show directional, though inverse, patterns of change: around A.D. 1000, shell replaced grit as the favored temper. Limestone fluctuated at a low frequency for several centuries, disappearing entirely around A.D. 750 (O'Brien and Holland, 1992, Fig. 1). They concluded that "shell-tempered and grit-tempered vessels were under selective control; limestone-tempered vessels were not" (p. 51). More recently, Neiman (1995) pursued the concept of selectively "neutral" variation in his study of Woodland ceramic assemblages from Illinois. He developed a mathematical model of the processes of neutral innovation and drift, which he applied to Braun's (1977) data on variation in lip exterior decoration around the tops of Woodland cooking pots.

Dunnell (1989) argued that ceramic variability should be considered part of the behavioral component of the human phenotype, a view that was adopted by most of the contributors to the volume edited by Teltser (1995a). In her introductory essay, Teltser (1995b) noted that the expansion of the concept of trait carries several methodological implications. The first of these recognizes that the transmission of information is required for artifactual variability to exhibit differential persistence over time; a way to measure this information transmission is therefore necessary (p. 5). Second, evolutionary change is assumed to be quantitative, not qualitative, which she regarded as a straightforward consequence of population thinking, as

opposed to typological thinking (p. 6). Third, she pointed out that the “notion of differential persistence says nothing about the source of variation, only about the sorting or patterning of variation through time” (p. 6). She agreed with Dunnell that the concept of undirected variation is essential to the Darwinian approach to cultural evolution (p. 6). Responding to those who argued that human intentionality generates directed variation (e.g., Boyd and Richerson, 1985; Flannery, 1986b), Dunnell (1989) had asserted that the validity of this position required that “a general mechanism for generating directed variation be documented” (p. 39). Yet because they assume natural selection is “the primary mechanism responsible for sorting variation through time” (Teltser, 1995b, p. 7)—indeed, the only general mechanism that produces directional change—the selectionists have no alternative but to see selection as the only possible cause of directed variation, which is why they tend to deride the concept of directed variation as one-step adaptation or Lamarckism.

It is important to recognize that the selectionists have chosen the “neo-Darwinian” or “modern” synthesis of evolutionary biology (e.g., Dobzhansky, 1937; Huxley, 1942; Mayr, 1942, 1963; Mayr and Provine, 1980; Williams, 1966) as their favored model for evolutionary archaeology (Rosenberg, 1994, p. 310). From this viewpoint, selection is the predominant, if not the only, source of cultural order and evolutionary change. Moreover, selection is seen to operate on the level of the individual—evolution results from the struggle between organisms. It is worth emphasizing, however, that the “modern” synthesis does not represent the full range of evolutionary thinking in contemporary biology. In recent years, a number of macroevolutionary theorists have sought to expand upon strict Darwinism, suggesting ways in which the operation of selection might be structured by the self-organizing, hierarchical properties of natural systems (Eldredge, 1985, 1989a, b, 1995; Eldredge and Salthe, 1984; Gould, 1989a; Goodwin, 1994; Holland, 1975, 1995; Kauffman, 1993, 1995; Nicolis and Prigogine, 1989; Vrba and Eldredge, 1984; Waldrop, 1992). Gould has asserted that “the hierarchical theory is non-Darwinian in its anti-reductionist claim that evolution proceeds by the simultaneous operation of selection at several levels (genes, organisms, and species among them), with complex transferences and interactions across levels” (1989a, p. 126). Gould portrayed “hierarchy theory as a ‘higher’ Darwinism because it takes the puzzles within conventional one-level selection theory and tries to resolve them by an enlarged view of selection acting at other levels as well” (1989a, p. 126).

The selectionist approach as currently practiced has difficulty handling questions of hierarchy. An illustration of this would be Dunnell’s proposed explanation for the rise of complex society: “The appearance of a complex society is a *consequence* of a shift in the scale at which selection is most

effective" (1980, p. 66; *italics added*). Dunnell has characterized this scalar shift as a novel evolutionary development.

The organism is both the unit of reproduction and the functional entity throughout the vast bulk of human history. Only with the appearance of centralized decision-making, occupational differentiation, and nonkin-based organization is there evidence for a shift in the scale of the unit on which evolutionary processes operate from the individual bounded by a skin to a larger individual composed of many, functionally differentiated organisms. (Dunnell, 1995, p. 41)

What brings about this crucial shift in scale? Dunnell proposed the following conditions:

The scale at which selection is most effective would shift upward to groups if: (1) the rate of change is sufficiently fast; (2) the group is a functionally interdependent unit, rather than an ecologically determined aggregate of redundant functional units; and (3) individuals no longer carry the full "code" for reproducing the human phenotype, including its behavioral component. (Dunnell, 1980, pp. 65–66)

There is a problem here. We are told that complex society is a consequence of a shift in the scale of selection, yet we are also told that this shift is brought about by the rapid emergence of a society with functionally interdependent parts, so intricate that a single individual cannot possess all the information necessary to reproduce the totality of the society's rules and behavior—a reasonable definition, most would say, of a complex society. So, while in one place Dunnell states that complex society emerges as a consequence of a shift in the scale of selection, elsewhere he argues that the scalar shift in selection is a consequence of the emergence of complex society. I submit that Dunnell's selectionist position *compelled* him to attribute the rise of complex society to a shift in the scale of selection; he was unable to explain that shift, however, without resorting to tautology.

This raises an intriguing question: Is the mechanism of undirected variation plus selection—the only route to change, according to the selectionists—by itself *sufficient* to account for this shift in the scale of selection? Eldredge has pointed out that Darwin himself regarded selection as a passive arbiter of presented alternatives, so that evolution becomes a record of "what worked better than what" over time (1995, p. 34). If variation is undirected, then *whence* the hierarchical order that appears *de novo* with the rise of complex society (according to Dunnell) and structures the subsequent operation of selection? It is difficult not to suspect that the strict selectionist approach is too narrowly defined to deal effectively with emergent complexity. What seems to be called for is a broader framework, one that recognizes directed variation, self-organization, and hierarchical structure—along with selection—as fundamental principles of cultural organization and evolution.

THE PROCESSUALISTS RESPOND, RETHINK, AND CARRY ON

A reviewer cannot—arguably, should not—keep his or her predilections hidden, and it is time for me to come clean: I consider myself an evolutionary archaeologist of the processual persuasion. That stated, let me proceed to consider the present situation of this contentious field. How are processualists responding to the criticisms leveled at them? What modifications are being made to the processual approach? What lies ahead?

