

Contingencies and Metacontingencies: Toward a Synthesis of Behavior Analysis and Cultural Materialism

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A synthesis of cultural materialism and behavior analysis might increase the scientific and technological value of both fields. Conceptual and substantive relations between the two fields show important similarities, particularly with regard to the causal role of the environment in behavioral and cultural evolution. Key concepts in Marvin Harris's cultural materialist theories are outlined. A distinction is made between contingencies at the behavioral level of analysis (contingencies of reinforcement) and contingencies at the cultural level of analysis (metacontingencies). Relations between the two kinds of contingencies are explored in cultural practices from paleolithic to industrial sociocultural systems. A synthesis of these two fields may offer the opportunity to resolve serious problems currently facing modern cultures.

Key words: cultural materialism, metacontingency, cultural evolution, behavior analysis

The drawing by B. F. Skinner (1981) of a parallel between biological, behavioral, and cultural selection appears to have stimulated behavior analysts to consider their enterprise within a broader context. Some behavior analysts have sought to clarify the conceptual and substantive relations between behavior analysis and other life sciences (e.g., Ator, 1986). Others have turned to the relations between behavioral and cultural phenomena (e.g., Glenn, 1985, 1986a; Malagodi, 1986). Behavior analysis has been characterized as a "border science" because its subject matter provides a substantive bridge between biological and cultural subject matters, much as the subject matter of biochemistry provides a bridge between the subject matters of chemistry and biology (Glenn, 1986b). The subject matters of border sciences are emergent processes that allow for new orders of complexity in nature. That is, DNA replication made biological evolution possible and operant behavior made cultural evolution possible.

Conceptual and substantive relations between *cultural materialism* (a particular approach to a science of culture) and *behavior analysis* (a particular approach to a science of behavior) seem especially worthy of exploration because the two fields share certain important characteristics. Probably the most critical commonality is the explanatory role of the

environment in the empirical and theoretical formulations of the two fields. Both fields also eschew explanations of human activities that appeal to mental events.

Both behavior analysis and cultural materialism seem to fit into a general conceptual scheme that is consistent with the physical and biological sciences. Cultural materialists and behavior analysts, however, work at different levels of scientific analysis. A science of behavior focuses on relations between the activities of individual organisms and environmental events, while a science of culture focuses on relations between recurring cultural practices (i.e., interrelated behavior among individuals) and the environments in which those *practices* occur. The units of analysis differ.

In behavior analysis the unit of analysis is the contingency of reinforcement (Skinner, 1969, p. 7). Although the empirical relations giving rise to the analytic unit are replicated repeatedly over time, instances of the unit are ephemeral in that both the environmental events and the organismic events entering into the functional relations are often momentary. The repeatability of behavioral instances allows an analytic unit to emerge (cf. Johnston & Pennypacker, 1980, chap. 3). The behavioral units involve *intra-organism* repeatability, even though the *processes* described are the same from operant to operant, organism to organ-

ism, and to an unknown degree from species to species.

Because cultural practices usually involve the behavior of two or more individuals interacting in systematic ways, it is clear that cultural practices may be "reduced to" the contingencies of reinforcement operating on each individual taking part in the cultural practice. However, such reduction does not fully explain the evolution and maintenance of the practice *as such*.

The issue may be seen as similar to another with which behavior analysts are familiar: While there would be no behavior without an organism, the biological characteristics of the organism cannot by themselves account for its behavior. To be sure, behavior is the result of the evolutionary history of the species of which the individual is a member, as well as the result of its current state (partly a function of its unique genetic characteristics). The behavior can also be characterized in terms of the neural, glandular, and muscular events comprising the organism's activities; but these events do not fully account for behavior *as such*—as an interaction between an organism and its world. Such explanation requires that the current environment, as well as the history of the environment's action with regard to the individual's activities, be taken into account. Thus the *behavioral* level of scientific analysis takes the organism as the "ground" against which the functional relations between its activities and environmental events are experimentally examined (Hineline, 1986).

At the *cultural* level of analysis, individual behavior becomes the "ground" from which cultural practices emerge and enter into functional relations occurring at the cultural level of analysis. The behavior of individuals that enters into cultural practices is the point of contact between behavior analysis and cultural materialism. Cultural practices involve consistencies in behavior of many individuals across both time and space. Anthropologists are interested in precisely that behavior which comprises cultural practices. In this role of promulgating a

science of culture, cultural materialists seek to identify cultural practices having various functions in the evolution and maintenance of cultures. A scientific analysis of cultures cannot be reduced to the behavior of individuals because cultural practices, even though comprised of the behavior of individuals, have outcomes of their own—outcomes that affect the survivability of the culture.

Since behavior (as a subject matter) may be conceptualized as the bridge between biological and cultural phenomena, and since the formulations of cultural materialism and behavior analysis are considered compatible (cf. Lloyd, 1985; Vargas, 1985), the possibility of a synthesis of the two fields seems worth exploring. The synthesis of two distinct but related fields into a larger conceptual framework, the parts of which remained separate disciplines, presaged rapid development in biological science (Mayr & Provine, 1980). A synthesis of behavior analysis and cultural materialism might lead to similar scientific and technological development.

Such a synthesis will require that each discipline's theoretical core remain intact while at the same time providing illumination and theoretical impetus for the other. A central problem, from my perspective, is to distinguish between the contingencies underlying behavior change and those underlying cultural development. This article is directed toward that end. Because many behavior analysts will be unfamiliar with key concepts in cultural materialist theory, the next section of the article will summarize those concepts. Then behavioral contingencies will be distinguished from cultural contingencies; and finally specific practices that anthropologists have studied will be examined in terms of behavioral and cultural contingencies.