Currently, the processual camp is in a state of flux. Selectionism is being examined and critiqued, attacks on processualism are being addressed, new fieldwork and analyses are being conducted, and new interpretive themes are being explored. There is, to be frank, such a divergence of viewpoints among contemporary processualists that I nearly abandoned the idea of treating them as members of a recognizable group for this review. Ultimately, though, it seemed to me that processualism's diversity was not a weakness but more probably a sign of intellectual fecundity. Also, it was helpful to have a label for those archaeologists who are seeking a better scientific understanding of the processes responsible for the evolution of cultures, but who do not adhere to the selectionist approach. A representative sample of recent processual contributions would include Adams (1988), Aldenderfer (1993), Anderson (1994a, 1994b), Arnold (1992, 1993), Bard (1992), Blanton *et al.* (1993, 1996), Boyd and Richerson (1985), Brumfiel (1987a, b, 1992, 1994a, b), Brumfiel and Earle (1987a, b), Brumfiel and Fox (1994), Carneiro (1990, 1991, 1992a, b), Cowgill (1992), Crumley (1987, 1995), D'Altroy (1994), DeMarrais *et al.* (1996), Drennan (1987, 1991b), Earle (1987, 1991a–d), Earle and Preucel (1987), Feinman (1991), Flannery (1986a–c, 1995), Flannery *et al.* (1989), Haas and Creamer (1993), Hayden (1990, 1995), Hirth (1992), Johnson (1987, 1989), Johnson and Earle (1987), Kirch (1991), Kirch and Green (1987), Kristiansen (1987, 1991), Ladefoged (1995), Marcus (1989), Marcus and Flannery (1994, 1996), Mithen (1989, 1990), Redmond (1994a, b), Roscoe (1993), Rosenberg (1994), Shennan (1986, 1987, 1989), Spencer (1987, 1990, 1991, 1992, 1993, 1994), Upham (1987, 1990), Webster (1990), Wright (1984, 1986), and Wilson (1992).

Agency and Structure

The processualists of the 1960s and 1970s, as we have seen, were roundly criticized for neglecting human agency in their evolutionary explanations (Hodder, 1986; Shanks and Tilley, 1987a, b). This attack was not

unjustified, and contemporary processualists have responded by incorporating agency along with institutional structure into their models of evolutionary change (e.g., Anderson, 1994a; Blanton *et al.*, 1996; Brumfiel, 1992, 1994a, b; Marcus and Flannery, 1996; Mithen, 1989, 1990; Roscoe, 1993; Spencer, 1993, 1994). Mithen, for example, asserted that a valid evolutionary approach needs to be "concerned with active individuals endowed with common psychological propensities to think and act in certain ways rather than others, taking decisions in ecological, social and historical contexts which are unique to themselves" (1989, p. 491), a perspective that he then applied to the archaeology of Mesolithic foragers (1990). Roscoe drew upon practice theory (Bordieu, 1977, 1990; Giddens, 1984) in his formulation of an evolutionary approach in which dynamic roles were assigned to both structure and agency:

...Structure comprises a complex of rules and resources that shape but do not determine social action. Agents receive these rules and resources as "objective conditions," but rather than responding mechanically to them they use them creatively to perform activities and achieve ends...The other side of this picture is that social action feeds back on structure, reproducing or transforming it. (Roscoe, 1993, p. 113)

Elizabeth Brumfiel (1992) proposed a series of principles that archaeologists should follow in order to "strike a proper balance between agency and structure" (p. 559). Among them was the view that cultural systems "are contingent and negotiated, the composite outcome of strategy, counterstrategy, and the unforeseen consequences of human action" (p. 559). When addressing questions of evolutionary change, Brumfiel asserted that archaeologists "should recognize that human actors, not reified systems, are the agents of culture change" (p. 559). Although she was placing great emphasis on individual human goals and intentions, she asserted that she was *not* seeking "to open the floodgates to cultural particularism" (p. 559), because "human action occurs within a structural context that shapes both its goals and outcomes" (p. 559). Aligning herself with Giddens (1979), Brumfiel concluded: "To analyze specific sequences of change, it will be necessary to alternate between a subject-centered and a system-centered analysis" (p. 559).

In a pair of papers on the evolution of chiefly (centralized but non-bureaucratic) authority (Spencer, 1993, 1994), I developed an evolutionary perspective that took into account the creative force of human agency as well as the structural imperatives of cultural institutions. I noted that considerable variability in leadership behavior in uncultured tribal societies is produced by the internal forces of factional development as well as the external dynamics of interfactional and intercommunity relations (Spencer, 1994). The key question, of course, is how this variability might be differ-

entially preserved through evolutionary mechanisms so that permanently institutionalized central authority is the result. First, it had to be recognized that much of this leadership variability is appropriately viewed as directed or guided variation (Boyd and Richerson, 1985, pp. 81–131), generated when an aspiring leader, to promote his own power-seeking interests, takes “an active role in shaping the variant forms of social and political life in his arena” (Spencer, 1993, p. 46). At the same time, it was necessary “to acknowledge both the tactics of aspiring leaders and the strategic responses of potential and actual followers” (1993, p. 45), what Giddens called the “dialectic of control” (1984, p. 374). This view, I thought, was compatible with Boyd and Richerson’s concept of *biased transmission* (1985, pp. 131–136), which explicates why individuals might be predisposed to accept some variations in leadership behavior over others (see also Flannery *et al.*, 1989). Especially relevant to chiefdom development is the form of biased transmission called *indirect bias* (Boyd and Richerson, 1985, pp. 241–279), in which potential followers accept multiple aspects of an aspiring leader’s authority based on his success at directing a specific activity that happens to be crucial to the survival of the group as a whole in high-risk contexts.

This model was then applied to archaeological data from the Arroyo Lencho Diego of Tehuacán, Mexico, and Barinas, Venezuela. These cases, widely separated in space and time, seemed superficially quite different: “Canal irrigation loomed large in arid Tehuacán; warfare was rife in rain-drenched Barinas” (Spencer, 1993, p. 69). On closer inspection, however, intriguing similarities became evident. In both cases the establishment of centralized leadership entailed the expansion of internal authority beyond the aspiring elite’s home village, accompanied by an increase in regularized external contacts mediated by the ascendant leadership. It also could be seen that in both cases the survival of individuals was linked to the group’s ability to adapt quickly to high-risk circumstances. In Tehuacán, agricultural life in the Arroyo Lencho Diego was impossible without irrigation; the Purrón Dam was an innovative, potentially productive, but risky strategy that required effective social coordination. The survival of each farmer became linked to the fortunes of the group. By directing the construction and operation of the first dam and irrigation system around 700 B.C., the emergent elite enhanced their own attractiveness as leadership models and the multiple dimensions of their authority were consequently accepted by the populace at large. In Barinas, the survival of an individual was dependent on the group’s ability to respond effectively and rapidly to the exigencies of war. An emergent elite around A.D. 550, however, successfully directed the critical warfare activities, and their war authority became accepted by the population along with other facets of their leadership (Spencer, 1993).

An emphasis on *strategies* is one notable consequence of the recent processualist concern with agency (Blanton *et al.*, 1996; Brumfiel, 1992, 1994a, b; Clark and Blake, 1994; DeMarrais *et al.*, 1996; Feinman, 1995; Flannery, 1986c; Flannery and Marcus, 1994; Flannery *et al.*, 1989; Hayden, 1995; Marcus and Flannery, 1996; Spencer, 1990, 1993, 1994). Selectionism, in contrast, does not allow a role for human agency as a creative evolutionary force, a position that results automatically from the selectionists' basic contention that cultural variation is undirected prior to the operation of selection. But contemporary processualists take agency very seriously because directed variation is an indispensable ingredient in their models of how cultural evolution operates.

Flannery (1986c), for example, has made human decision making a central feature of his model of the evolution of agriculture.

Human hunting and gathering is, after all, economic behavior. Foragers make decisions about which vegetational facies to harvest in, how far to travel, how large an area to search, which plants to concentrate on, and when to move on because they've reached the point of diminishing returns. Their shift to agriculture wasn't a change in genetic programming, such as happened when ants adopted acacia trees. It represents a change in their pattern of decisions, reversible change, possibly only one of several alternative reactions to a new situation they perceived. It has to be understood in terms of their previous decision-making pattern, the options open to them, and that new situation. (Flannery, 1986c, p. 518)

More recently, Marcus and Flannery (1996, pp. 29–32) drew upon action theory (Ortner, 1984) to emphasize the role of human agency in their discussion of the evolution of urban society in the Oaxaca Valley; their analysis placed emphasis on the human actors themselves and how they changed their economic, social, and political strategies at various times over the course of 10,000 years of Oaxacan prehistory. As they noted, "By putting actors back into the scheme, action theory also responds to complaints that most evolutionary theory makes humans little more than cogs in a machine" (1996, p. 244). At the same time, they were in agreement with Spencer (1993, p. 46) and Sanderson (1990, pp. 223–224) that a powerful new synthesis can be forged if action or agency-based theory is combined with evolutionary theory. For example, Flannery (1986a) took an actor-based approach in his study of the evolution of agriculture, and yet he was careful to point out that all actor-generated initiatives, all decision-making strategies, will not be equally effective. Evolutionary mechanisms—and selection, in particular—will determine which strategies persist over the long run: "Your evolutionary explanations must deal with the selective advantage conferred on early cultivators, and the fact that they became the means of seed dispersal for a group of plants whose genetic program they had altered" (Flannery, 1986c, p. 519).

Underlying the processualists' concern with agency, strategies, and directed variation is their assumption (not always explicit) that decision-making strategies can be initiated spontaneously by human actors, prior to the operation of selection. Such a view is consistent with recent theories in evolutionary biology concerning the self-organizing properties of natural systems, their capacity to generate order spontaneously, independently of natural selection (Kauffman, 1993, 1995; Nicolis and Prigogine, 1989; Waldrop, 1992). From this standpoint, I suggest, a human strategy can be seen as an example of an "autocatalytic set," which Kauffman defines as "a self-maintaining and self-reproducing metabolism," a capability of open thermodynamic systems (1995, p. 50). Kauffman has proposed that order in natural systems, including human cultures, is a product of two major forces: selection and spontaneous self-organization (1993, 1995). This perspective, as he has noted, departs from the traditional Darwinian view of evolution as undirected variation shaped by selection—in which organisms and ecosystems are seen as ultimately accidental contraptions cobbled together by selection, the products of "chance caught on the wing" (Monod, 1971).

In cultural systems, self-organizing properties are expressed by the human capacity to initiate strategies, build factions, organize work groups, launch war parties, and mount rebellions. Which strategies survive in the long run, of course, is largely decided by the implacable force of selection. But the key point here is that it is not just individual traits that are subject to selection. Instead, it is alternative *constellations* of linked traits—alternative *structures*—that are generated through human agency and then become the raw material for selection. Accounting for this capacity to generate structure, argued Kauffman, requires an expansion of traditional Darwinian theory to include the capacity for spontaneous self-organization that characterizes both natural and cultural systems.

Directionality and History

We have seen that the processualists of the 1960s and 1970s came under critical attack for their use of directional, progressive schemes of cultural evolutionary change (e.g., Fried, 1967; Service, 1962). Contemporary processualists have become wary of these "unilineal" frameworks, although many believe that recurring trends and patterns in human history are nevertheless important data that must be subjected to analysis and interpretation (Blanton *et al.*, 1993; Carneiro, 1981, 1990, 1992a, b; Demarraais *et al.*, 1996; Earle, 1987; Flannery, 1995; Johnson and Earle, 1987; Spencer, 1987, 1990, 1992; Wright, 1986). A similar concern with convergent devel-

opment in the history of life also is seen in contemporary evolutionary biology (Nitecki, 1988; Nitecki and Nitecki, 1992).

A central weakness of any progressivist framework is surely the notion of progress itself, which Gould criticized as "a noxious, culturally embedded, untestable, unoperational, intractable idea that must be replaced if we wish to understand the patterns of history" (1988, p. 319). Gould's preference was for a research orientation that stresses "the study of directional change in history" (p. 319). Fundamental to such a viewpoint, he suggested, is "the most important contemporary reformulation of evolutionary theory—the hierarchical principle of interacting levels" (1988, p. 326). Another key ingredient is exaptation, which refers to a currently useful feature that originated for adaptive reasons different from those related to its current use (Gould and Vrba, 1982). It is such "exaptive possibilities" that provide the "potential to build upon existing structure towards a new state that we judge as more complex" (Gould, 1988, p. 332). Greater complexity, he argued, often comes about when a feature that has evolved on one level becomes coopted into higher-level evolutionary processes, in which the feature plays a different functional-adaptive role (1988, p. 331).

Although archaeologists have recently been showing less enthusiasm for progressivist schemes, they continue to be concerned with directional processes in human history. Blanton *et al.* (1993), for example, took an explicitly evolutionary approach in their analysis of Mesoamerican civilization, though they were careful to point out that "by evolution we do not mean to imply progressive development or teleological movement toward an end goal or in a necessary direction" (1993, p. 11). They were skeptical of taxonomies that attempt to characterize social and political complexity in terms of modal institutional structures (such as Service's band-tribe-chiefdom-state framework). Taxonomies of this kind, they averred, can "blind the researcher to the highly variable and sometimes counterintuitive aspects of cultural evolution" (1993, p. 19). Nevertheless, they recognized that taxonomies can be helpful when dealing with complex phenomena, and they ultimately used a slightly redefined version of Service's taxonomy: "In the remainder of this book, when we use the terms 'chiefdom' and 'state,' we are referring to particular political forms within society, not to types of societies" (1993, p. 19).

Like Hallpike (1988), Blanton *et al.* (1993) favored a comparative, evolutionary approach that focused on *institutions* rather than whole societies. Their analytical framework employed a set of "core features," the most essential of which, they asserted, were "scale, integration, complexity, and boundedness" (p. 14). They suggested that these "are characteristics that are not epiphenomenal, but basic to all societies, permitting valid comparison over space and time" (p. 14). Directionality, they argued, is a general

characteristic of long-term cultural evolution, but it is a more complex directionality than that expressed in the earlier unilineal schemes.

Cultural evolution can be defined as change in scale, integration, complexity, and boundedness. When viewed over the long run, there have been increases in these four variables....But when one is looking at the behavior of a particular society over time, these general trends are not often duplicated. This is because culture change is not always linear, unvarying, or unidirectional. Instead, in specific cases it typically involves periods of rapid change followed by plateaus of relative stability, or even collapse and reorganization in new formats, perhaps followed by further periods of substantial change, and so on. But cycles of change do not necessarily imply repetitive cycles, because the starting point of each new cycle is never the same as the starting point of any prior cycle. Each cycle alters conditions so that a return to the status quo is never really possible. *This cycling with alteration will result in directional change, but not in a simple unilinear manner.* (Blanton *et al.*, 1993, p. 14; italics added)

Flannery (1995) also recently addressed the interrelated topics of social taxonomies and directional change. Like Blanton *et al.* (1993), he asserted that there has been an overall long-term trend in cultural evolution from simple to complex, though he acknowledged the existence of considerable short-term variability in specific historical sequences. Flannery regarded social taxonomies as heuristically valid attempts to characterize recurring patterns of human organization, noting that "out of the hundreds of possible ways that human societies could be organized, certain types of organization work so well that they show up over and over again throughout the world" (1995, p. 21). He favored the following framework: hunting-gathering bands, autonomous villages, rank societies, chiefdoms, archaic states, and empires (1995).