KEY CONCEPTS IN CULTURAL MATERIALISM

The scientist most closely associated with cultural materialism is Marvin Harris. Since 1952 Harris has produced a steady flow of publications ranging from

field studies to philosophical and theoretical treatises. As Skinner's works span the entire field of psychology, Harris's works span the entire field of cultural anthropology. Because Skinner and Harris are both acknowledged as leading spokesmen and because both have provided coherent conceptual frameworks for their fields, this article will draw heavily on the work of those two men. Their works provide the coherent disciplinary cores from which a synthesis might initially be fashioned. In order to familiarize behavior analysts with cultural materialist concepts, this section of the article will focus on those concepts discussed in Harris's *The Nature of Cultural Things* (1964) and *Cultural Materialism* (1979).

Concepts from Harris's Earlier Work

In *The Nature of Cultural Things* (1964), Harris develops an empirical classification system for cultural entities. The "atomic" cultural entity is a bit of behavior called an *actone*. Examples of actones are lifting, walking, sitting, cutting, etc. That which is lifted or cut is an *actone object*. Actones enter into larger behavioral units, or sequences of actones. Actones and sequences, as described by Harris, are consistent with the behavior analytic concept of behavioral units,¹ and they virtually always involve operant behavior.

Scenes are more extended sequences of behavior, usually having an outcome. They are identified in terms of the behavioral sequence of a particular *actor* (or type of actor) and the *place* and *time* of action. A farmer who milks his cows daily in his barn by carrying out a series of acts resulting in milk participates in a particular scene. Thus, the behavior of individuals is specified in terms of the same kinds of empirical events behavior analysts use in identifying behavioral units.

Scenes often involve several actors and

the behavioral patterns occur repeatedly among specific individuals. Those individuals then comprise a unit called a *nomoclone*—a specific set of individuals who repeatedly take part in one or more specific scenes (e.g., the Jones family or Ms. Smith's first grade class of 19 specific 6-year-old children). Members of a given nomoclone may also engage in repeated behavioral episodes with people outside that nomoclone and thus be part of a second (or third, etc.) nomoclone. For example, Jones Jr. may be a member of a neighborhood gang and his father a member of Local Union 223, and his sister a member of Ms. Smith's class.

The cultural unit that takes account of the replication of behavioral scenes that involve different individuals across years or generations is called a *permaclone* by Harris. A permaclone is comprised of individuals engaging in repeated behavioral episodes wherein the individuals in the group may be replaced over time. The local high school football team is an example of a permaclone. Each year some of the members of the team leave and others come on, while the scenes may remain quite similar from generation to generation or change quickly over a short time or slowly over a long time.

A permaclonic system is an entity comprised of several related permaclones, e.g., Bigtown High School. The series of freshman classes (new faces, similar scenes each year), the faculties (a few gone, a few new, many remaining—but similar scenes in classrooms, faculty meetings, etc.), the football teams (gradual changes in players and coaches, similar scenes) comprise a specific permaclonic system. Permaclonic systems, of course, are also replicated across times and places in a sociocultural system. They may also be similar to (but not necessarily historically related to) permaclonic systems in other cultural systems.

Most important to a behavioral synthesis is that the dimensions of the various cultural materialist entities are always *behavioral* dimensions. Entities involving interrelated behavior of individuals get classified on the basis of similarities in repeated behavioral episodes

¹ The size and complexity of behavioral units may vary considerably (see Lubinski & Thompson, 1986), but they are always identified in terms of regularity of relations between environmental events and organismic activity (cf. Branch, 1977).

across individuals as well as groups of specific individuals and groups whose memberships change over time. The empirical phenomena providing the basis for classification are behavioral phenomena (functional relations between activities of people and their environments). Harris's classification of cultural entities as reducible to behavioral interactions among individuals makes cultural phenomena accessible to behavior analytic concepts.

Harris names and describes these cultural entities, from actone (smallest cultural thing) to permaclonic supersystem (e.g., General Motors). His delineation of cultural entities is primarily in terms of their structure (i.e., their behavioral *components*); but Harris does consider the functional characteristics of the behavioral episodes, noting that scenes culminate in a product or outcome or consequence. How far a scene could deviate in form from another and still be considered "the same" (based on its outcome) is not clear. This focus on "outcomes" takes on primary importance in Harris's later works.

Concepts from Harris's Later Work

In looking for the *causes* of cultural evolution, Harris focuses on selection contingencies—ultimately survival contingencies. But the units selected are not *organisms* (or genes) as in biological evolution, but *cultural entities*—permaclones whose practices are replicated across generations.

Because survival (both of individuals and sociocultural systems) *ultimately* gets down to overt behavior that operates on the environment, Harris gives causal primacy to overt nonverbal behavior. In fact he divides the behavioral world into two categories—the nonverbal overt behavior in cultural practices is called the "behavioral component" of cultures, while the "mental" component includes verbal behavior (overt or covert) and other covert behavior. Harris also distinguishes between rules that can be empirically validated independent of the verbal community in which they emerged (the "etic" component) and rules propagated within

a verbal community that may or may not be empirically tested or testable (the "emic" component).² I shall not try to maintain these distinctions in this article but shall focus primarily on the behavior involved in those practices Harris labels as "etic behavioral components." Those practices are classified into three categories—those belonging in the cultural infrastructure, the cultural structure, and the cultural superstructure.

A culture's *infrastructure* (Harris, 1979, pp. 52–53) is comprised of productive and reproductive practices. The infrastructure includes those cultural practices critical to the physical survival of the individuals whose behavior keeps the nomoclonal and permaclonal intact. Infrastructural practices are those that (1) produce the objects needed for subsistence of enough individuals to maintain the practice and (2) regulate the size of the group. Harris (1979, pp. 85–95) is clear about the importance he attributes to the physical characteristics of the environment from which infrastructural practices emerge. Infrastructural practices have outcomes directly related to survival; that is, if a developing permaclonic system results in a balance of food and protection from physical harm on the one hand, and number of people who must be fed and protected on the other, enough individuals in the group may survive to replicate the cultural practices making up the infrastructure. Premodern methods of birth control have included extended lactation, herbal potions, separation of the sexes, traumatic abortion (pounding a pregnant woman's abdomen, etc.), and infanticide. Although some of these methods are obviously aversive to most individuals and deadly to others (e.g., traumatic abortion and infanticide), humans have necessarily resorted to such methods when less aversive methods failed to control population (Harris, 1977, pp. 21–22).