Yet Flannery also maintained that the use of such taxonomies does *not* mean that researchers should emphasize developmental parallels to the neglect of specific historical and contextual variation (1995). He agreed with Spencer (1990) that contingent historical processes play a crucial role in generating the specific contextual variation within which and upon which evolutionary mechanisms such as selection operate (see also Earle and Preucel, 1987, p. 509). Flannery concluded that archaeologists

...need to engage in two different types of evolutionary studies. One, basically *historic* in nature, documents the changes through time within a specific culture...[the] second type of evolutionary study is *comparative* in nature. It seeks not to trace the history of one specific culture, but to compare the evolution of unrelated cultures in different regions of the world. Such a comparative study needs terms like "autonomous village," "chiefdom," and "archaic state," for the same reasons that paleontology needs terms like "reptile," "bird," and "mammal"...Such labels...provide us with shorthand references to some very common types. (Flannery, 1995, p. 22)

While some processualists are overtly skeptical of such sociopolitical typologies (Blanton *et al.*, 1996; Feinman and Neitzel, 1984; Upham, 1987,

1990), others look beyond the obvious liabilities of classification to the (sometimes subtle) potential benefits. Recently, Rosenberg (1994) and Spencer (1987, 1990) have pointed to an analogy between such sociopolitical taxonomies and the "basic design" concept or *Bauplan* (pl. *Baupläne*) that some macroevolutionary biologists have found useful (Frazzetta, 1975; Gould and Lewontin, 1979; Mayr, 1982, p. 468). Gould (1985, p. 25), for example, acknowledged history's importance as "the cause of nature's ordering," but he also pointed out that "history flows along constrained pathways of form," recurring designs or *Baupläne* such as "wrenness, dogness, and wormness," that act almost as a set of "Platonic types...themes that transcend time, and nature's protoplasm flows through them again and again" (Gould, 1985, p. 25). A complete evolutionary analysis, said Gould, must consider the "homology of history and the analogy of optimal form; dynamism and structure; motion and inherence; uniqueness and repetition" (1985, p. 25). Taking a similar position, I have urged archaeologists to adopt a more inclusive evolutionary approach, one that employs historical as well as comparative analyses so that homology and analogy can both be addressed (Spencer, 1990, 1992). Such an approach "recognizes history's substantial contribution in generating the contextual basis of behavioral variation, while at the same time it acknowledges the importance of analogy when we are seeking answers to questions concerning function and development" (Spencer, 1990, p. 23). Such questions are most effectively addressed when diachronic data are used to compare different *trajectories* of long-term culture change (Drennan, 1987, 1991b; Spencer, 1987, 1990, 1993; Wright, 1986). Comparative studies that draw only on synchronic or short-term data from the "ethnographic present" will inevitably be less useful, since they "reflect only observed behavioral variability and lack the temporal scope necessary to reveal the operation of evolutionary processes that result in the differential preservation of this variability" (Spencer, 1987, p. 381).

More than a century ago, Karl Marx argued that a society's historical trajectory places powerful constraints or limits on the range of future developmental possibilities:

Men make their own history, but they do not make it just as they please; they do not make it under circumstances chosen by themselves, but under circumstances directly found, given and transmitted from the past. The tradition of all the dead generations weighs like a nightmare on the brain of the living. (Marx, 1978, p. 595; cited by Sanderson, 1990, p. 189)

Directionality can therefore be a consequence of historical contingency, or what could be called "path dependency" (see David, 1986; Gould, 1989b, 1991, pp. 59–75; Gould and Lewontin, 1979). As Sanderson noted, "many adaptations arise in response to existing social arrangements, and

these arrangements exert powerful constraints on the nature of the adaptations that are likely to arise [in the future]" (1990, p. 189). Like Rosenberg (1994) and Spencer (1987, 1990), Sanderson recognized the existence of sociopolitical *Baupläne*, a concept that he felt was "crucial for theories of social evolution" (1990, p. 189). From this viewpoint, societies (like organisms) "must be analysed as integrated wholes, with *Baupläne* so constrained by phyletic heritage, pathways of development, and general architecture that the constraints themselves become more interesting and more important in delimiting pathways of change than the selective force that may mediate change when it occurs" (Gould and Lewontin, 1979, p. 581). I have suggested (Spencer, 1987, 1990) that the categories "chiefdom" and "state" are examples of such sociopolitical *Baupläne*. A chiefdom, according to Wright (1977), is a society with a political organization that is centralized but not internally specialized, while a state has a political organization that is both centralized and internally specialized, so that "the central process is divisible into separate activities which can be performed at different places at different times" (Wright, 1977, p. 8). One consequence of these differences in political organization is that a state is usually able to integrate a much larger population and territory than a chiefdom (Spencer, 1990). A number of anthropologists have argued that the existence of the chiefdom form of organization is a precondition for the emergence of the primary or pristine state in a particular developmental trajectory (e.g., Carneiro, 1981; Earle, 1987; Flannery, 1972c, 1995; Wright, 1977, 1986): "Before a decision-making organization can be both centralized and internally specialized it must first be centralized; the chiefdom is thus the precursor of the state" (Spencer, 1987, p. 378).

Directionality is not the same thing as "progress" or "improvement," and I doubt that any contemporary processualist would want to argue that the ordinary members of archaic states invariably led better lives than their counterparts in Upper Paleolithic bands. Selective advantage, however, is quite a different issue: the relevant point is that more populous, complex societies tend to have an advantage over smaller, simpler ones in most competitive situations. As Kosse (1994, p. 40) has suggested,

Large groups are advantageous in competition....Size confers a direct advantage by increasing fighting strength in offense and defense; in the absence of overwhelming technological disparity, competitive advantage comes almost entirely from numerical superiority.

Carneiro has noted that "so great is the competitive advantage conferred by large size that the larger a society becomes through successful warfare, the likelier it is to become even larger" (1992b, p. 131). For Carneiro, this pattern of "social augmentation through successful competition" (1978, p. 208) has imparted significant overall directionality to hu-

man history. Although short-term, specific history has often been marked by cycles of political unification and fragmentation, Carneiro (1978) concluded that long-term history exhibits a general trend toward successively larger political units (see also Axelrod, 1984; Blanton *et al.*, 1993, p. 14; Flannery, 1995; Marcus, 1992; Spencer, 1990).

Hierarchy, Self-Organization, and Evolution

Current processual interpretations tend to be based on an interrelational, systemic view of culture that differs fundamentally from the selectionist perception of culture as a collection of traits. Hallpike (1988) has argued that "cultural selectionism is therefore inherently atomistic" (p. 37), an unavoidable consequence, he felt, of the selectionists' desire to find a cultural analog to the gene. The most extreme expression of this tendency can be seen in the notorious "memes" and "culturgens" of Dawkins (1976) and Lumsden and Wilson (1981), respectively.

To Hallpike, selectionism's trait-based view of culture is fundamentally at odds with a perspective that recognizes the dynamic roles that structures such as social, political, economic, and religious *institutions* play in the lives of human beings. A concern with institutional development has led Hallpike to be skeptical of the selectionist (not to mention postprocessualist) tendency to make the individual the locus of evolutionary mechanisms and processes:

...The individual members of society are not causally autonomous. That is, what they do and why they do it are the expression of the institutions, beliefs, and values of the particular society into which the individuals composing it have been socialized, which they did not create as individuals, and which will outlast them. (Hallpike, 1988, p. 38)

The selectionist view, according to Hallpike, is incompatible with a perspective that recognizes institutions as real entities rather than statistical summations of numerous individual acts (1988, p. 78). He favored an approach that regards societies as systems that behave according to certain "core principles," expressed in the form of social, economic, political, and religious institutions (1988, p. 290). Evolutionary mechanisms, he maintained, operate not only on individuals but also on the institutional level: "The extremely rapid pace of the evolution of societies, the independent appearance of the state in many different areas of the world, and the shortage of time demonstrate conclusively that any explanation of social evolution must be based on the structural properties of institutions and beliefs" (Hallpike, 1988, p. 373).

Selectionism's atomistic view of culture—coupled with its insistence on undirected variation winnowed by selection as the essence of evolution—has made it difficult to account for the origins of the shift in scale of selection that Dunnell suggested is the mechanism that brings about the rise of complex society (Dunnell, 1980, 1988, 1989). Processualists also have been concerned about the origins of hierarchy, but they have generally approached the problem from a different angle, drawing inspiration from recent punctuational and macroevolutionary theory in biology (e.g., Eldredge, 1989b, 1995; Eldredge and Gould, 1972; Eldredge and Salthe, 1984; Gould, 1989a; Gould and Eldredge, 1977, 1993; Vrba and Eldredge, 1984). Because punctuational theory has implicated species-level selection (or “species sorting”) as a key mechanism of macroevolutionary change, it has led a number of theorists to argue for a new, hierarchical view of evolution. Gould is an enthusiastic proponent: “I believe that hierarchy theory in causal perspective will provide the most fundamental reconstruction of evolutionary theory since the Modern Synthesis of the 1930s and 1940s” (1989a, p. 126).

These recent developments in macroevolutionary biology have been utilized by some anthropologists as they argue the case for a hierarchical, processual approach to cultural evolution (Diener, 1980; Rosenberg, 1994; Spencer, 1987, 1990, 1993). Rosenberg suggested that “punctuated evolution accounts for the most dramatic type of culture change—the emergence of new cultural systems” (1994, p. 308), which he illustrated with data on several sequences of prehistoric change. He maintained that the *Bauplan* of an emergent cultural system “is not produced by the incremental operation of infrastructural determinism or natural selection, but rather by a discontinuous process of infrastructural *opportunism*” (Rosenberg, 1994, p. 308; italics in original). He went on to suggest that such punctuational change “implies the existence of a hierarchy of evolutionary processes” (p. 308). Punctuational change, Rosenberg argued, cannot be understood simply by invoking extrarapid directional selection on the level of the individual, because recent macroevolutionary theory has indicated that punctuational change involves shifts in the relative impact of selection among different levels of organization. As Gould has proposed, species sorting must be brought about by “a higher form of selection, acting directly upon species through differential rates of extinction” (1980, p. 126).

Emergent complexity in a cultural sequence is manifested through the appearance of more inclusive (or “higher”) levels of political integration, such as when a regional chiefly polity emerges out of a context of autonomous villages or when a state system arises from a network of chiefdoms (Carneiro, 1970, 1981; Flannery, 1972c; Johnson, 1973, 1978, 1987; Marcus and Flannery, 1996; Spencer, 1982, 1987, 1990; Wright, 1977, 1986). It has

been noted that such developments are usually associated with an increase in the scale of the centralized polity; this larger polity becomes a critical unit for subsequent selection (Johnson, 1982; Spencer, 1987, 1990). For example, a necessary condition for the evolution of regional chiefly authority is when a village leader attempts to extend the scope of his internal (i.e., intrafactional) authority to villages other than his own (Spencer, 1994). Whether this strategy succeeds, of course, will be determined by selection.

Although selection can be invoked to explain the survival (or failure) of such a newly centralized polity, we need to look elsewhere to account for the origin of the emergent complexity. A clue was recently provided by Crumley (1995), who argued that in cultural systems there are at least two kinds of hierarchy: scalar hierarchies (such as family/village/region) and control hierarchies (such as household head/village chief/regional chief). The scalar hierarchy is characterized by mutually influential interactions among levels, while in the control hierarchy the upper levels tend to exert disproportionate influence on lower levels (Crumley, 1995, p. 2). A third form of order in cultural systems, she suggested, is "heterarchy," a network of units, not necessarily ranked with respect to one another—similar to the neural structure of the brain (1995, p. 3). She provided the following illustration of heterarchy: "Three cities might be the same size but draw their importance from different realms: one hosts a military base, one is a manufacturing center, and the third is home to a great university. Similarly, a spiritual leader might have an international reputation but be without influence in the local business community" (Crumley, 1995, p. 3). This last suggestion is reminiscent of Johnson's concept of the "sequential" hierarchy, in which leadership is not permanently centralized on a single officeholder but is instead temporary and sequential, with different leaders emerging at different times and in different contexts (1982, 1989). Although they are obviously subject to selection, Crumley noted that such structures are spontaneously generated by cultural systems, and she related her ideas explicitly to those of Kauffman (1993) and other complexity theory researchers, citing Corcoran (1992), Kohler (1993), and Scott (1991).

All three elements of Crumley's model (scalar hierarchy, control hierarchy, heterarchy) are of help in understanding the process of sociopolitical evolution. I suggest that the emergence of a new, more inclusive level of hierarchical control entails a concentration of authority in one of the social units that make up a particular level of the scalar hierarchy. For example, in the transition from autonomous villages to a chiefdom, intervillage integration changes from a situation where authority is divided or shared among the component villages (heterarchy) to a situation where intervillage integration is achieved through centralized authority concentrated in a single village, which emerges as the paramount of the new chiefly polity center

(hierarchy). A similar process occurs when a state authority emerges and rules over previously autonomous chiefdoms. An essential difference between the centralization achieved by chiefdoms and states is the generally greater area included within the boundaries of the state polity, the effective integration of which usually requires the delegation of aspects of central authority to secondary and tertiary administrative centers far from the political capital (Spencer, 1990). In both situations there is a qualitative shift from the heterarchical to the hierarchical mode.

How does a control hierarchy emerge from heterarchy? The essential mechanism, I propose, is *extrapolation*, which I define as follows: *an extension or projection of the internal model of authority from one social unit to others on the same level of the scalar hierarchy*. As I suggested earlier, extending the internal (intrafactional) central authority of an aspiring leader to other villages is a strategy that can lead to a permanently centralized regional chiefdom—if the selective context is propitious (Spencer, 1993, 1994). Similarly, state formation may result when the internal authority of a centralized regional chiefdom is extended (through military conquest, for example) to other, previously autonomous, polities (Spencer, 1990).

Extrapolation is an expression of both agency and self-organization (Blanton *et al.*, 1996; Brumfiel, 1994a; Holland, 1995; Kauffman, 1993; Roscoe, 1993; Spencer, 1993). Also, extrapolation is appropriately seen not as a single trait but as a *strategy*, which when successfully implemented extends a structure of power relationships from one unit in a scalar hierarchical level to others on that level. In so doing, the unit from which the extrapolation emanates is “promoted” (in Flannery’s terms) to a higher, emergent level of the control hierarchy (Flannery, 1972c); for example, a village may be promoted to a chiefly center, a chiefly center promoted to a state capital. Extrapolation is *not* the same as “linearization” (Flannery, 1972c); the latter involves intervention by an already established higher-level institution into the affairs of an institution on a lower level of the control hierarchy. I see extrapolation as a key mechanism by which the control hierarchy can emerge out of heterarchy in the first place.