The *structure* of a culture includes do-

² This is my understanding of the distinction Harris makes, and is expressed in behavior analytic terms, not in Harris's terminology.

mestic and political practices that support the infrastructure by “maintaining secure and orderly behavioral relations among [the society’s] constituent groups and with other societies” (Harris, 1979, p. 51). The cultural practices comprising the cultural *structure* include the differing behavioral patterns of different family members and different social classes; age and sex roles; education and socialization practices; political organizations, tax practices, military and disciplinary practices. In this system, infrastructural practices are the foundation on which structural practices are built, and not vice versa.

Emerging from the infrastructure and structure is the cultural *superstructure*, those practices having to do with art, science, games, literature, advertising, rituals, and sports (among others). These practices are accompanied by an entire set of superstructural practices that are less clearly related to empirical consequences—e.g., myths, religious beliefs, magic, aesthetic standards, ideologies.

A fundamental principle of cultural materialism is referred to as “infrastructural determinism,” which means that the requirements of the infrastructure ultimately account for the selection of practices in all cultural components. The reasoning goes like this. Infrastructural (i.e., production and reproduction) practices produce outcomes that affect survival of the permaclone.³ If infrastructural practices do not change as the requirements of the infrastructure change, the group together with its practices (the permaclones constituting a sociocultural system) will ultimately fail to survive. If variations in infrastructural practices enhance the balance of production/repro-

duction, changes in the structure and superstructure may follow, supporting the infrastructural changes.

Variations in domestic and political practices may occur, but only those changes that are consistent with the requirements of the infrastructure spread through the culture. Local inconsistencies between structure and infrastructure result in the structural variations “extinguishing.” If infrastructural requirements change, then variations in domestic and political practices may be amplified throughout the cultural structure and also in the cultural superstructure. However, once a coherent pattern of infrastructural, structural, and superstructural practices has emerged, deviation amplification is difficult because of “system-maintaining negative feedback, the dampening of deviation resulting either in the extinction of the innovation or in slight compensatory changes in the other sectors, changes which preserve the fundamental characteristics of the whole system” (Harris, 1979, p. 71).

Changes in infrastructural practices that increase productive efficiency or reduce reproductive pressure, however, are most likely to be replicated throughout the sociocultural system, leading to changes in structural and superstructural practices. Variations having their source in the structure or the superstructure are rarely amplified in the infrastructure, however, because infrastructural practices are likely to remain consistent with production and reproduction requirements. The positive role of structure and superstructure in cultural evolution is limited to the possibility of “lessen[ing] the resistance to an infrastructural change” that is brought about by changing infrastructural requirements (Harris, 1979, p. 72).

Many of Harris’s books (e.g., 1974, 1977, 1981, 1985) analyze cultural practices in terms of infrastructural requirements of cultures as those requirements have changed (and are changing) over time. Domestic, political, and religious practices are traced to changes in relations between production/reproduction practices and the physical environments in which the cultures evolved.

³ Important to note it that the selection process under discussion here is NOT *natural selection*. In natural selection, individual organisms interact with environments and, as a result, genes survive and replicate themselves (Dawkins, 1986). In cultural selection, individual organisms interact with the environment (an important part of which is comprised of the activities of other organisms) and the entity that survives to replicate itself is a cultural practice (cf. Skinner, 1981). Both the cultural practice and the gene are “carried” by organisms.

In his earlier work Harris (1964) builds the concept of a culture from the bottom up, beginning with the smallest cultural thing—a bit of behavior. The analysis proceeds from molecular to molar units—permaclones and permaclonic systems. In *Cultural Materialism* Harris develops another kind of conceptual scheme, beginning with the culture as a whole, with all its existing permaclones presumably in action. Cultures are described in terms of three general classes of cultural practices, those constituting the infrastructure, the structure, and the superstructure of a culture.

Harris's earlier analysis is not clearly integrated with the principles promulgated in his later works (e.g., 1979).⁴ The composition of cultural things was Harris's first focus and the *function* of cultural things his second. Clear specification of the relation between behavioral selection and cultural selection may help integrate the taxonomic and functional concepts of cultural materialism as well as make possible a synthesis of behavioral and cultural sciences.

In the next section of this article, I develop the distinction between behavioral contingencies and cultural contingencies. In the last section of the article I attempt to integrate the theoretical core of behavior analysis with some of the cultural materialist concepts summarized above.

BEHAVIORAL CONTINGENCIES AND CULTURAL CONTINGENCIES

In the previous section, I mentioned several times that cultural practices had *outcomes*; they are empirical and measurable. For example, the outcomes of reproductive practices can be measured in terms of the number of individuals to be sustained by a culture during any given time period. Of vital interest is the

rate of reproduction and *changes* in rate. Similarly, production practices have measurable outcomes, for example, number of bison killed, or yams dug up, or cars rolling off the assembly line. Production can also be measured in terms of "labor efficiency (calories obtained per calorie expended)" (Harris, 1977, p. 34) or *changes* in labor efficiency.

This section of the article is divided into two parts. The first part relates behavioral contingencies to cultural practices, and the second part relates cultural practices to cultural outcomes.

Behavioral Contingencies and Cultural Practices

The basic elements in the contingency of reinforcement are the activity of an organism in a given environment and the consequences (changes in the world) contingent on that activity. The size of a behavioral unit may vary over time, and similar units may be observed in the repertoire of other individuals, but a behavioral unit is specific to an individual organism. Common characteristics in behavioral units of different organisms may be seen as similar to the biological concept of convergence. For example, a particular biological characteristic, echolocation (Dawkins, 1986), evolved independently in bats and oil-birds because entirely different evolutionary lines faced similar environmental exigencies at quite different points in time.

"Echolocation," then, may be a verbal response humans make in the presence of certain kinds of events having similar features but with different genetic histories. Not all events called "echolocation" have a single evolutionary source even though they function as a common stimulus class for the verbal response "echolocation."

Similarly, the behavior of several parents in responding to their crying children may have common characteristics (structural and functional), but each parent's behavior has its own source in historical contingencies. Instances of Ms. Martin's *picking up the baby* comprise a unit (an operant). The relation of the in-

⁴ Readers of drafts of this paper have questioned whether Harris considers his earlier work still relevant or important to a behavioral synthesis. I believe he does, because he specifically referred me to *The Nature of Cultural Things* and went to the trouble of locating a copy of the book, which is out of print.

stance to the unit is parallel to the relation between individual organisms and the biological unit called a "species." Mr. Bell's repertoire may include an operant unit that resembles Ms. Martin's. We may call that unit "picking up the baby" too. It is critical, however, to distinguish between the similarity in the behavior/environmental relations we observe (which lead us to call both operants "picking up the baby") and the individual histories of the two parents that resulted in their behavior looking "the same" to us.

The behavior of the two parents does not belong to the same behavioral class (any more than echolocation in bats and oil-birds belongs to the same biological class) because the same behavioral histories do not account for both. Although the histories may be similar, different empirical events actually account for the similarities in behavior. A change in contingencies for Ms. Martin will affect only Ms. Martin's *picking up the baby* operant; that change in contingencies has no effect on Mr. Bell's *picking up the baby* operant.

Because many individuals in a culture participate in the same cultural practices, it would be tempting to consider their behavior as functionally interchangeable. While that may be so at the cultural level, at the behavioral level it is not. Each individual's behavior must emerge as a function of specific historical, behavioral contingencies. Whatever a change in cultural practices involves at the cultural level of analysis, it also must involve changes in contingencies of reinforcement for the individuals participating in the practice.

Sociocultural systems arise from the interrelationships among the contingencies of reinforcement of which individuals' operants are a function. As Skinner (1969, p. 13) put it, "A culture . . . is the contingencies of social reinforcement which generate and maintain [its members'] behavior." Obviously, the social contingencies are replicated across individuals and generations or there would be no cultural continuity. Harris's permaclones are the entities exemplifying the social contingencies maintained across nomocloned of a single generation and

across generations. The systematic replication of interrelated behavioral contingencies comprising a permaclone leads us to the concept of a *cultural practice*.

A culture, of course, is not an unorganized set of social contingencies (any more than an animal is an unorganized set of cells). Conglomerates of contingencies clump together to form cultural practices as conglomerates of cells clump together to form organs in animals. Thus, a cultural practice is a subset of interlocking contingencies of reinforcement and a culture is made up of many such subsets.

In summary, a cultural practice is a set of interlocking contingencies of reinforcement in which the behavior and behavioral products of each participant function as environmental events with which the behavior of other individuals interacts. This is the *behavioral* view of a cultural practice. As Malagodi (1986) has suggested, the behaviorist vision must be broadened if cultural phenomena are to be encompassed by the behaviorist world view. Cultural practices must be understood at the *cultural* level of analysis before a synthesis can be undertaken. We have now reached the point at which the notion of a cultural contingency can be introduced.

Contingencies and Metacontingencies

If the selection of cultural practices is to be considered a "third kind of selection" (Skinner, 1981), we need to distinguish between the contingencies in the second kind of selection (behavioral contingencies) and the contingencies in the third kind of selection.

Behavioral contingencies involve contingent relations between the specific activity of individual organisms and specific environmental events, and each organism's behavior has a unique history. When the behaviorally potent environment is made up of the actions of others (and their products), and the behavior of those others has been conditioned by similar kinds of contingencies, a cultural practice propagates itself. The behavior of any new participant (new-

born, new parent, new employee, kindergarten enrollee, etc.) is shaped and instructed by those already involved in the practice. The new participant's behavior is in part a function of those contingencies provided by the others. However, the environmental events comprised of the *others'* behavior include the behavior of the new participant.

Since each individual in a culture is unique (having a unique genetic structure and a unique behavioral history), variations in the cultural practice are bound to occur. They are a function of variations in the specific behavioral contingencies for each participant in the practice. The behavior of each individual participating in the practice has its own consequences. Even so, there are certain "constants" that provide parameters for most participants. For example, in the American practice of building automobiles some constants have been the types of jobs to be done, factory design for assembly lines, pay scales, and supervisory structure. Other elements of the environment can be more dynamic and fluid (specific ways individual supervisors respond to workers, how pay relates to work performance, co-workers' verbal and nonverbal responses to management as well as to objects involved in the task). Behavioral contingencies for any specific participant in the American practice of "manufacturing cars" may vary, but the behavioral environment (and the behavior) of all individuals is constrained by physical and institutional structures of the larger environment in which automobiles are manufactured. Those structures also provide the framework for the rapid transmission of practices across changing nomoclines that comprise a permaclone.

The cultural practice, the set of interlocking contingencies supporting the behavior of all the participating individuals, has an outcome, of course. In the above example, the outcome is the number and quality of cars manufactured (measurable in terms of service records, length of car life, drivers with backaches, injuries, or deaths in collisions, etc.). Important to note, the outcomes of practices

are a function of the aggregate behavior of participants in the context of the physical and institutional structure of the company. Because the outcome of the practice is contingent on the behavior of so many different people, variations in the behavior of any individual have no measurable impact on the cultural outcome. As long as shifts in individual behavior average out, there is no change in the outcome. If shifts in individual behavior converge to produce a changed outcome, no *specific* individual could affect that outcome in any significant way because the effects of an individual's behavior are lost as a fraction of the aggregate.