Whether an extrapolation initiative will succeed is of course ultimately decided by selection. However, we must recognize that *the act of extrapolation itself changes the relative impact of selection among levels of the scalar hierarchy*. For example, in an autonomous village context, selection on the multivillage (or regional) level tends to be weaker than intervillage and intravillage (interfamilial) selection. But if the leadership of one village launches an extrapolation initiative—seeking to extend its internal model of authority to other villages—this will increase the relative importance of selection on the multivillage level, because the newly centralized multivillage polity will persist only if the emergent regional leadership successfully

withstands challenges from without and within the new polity (Carneiro, 1981; Spencer, 1987).

Similarly, an extrapolation initiative by a nascent state will alter the pattern of selection throughout the territory affected by this strategy. As an example, let us consider the Monte Albán state, which emerged in the Valley of Oaxaca, Mexico, probably sometime during the Monte Albán Ic phase (300–100 B.C.), and flourished for eight or nine centuries (Marcus and Flannery, 1996; Spencer, 1990; Wright, 1986). Recent research has shown that the emergent Monte Albán state subjugated a number of previously autonomous regions adjacent to the Valley of Oaxaca (Feinman and Nicholas, 1990; Marcus and Flannery, 1996; Redmond and Spencer, 1982, 1992). Various lines of evidence indicate that one of these regions, the Cañada de Cuicatlán, was subordinate to Monte Albán throughout the Lomas phase in the Cañada sequence, dating from approximately 200 B.C. to A.D. 200, corresponding to Monte Albán Ic–II in the Valley of Oaxaca sequence (Marcus, 1976, 1980; Redmond, 1983; Spencer, 1982; Spencer and Redmond, 1997).

The Cañada is a *tierra caliente* (hot country) canyon about 50 km north of the Oaxaca Valley (Fig. 1). Occupation in the Cañada is restricted to four alluvial fans or “localities”: Domingullo, El Chilar, Cuicatlán, and Quiotepec (Fig. 2); these localities were inhabited by autonomous ranked societies or *cacicazgos* during the Late Postclassic (Hopkins, 1984; Hunt, 1972; Redmond and Spencer, 1994). This pattern of autonomous *cacicazgos* appears to characterize earlier time periods also, with the single exception of the Lomas phase, when the Cañada was unified into a single region under the control of Monte Albán (Redmond, 1983).

Drawing upon data in Redmond (1983), I have constructed charts of the changing relationship between estimated population and potential population (or “carrying capacity”) over four time periods—Perdido (600–200 B.C.), Lomas (200 B.C.–A.D. 200), Trujano (A.D. 200–1000), and Iglesia Vieja (A.D. 1000–1525) phases—for each of the four alluvial fans (Figs. 3–6). For the Domingullo, El Chilar, and Cuicatlán localities (Figs. 3–5), estimated population increases over time, though it is always comfortably below the estimated carrying capacity, which also increases over time due to larger maize cobs and other productive improvements (Kirkby, 1973; Lees, 1973; Redmond, 1983). This is the pattern we would expect to observe if each locality was autonomous and selection was operating strongly on the interlocality level and below but weakly on the regional or multilocality level.

This interpretation, however, does not hold up across all time periods. Look now at the graph for the Quiotepec locality (Fig. 6). Here, the estimated population is well below carrying capacity for all phases except the

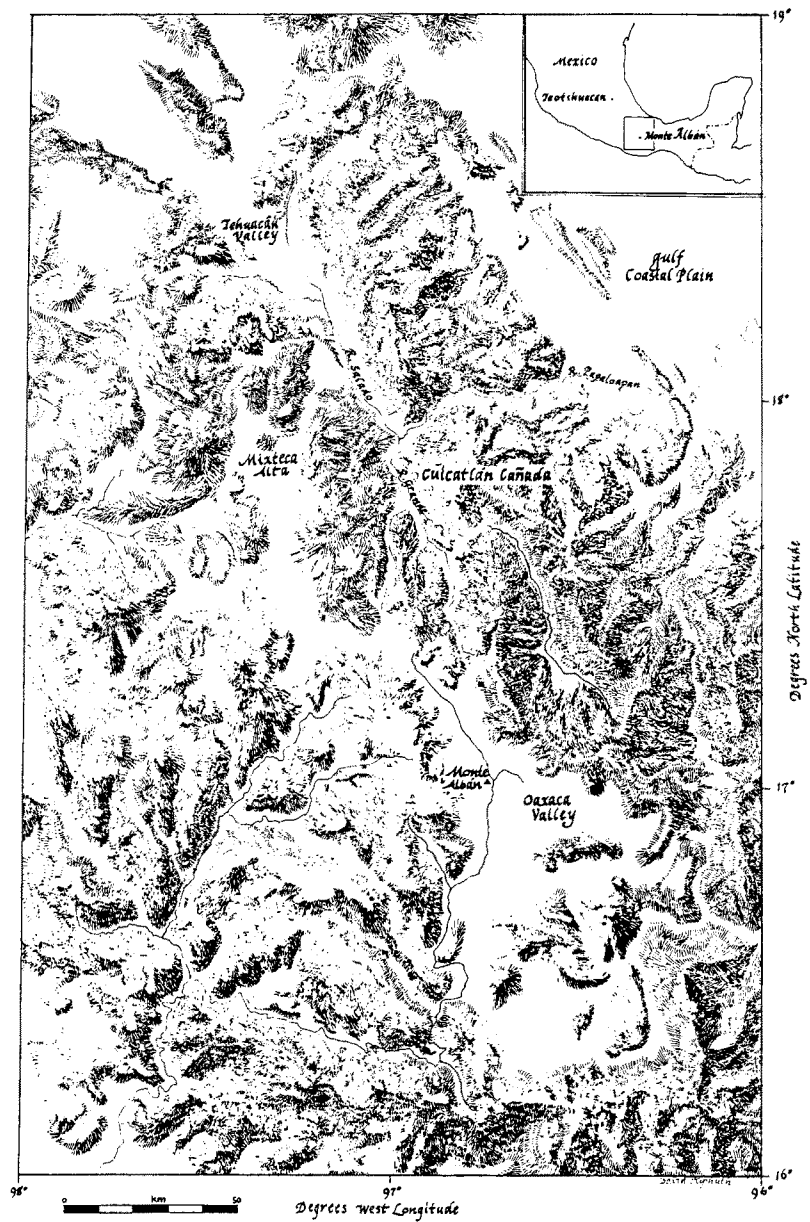


Fig. 1. Location of the Cañada de Cuicatlán, in the southern highlands of Mexico between the Valleys of Oaxaca and Tehuacán.