The outcome of these practices does affect the viability of the practice as a *unit*, however. The practice evolved because variations in interlocking contingencies resulted in outcomes that enhanced the survivability of the permaclone (which, of course, includes cultural practices). If the continuing outcome of the continuing practice is cars that are bought, the practice is likely to survive. If the outcomes essential for survival of the practice do not occur, disintegration of the specific permaclone or permaclonic system is the result (as in the recent example of American Motors Corporation).

The metacontingency is the unit of analysis encompassing a cultural practice, in all its variations, and the aggregate outcome of all the current variations. The outcomes of cultural practices must, of course, be specified empirically. For example, the number of children who can read at a certain level of proficiency is the outcome of educational practices. The amount of milk available for drinking is the outcome of farming and dairy practices. The number of children born is the outcome of sex and birth control practices. The functional relationship between cultural practices and their outcomes feeds back into cultures through the selection process. If variations in the practice fail to keep pace with changes in the metacontingencies, the practice is no longer selected. Practices that "fit" their

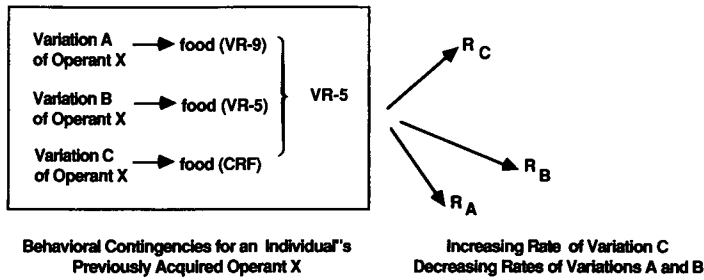


Figure 1. Functional relation between behavior/consequence relations and future probability of operant x for Individual O. The difference in consequences can result in the differentiation of operant x into two or more units—one that increases in rate and the other(s) that decrease in rate if other conditions are held constant. Behavioral consequences are contingently related to the behavior of the individual emitting operant x .

environment produce outcomes that maintain permaclones (i.e., the continuous practices of a group comprised of individuals gradually replaced over time). This is selection of the third kind.

Selection at the behavioral level and selection at the cultural level may easily be confused because they both involve relations between behavioral events and resulting changes in the environment. Cultural outcomes, however, do not select the behavior of individuals; they select the interlocking *behavioral contingencies* comprising the cultural practice. Likewise, the behavior of any specific individual has little effect on cultural outcomes. The concept of metacontingency clarifies that cultural processes and behavioral processes occur at different levels of organization.

The figures here are an attempt to schematize behavioral contingencies and cultural contingencies and their relation to one another.⁵ Figure 1 depicts a behavioral contingency and its function in the biobehavioral world. The contingency of reinforcement, or the unit of analysis in behavior analysis, results in increased probability of a class of behavior of a specific person. The contingency functions to shift the probability of occurrence of a class of responses (operant). Consequences select responses of certain dimensions (or a range of stimulus con-

trol relations), increasing or decreasing the probability of replication. Stable responding indicates ecological balance—so long as environmental conditions for the operant remain consistent, the probability of the operant over time is likely to remain stable.

Figure 2 depicts the interlocking contingencies of reinforcement that constitute a cultural practice. The practice of “teaching reading” involves a large number of people, most of whom never come in direct contact with others participating in the practice. Each individual’s participation in the practice is maintained by individual contingencies. Taken together, every participant’s behavior and the contingencies maintaining the behavior comprise the cultural practice. Elements in the contingencies include the teaching behavior of teachers and the reading behavior of pupils, the reading materials, written and oral guidelines provided by state agencies, the school board’s directives, the verbal comments of other teachers, the principal’s instructions, the nonacademic behavior of pupils and teachers in the classroom, the physical layout of the classroom, and any number of other environmental events and contexts. Responses and response products of the designers, publishers, and salespeople of reading programs plus all the people mentioned above who function as part of the teacher’s environment are also part of the cultural practice.

Each of the individuals participating in

⁵ These figures are variations of those in Glenn (1986b).

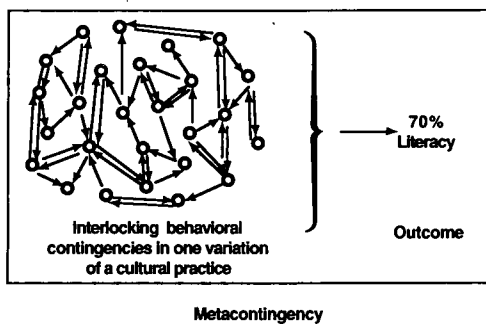


Figure 2. Elements of a metacontingency. A cultural practice is comprised of interlocking behavioral contingencies for a large number of individuals. In this schematic the O's denote individual behaviors and the arrows denote behavior entering into the contingencies of reinforcement supporting the behavior of those individuals (O's) to which the arrows point. This variation of an educational practice results in 70% literacy. The behavior of individuals is maintained by the behavioral contingencies, but the outcome of the practice can affect the viability of the culture. Current versions of the educational practice are variations of practices selected by previous relations between earlier metacontingencies and requirements of the infrastructure.

any variation of an educational practice is behaving as a function of the unique contingencies in which his or her behavior enters. A teacher's choice of a reading program is a joint function of the verbal behavior of the salesperson, the opinions of colleagues, the philosophically biased statements of the teacher's instructors, and the reinforcement value of the materials themselves for the teacher. Another program might produce a much better *cultural* consequence (more readers), but individual teachers are not likely to go through the painful process of learning new techniques when *behavioral* contingencies are stable, that is, continue to support well-learned behavior (cf. Hopkins, 1987).

Figure 3 suggests a kind of cultural parallel of the relations seen in Figure 1. The practice of teaching reading is seen to have several variations, each producing a characteristic outcome. While the practice as a whole may result in outcomes having a suppressive effect on production efficiency (assuming that production needs required almost everyone to read),

one variation of the practice would have a less detrimental (possibly a positive) effect if that effect were produced by the practice as a whole. But the relation between the better variation and production efficiency could easily be obscured and its effect obliterated by the effects of the other variations.

Considering the three figures together, one might see that cultures whose educational practices produce more readers have a survival advantage (over those that produce fewer readers) if reading behavior is critical in production and/or reproduction practices. However, better educational practices (those that produce relatively more readers) may lose out to worse educational practices for a long time in a complex culture if behavioral contingencies for individuals support the behavior of those involved in the less productive practices. A *gradual decline* in productivity could occur. The decline may or may not be monitored by members of the permaculture or by others; if monitored, the monitors may or may not be able to identify the variations in practice contributing to the decline (or capable of reversing it); if able to identify the problematic practices, people may or may not be able to intervene effectively in changing the behavioral contingencies for enough people to constitute a change in the cultural practice that could result in a "better" outcome.

As long as behavioral contingencies support the behavior comprising the less productive educational practice, cultural outcomes may continue to select that practice *so long as the metacontingencies do not change sufficiently to result in dissolution of the permaculture or permacultural system carrying the practice*. Because a cultural outcome is a joint function of the behavior of many different people, the outcome may be poorly correlated with the behavior of many of the people engaged in the practice. A cultural practice may produce increasingly ineffective outcomes but continue occurring because the behavior of its individual participants is maintained by stable *behavioral* contingencies.

In summary, metacontingencies de-

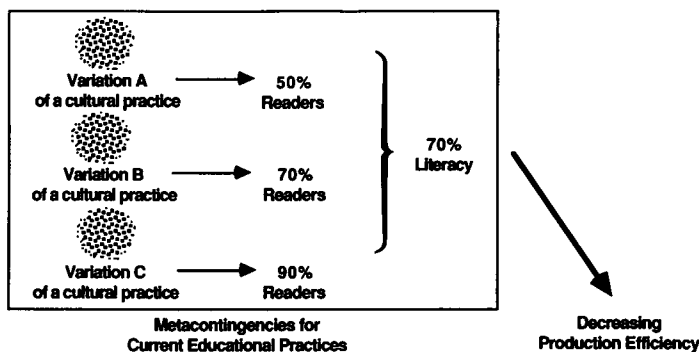


Figure 3. Functional relation between a metacontingency and future production efficiency. Note that variations of this complex practice have varying outcomes. The *aggregate* outcome can pull production efficiency down (or up), but a variation that produces more readers does not necessarily result in more reinforcement for individuals involved in that variation. The reinforcement (provided by others participating in the practice) for participating in a variation is not likely to be correlated with its outcome if the practice involves large numbers of people scattered over large areas. The differential correlation of variations with different outcomes is even less likely. The variation with a more favorable outcome will replace lesser alternatives only if behavioral contingencies change for people engaging in the practices having less favorable outcomes.

scribe functional relations at the cultural level. Those relations involve cultural practices and their outcomes. Cultural practices themselves are comprised of interlocking behavioral contingencies. The relation of contingencies to the metacontingencies of the infrastructure, structure, and superstructure of culture materialist theory will be discussed next.

CONTINGENCIES, METACONTINGENCIES, AND EVOLUTION OF CULTURES

The interlocking behavior of individuals constitutes cultural practices, which produce different kinds of outcomes. The three structural components of a culture—its infrastructure, structure, and superstructure—are classified in terms of their associated practices and outcomes. The remainder of this article will focus on two things: (1) the shifting infrastructural metacontingencies of increasingly complex cultures and (2) examples of possible changes in behavioral contingencies comprising the cultural practices entering into those metacontingencies. Focus will be on infrastructure, rather than structure or superstructure, since the infrastructure is given priority by cultural materialists.

Infrastructural Contingencies and Metacontingencies

Infrastructural *contingencies* are those interrelated behavioral contingencies that constitute a production or reproduction practice characterizing a permaclone. Infrastructural *metacontingencies* are the relationships between these infrastructural practices and their outcomes—outcomes having direct effect on survival of a permaclone (succeeding generations of people engaging in a continuous cultural practice). Cultural evolution depends on the evolution and maintenance of cultural practices that meet changing production and reproduction requirements, that is, changing metacontingencies.

If at one point in time, a permaclone could produce two bison a week by each member's hunting 3 hours a day, and later they had to hunt 7 hours a day to produce two bison a week, the metacontingencies had changed. Variations in practice that slow, halt, or reverse such declining efficiency enhance survival of a permaclone. That does not mean, of course, that such variations always occur. Throughout human history, infrastructural metacontingencies have changed continuously, one reason being that human cultural practices have continuously

brought about changes in the environment with which humans interact.

Variations in cultural practices are always occurring because practices involve the behavior of succeeding generations of individuals who live in slightly different behavioral environments from individuals of previous generations. One important difference is that each generation's environment contains concrete tools (e.g., longer spears) and conceptual tools (e.g., the numeral "0") that allow forms of behavior by the current generation that were not possible for previous generations (cf. Ayres, 1962).

Like biological evolution and behavioral evolution, cultural evolution has resulted in increasingly complex organizations of entities over time. Malott and Whaley (1976) suggested that systems (chemical, biological, behavioral, or cultural) reach a point of instability as complexity continues to increase.⁶ At the point of instability, systems cannot be maintained.