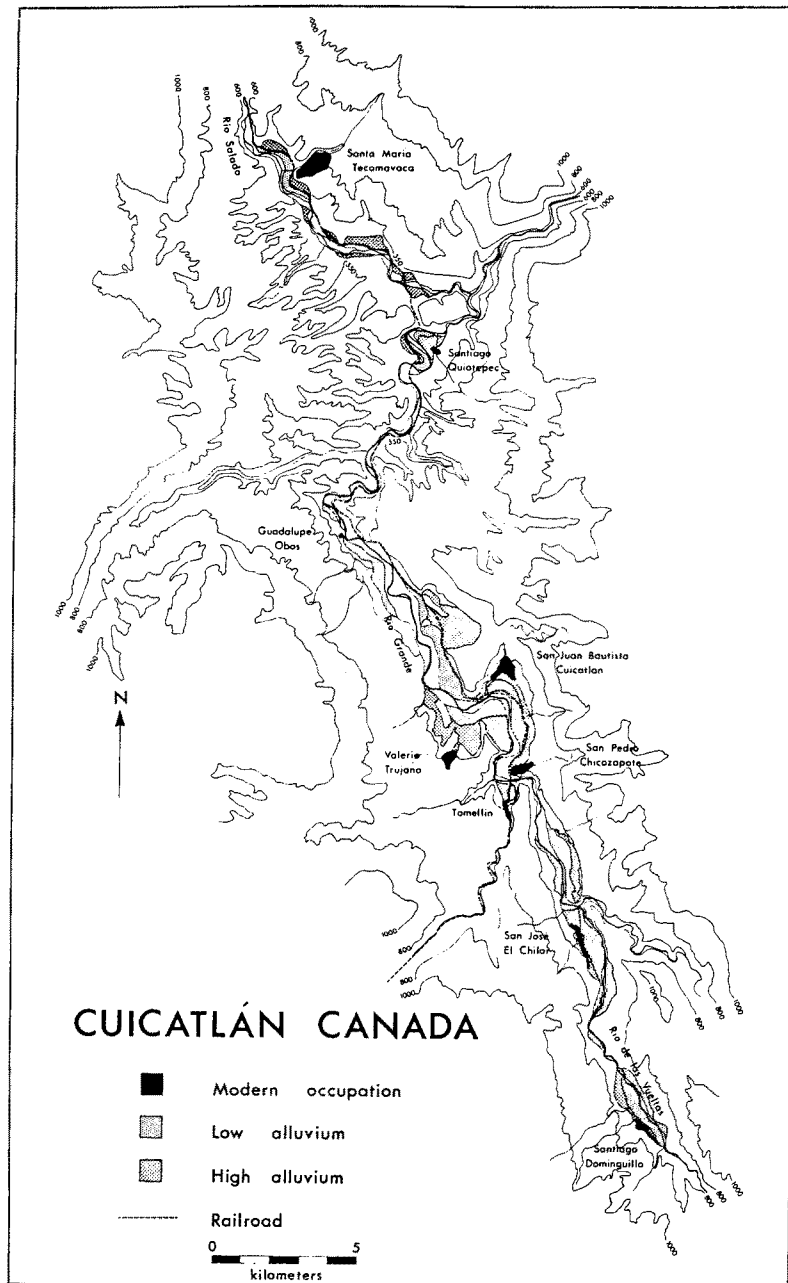


Fig. 2. The Cañada de Cuicatlán, showing the locations of the four major alluvial fans (or localities) of Dominguito, El Chilar, Cuicatlán, and Quatepec.

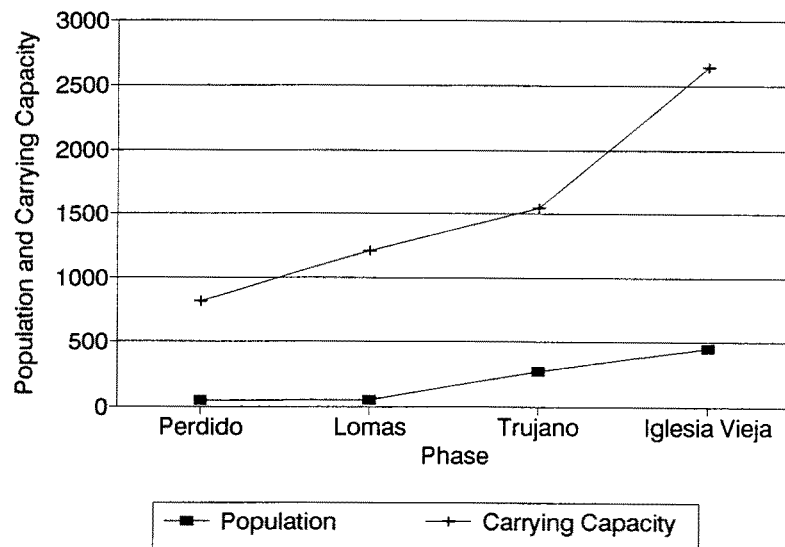


Fig. 3. Graph of estimated carrying capacity and archaeological population for four prehistoric phases in the Dominguillo locality.

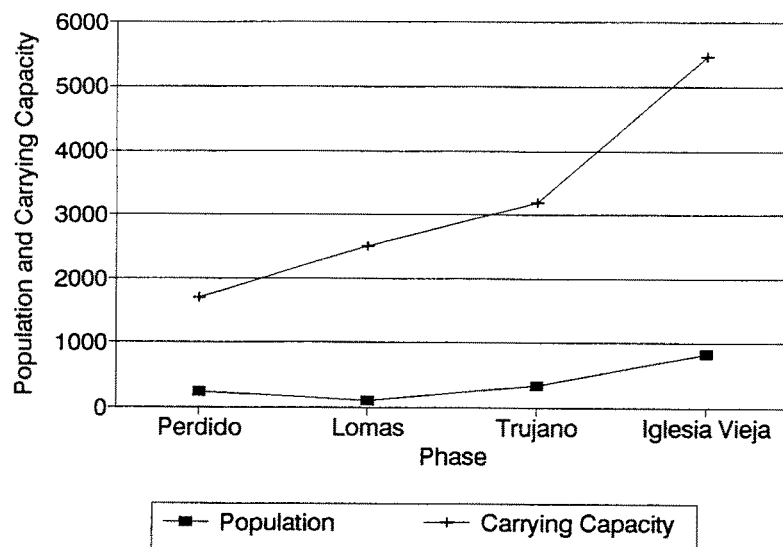


Fig. 4. Graph of estimated carrying capacity and archaeological population for four prehistoric phases in the El Chilar locality.

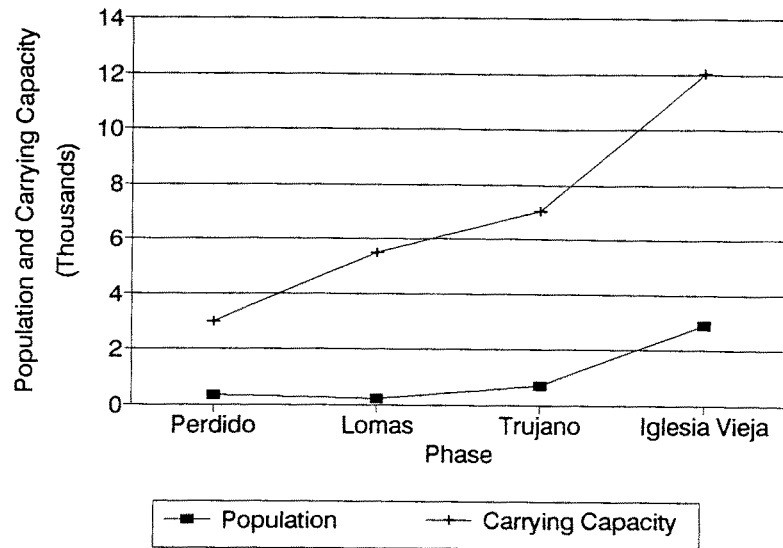


Fig. 5. Graph of estimated carrying capacity and archaeological population for four prehistoric phases in the Cuicatlán locality.