Instability of cultural systems may occur when complexity reaches a point where cultural outcomes consistently fail to feed back into the interlocking contingencies of reinforcement comprising cultural practices. The complexity of the practices obscures the relationship between individual behavior and outcomes of cultural practices. So, behavioral contingencies that might support beneficial infrastructural variations may not be maintained by individuals participating in the practice. Both Skinner (1948) and Harris (1981) have suggested small communities with face-to-face interactions among members as a solution to problems endemic to large, complex cultures like our own. Such communities would, of course, be more likely to maintain be-

havioral contingencies closer to cultural outcomes. In the following pages, I shall try to show that as cultural practices have become more complex, the outcomes of those practices maintaining the culture have become progressively unrelated to reinforcement in the interrelated behavioral contingencies making up the practice. We begin with the paleolithic culture and follow the path traced by anthropologists through cultural history.

Paleolithic contingencies. During the course of tens of thousands of years our ancestors developed tools and technologies for hunting large animals. The ubiquity of hunter/collector bands around the world and the time span covered by succeeding generations of such human bands suggest that paleolithic practices had high survival value. They also suggest that the environment with which humans interacted did not change in ways that required substantial changes in practices. Between 30,000 and 13,000 B.C. paleolithic technology reached its peak; an abundance of large animals provided a highly nutritious diet in return for a modest behavioral investment (Harris, 1977).

The human bands that hunted and collected during paleohistory may be seen as a large number of permaclones, some of which survived as a continuing unit throughout the Old Stone Age, some of which failed to survive altogether (all members died and their practices with them). There were also some which failed to survive as a unit, but which contributed members (and components of cultural practices) to other permaclones that did survive. Because the practices of all those permaclones were similar, we tend to lump them together when discussing paleolithic *culture*. Paleolithic culture survived only as long as there was at least one permaclone engaging in practices characteristic of the paleolithic period.

Each member of a paleolithic band must have been engaged directly in food production. Cooperative nonverbal behavior would have enhanced safety and amount of food per capita in the era of big game hunting. Verbal behavior that coordinated and supported such nonver-

⁶ Malott and Whaley (1976, p. 23) give the example of uranium as the element whose atomic complexity is at asymptote. Atoms more complex than uranium exist for only a short time because their complexity makes them inherently unstable. Heavier elements than uranium cannot enter into the next level of evolution because their existence is too unstable. Only stable elements could combine to produce organic compounds that eventually made genetic replication possible.

bal behavior would have resulted in more food. Of course, the verbal community itself must have evolved. Skinner (1986) provided an imaginary scenario of two people whose fishing behavior evolves as verbal behavior gradually emerges, coordinating and supporting nonverbal behavior of the fishers. Skinner's scenario portrays the emergence and maintenance of interlocking behavioral contingencies that produce an outcome that is the joint function of verbal and nonverbal behavior of the participants. This scenario could as easily have described the emerging integration of verbal and nonverbal behavior of participants in a hunting practice.

While animal proteins were plentiful and fairly easily obtained, and production practices involved only a small number of interlocking behavioral contingencies, the outcome of the practice (food obtained) might be understandable as reinforcement in behavioral contingencies as well as the outcome of a cultural practice. In the simplest case, each participant's behavioral sequence in the cooperative enterprise can be viewed as a chain in which the other participants provide many of the discriminative stimuli and conditioned reinforcers.

Even in this simplest case, however, the outcome for the *group* (amount of food per capita) was a function of the adequacy of the *practice* (interlocking contingencies of reinforcement). The behavior of individuals was necessary but it was not sufficient for survival of the permaclone. Individuals whose behavior was not integrated with others in a cultural practice could have little effect on the outcomes critical to survival of a permaclone. The earliest practices integrated the behavior of individuals because a single event served two functions—reinforcement of individuals' behavior and selection of the interlocking contingencies of reinforcement.

Infrastructural reproductive practices seem to have involved a similar relation between behavioral contingencies and metacontingencies. Children born in rapid succession made caring for all of them difficult. Limiting the number of births protected the living children and pre-

cluded an excessive number of children to feed and carry about. When less aversive birth control practices failed, people apparently have resorted to abortion and infanticide to avoid negative consequences associated with excessive number of live births. People other than pregnant women undoubtedly participated in these practices, both verbally and nonverbally, and their behavior may be understood as avoidance of problems associated with more infants than could be fed and cared for by a nomoclone. Thus, the cultural outcome and the behavioral consequences for individuals participating in the practice involved the same event. Important to note is that the critical consequences were not always *immediate*; they may have been quite delayed, requiring association with conditioned reinforcers and verbal instruction (perhaps in the form of gesture). Immediate or delayed, the same events served to reinforce (as conditioned or backup reinforcers) the behavior of individuals and to select the cultural practice.

Separation of consequences and outcomes: A village example. A variation in a cultural practice involves a change in some behavioral component of that practice which is replicated in the behavior of other participants. Such a variation will amount to a change in the behavioral contingencies for still others engaged in the practice. For example, consider a village production practice where some people weave baskets in which others carry water from a river. The baskets leak a little, but enough water can be obtained to perform essential tasks on a daily basis. A weaver who ties a slightly different knot may provide a basket that must be set down periodically in order to tighten the knots and thus prevent excessive leakage during transit. The water carrier is likely to complain and possibly instruct the basket weaver to behave differently; if things do not improve, the water carrier may provide the basket weaver with a smaller share of the water brought back, or complain to others who may scold or withhold other items. The basket weaver may revert to earlier knot-tying behavior

or experiment with other ways to tie the knots.

Another kind of new knot may result in a basket that does not leak at all. Water carriers ask for that weaver's baskets and reinforce that weaver's behavior in various ways. Other weavers watch that weaver tie the new knot and imitate the behavior. As the new knot becomes the standard knot, the variation of the practice becomes the standard practice. Social reinforcement is now contingent (but delayed) on weavers making baskets that do not leak at all. Interlocking behavioral contingencies that produce watertight baskets become the standard practice. Such a practice, brought about by changing behavioral contingencies, results in a state of affairs that allows water storage.