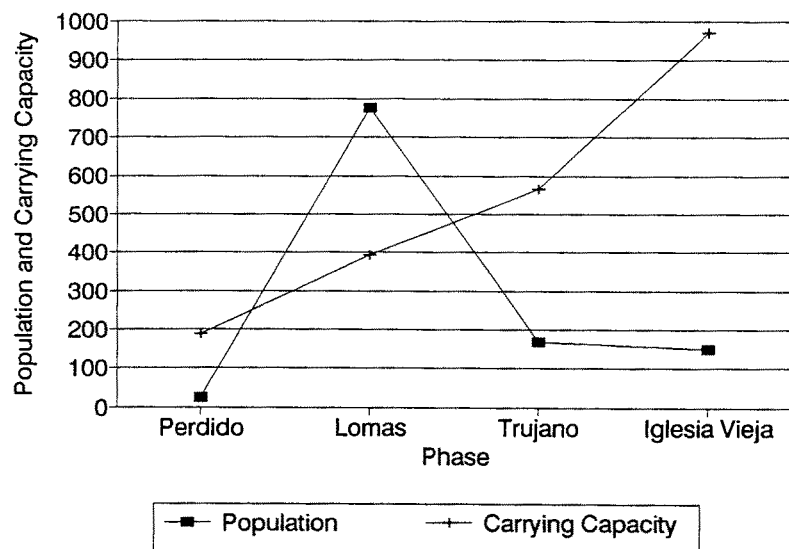


Fig. 6. Graph of estimated carrying capacity and archaeological population for four prehistoric phases in the Quiotepec locality.

Lomas phase, the time period of the Cañada's incorporation into the Monte Albán state. During the Lomas phase, there was a concentration of seven sites in the Quiotepec alluvial fan totaling 45 ha, far more occupation than occurred in the locality in any other time period before or since (including the present). Noting the presence of fortifications, ballcourts, and Monte Albán II-style pottery here, Redmond has interpreted the Quiotepec occupation as a complex of fortified sites established by Monte Albán in order to protect the frontier of the expanded state and administer the subjugated region of the Cañada (Redmond, 1983, pp. 107–120).

Given the small amount of arable land in the Quiotepec locality, the relatively large Lomas phase population here could have survived only if comestibles were brought in from elsewhere. Figure 7 graphs the estimated population and carrying capacity for the Cañada as a whole (all four localities together) for each of the four phases in the prehistoric sequence. Figure 7 shows that the total regional population of the Cañada was comfortably below the overall regional carrying capacity during all four phases. During the Lomas phase, there would have been more than enough productive potential in the Cañada as a whole to support the Quiotepec occupation, but *only* if surplus production was mobilized in the other three localities of Cañada. This is apparently what happened, for the large population at Quiotepec was successfully sustained in spite of the insufficient farmland in its locality. Moreover, evidence of productive intensification elsewhere in the Cañada at this time has been found in the Cuicatlán and Dominguillo localities, in the form of canal irrigation facilities at two Lomas phase sites (Redmond, 1983, p. 123; Spencer, 1982, pp. 221–231).

During the Lomas phase, therefore, selection on the interlocality level was evidently suppressed or overridden by relatively stronger selection on the regional or multilocality level. This higher-level selection was imposed as a consequence of Monte Albán's incorporation of the Cañada into the expanding state polity. The short-term success of this strategy required an effective military capable of carrying out the initial takeover, while longer-term success depended on the state's ability to finance its operation through a tributary political economy and withstand challenges from within and beyond the Cañada. Several lines of evidence point to the rise of a specialized Zapotec military by Monte Albán Ic-II (Marcus, 1976; Redmond, 1983, pp. 171–176; Redmond and Spencer, 1992). In the subjugated region, the introduction of canal irrigation allowed the state to increase agricultural production (Spencer, 1982, pp. 231). Internal rebellion was undoubtedly discouraged through the presence of military personnel, as well as through the use of propagandistic terror tactics, such as the skull rack excavated at Loma de La Coyotera (Spencer, 1982, pp. 235–240). External threats were addressed by the establishment of the large military complex at Quiotepec,

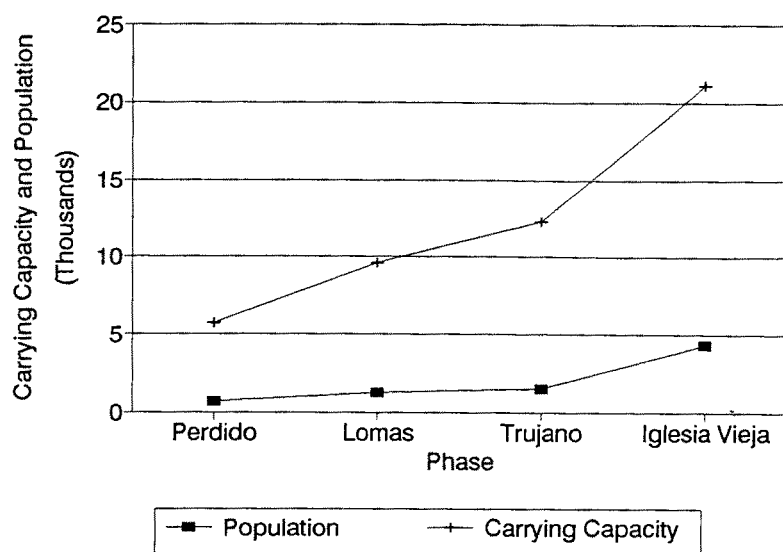


Fig. 7. Graph of estimated carrying capacity and archaeological population for four prehistoric phases in the Cañada de Cuicatlán taken as a whole region.

at the northern edge of the Cañada (Redmond, 1983, pp. 91–120). These strategies helped the Monte Albán state maintain its control over the conquered region until the end of the Lomas phase (about A.D. 200), at which point Monte Albán abandoned its control over the Cañada and pulled back to the Valley of Oaxaca proper (Spencer, 1982, pp. 254–255). During the succeeding Trujano phase (A.D. 200–1000), the Cañada's population once again was distributed so that the occupation in each locality was comfortably below the local carrying capacity, the pattern it has exhibited for all periods other than the Lomas phase.

It is worth emphasizing that the scalar shift in the relative impact of selection during the Lomas phase was a *consequence* of Monte Albán's attempt to extrapolate an internal model of political control from the Valley of Oaxaca to the Cañada. This sort of initiative would be difficult to understand using only the selectionist concepts of undirected variation and selection. From a processual viewpoint, however, Monte Albán's conquest strategy can be seen as an expression of agency, self-organization, and directed variation. It survived the operation of selection when it was directed at the Cañada because the state pursued effective military and political-economic strategies. Not the least of these was the unification of previously autonomous localities into a single tributary region, which emerged as a

new unit for higher-level selection, the operation of which suppressed the effects of selection on the level of the locality.

CONCLUSION

What shape will evolutionary archaeology take in the next century? The selectionists of the mid-1990s are a tightly defined group, relatively stable, and internally coherent. The processualists, on the other hand, seem constantly in flux, embattled, and internally divided. Yet it is precisely in that dynamism and diversity where I see potential. Although forecasting the future is tricky—and perhaps out of character for a prehistoric archaeologist—I will stick my neck out and predict that the future of evolutionary archaeology lies with the processualists rather than the selectionists. The processual perspective is more varied and robust; it dovetails more effectively with recent and continuing innovations in macroevolutionary biology, complexity theory, action/practice theory, and hierarchy theory; it allows for the inclusion of human agency and directed variation as important evolutionary forces along with selection; it recognizes that these evolutionary forces operate on institutions and social groups as well as on individuals; it eschews pat answers to complex questions; finally, and perhaps most importantly, it is an approach that continues to evolve, challenging us to search on.

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