At some point (during droughts, for example), water storage allowed permaclones that had developed water storage practices to survive while those permaclones that had not produced baskets in which water could be stored disappeared; the basket-making and water-carrying practices of the former permaclone survived while replication of the latter's practices ceased. Only some interlocking behavioral contingencies (cultural practices) were selected by outcomes.

Contingencies of reinforcement account for the survival of the behavior of individuals participating in the changing practice described above; metacontingencies account for the survival of the practice. In the above example, behavioral contingencies constituting a cultural practice changed as variations in *individuals'* behavior were reinforced and replicated in the behavior of others. The reinforcers provided by others were closely related to a primary reinforcer (water) for individual behavior; and efficiency in water production produced a cultural outcome (more water than was needed for immediate survival) that resulted in survival of the permaclone when metacontingencies changed. The outcome of the practice strengthened the permaclone as a unit, while the behavior of individuals was maintained by consequences provided by others.

Individuals participating in a practice maintained the behavior of other participants because their own behavior in doing so was reinforced. When the practice emerged in the culture, the behavioral components remained intact so long as the individuals' behavior was reinforced (or, perhaps, doing otherwise was punished). This practice was not *directed toward* a cultural "end." However, the practice had an outcome that affected survival of the group at a later time. The ability of the group to increase water production during a drought (due to their superior water storing, which resulted from improved basket making) would result in that permaclone's survival (and further replication of that practice).

The relation between behavioral contingencies and cultural outcomes is parallel to the relationship between genetic mutations and the organismic outcomes selected by the environment in natural selection (cf. Dawkins, 1984). Variations in the practice, like genetic variations in species, do not generally occur because of the outcomes they are going to produce.⁷ Their occurrence may be stimulated by conditions in the environment (x-irradiation or the behavior of others engaged in the practice) or they may be random (as observed in relation to the level of organization that they affect—bodies and cultural practices). But only sometimes are they selected—when their results allow the carrier (organism or permaclone) to better meet environmental exigencies, thus allowing further replication.

As cultural practices become more complex, social reinforcement of individual behavior remains a matter of individuals' maintaining behavior of others that is reinforcing for those individuals. The cultural outcome of these interlocking contingencies of reinforcement may or may not support cultural survival.

⁷ Of course, humans have made planned interventions in contingencies at all three levels after they became able to specify the relations between their interventions and outcomes.

The “blind” character of cultural evolution is similar to the blind character of biological evolution and behavioral evolution. From the perspective of a contemporary observer, evolution appears to have been directed *toward* the present state of affairs since only “successful” species, operants, and cultural practices are around to be examined. At any given time, however, we must assume (indeed it seems we can *see* with the help of science) that some species, operants, and sociocultural systems are not likely to survive in their current environments or any environments likely to prevail in the near future. Variations aiding in survival (or at least not hindering it significantly) at one point in time may carry the class (species, operant, or cultural system) into an evolutionary corner when environmental contingencies (at the relevant level) change.

Agricultural intensification and emergence of nonreciprocal behavioral contingencies. Cultural practices having the outcome of “redistributed goods” appear to have characterized virtually all human cultures. The metacontingencies of preagricultural cultures (a few of which exist yet) favored egalitarian societies where redistribution took the form of *reciprocity*. Individuals gave to their neighbors at times and got from those neighbors at other times. No one said “thank you” and gratitude did not exist—it suggested a nonreciprocal relationship (Harris, 1974, pp. 105–108). Prestige in those egalitarian societies came from being “equal,” giving and taking in a reciprocal fashion; and the status relations (relative ranks in a hierarchy) typical of later-emerging cultures did not exist.

At the behavioral level of analysis, the reciprocity in egalitarian cultures is a function of the equal access to, or control over, reinforcers shared by all members of the community. Equal access negates imbalances in behavioral control that, in the most extreme cases, typify slave/master relations. A master (who controls all access to primary reinforcement) is able to control the behavior of slaves through negative reinforcement and pun-

ishment, while the slaves (lacking direct access to primary reinforcement) must positively reinforce the master’s aversive behavior if they are to survive. The behavioral contingencies are nonreciprocal. “Built into the structure of any equitable group must be the fundamental requirement that the rulers be subject to the same contingencies as the ruled—indeed, that there be no such distinction as ruler vs. ruled” (Segal, 1987, p. 150).

At the cultural level of analysis, egalitarian reciprocity was selected and maintained by infrastructural outcomes that mitigated against accumulation of wealth (no place to store it, no way to keep it from spoiling) and excessive intensification (i.e., increasing rate of production). Any preagricultural permaclone in which rank and status based on competitive production emerged did not survive, because the intensification was limited by the “natural” rate of reproduction among the plants and animals that humans foraged. Preagricultural production was thus strictly limited by ecology. Since competition led to intensification and intensification to depletion in preagricultural cultures, any such practices that emerged in such cultures disappeared.

A different set of metacontingencies prevailed in agricultural economies. The development of agricultural practices allowed long-term intensification to occur without concomitant “sharp depletions and efficiency losses” (Harris, 1977, p. 103), because agriculturists did not wait for nature to take its course. Agriculture evolved because it allowed people to intervene in natural processes in ways that resulted in higher production rates. Agricultural practices, then, brought about a change in infrastructural metacontingencies. Intensification practices that would have destroyed hunter/collector permaclones were selected in agricultural economies because they resulted in more food per capita and related outcomes (e.g., brawnier fighters).

The cultural practices that supported such intensification involved a new kind of redistribution—one in which nonre-

ciprocal behavioral contingencies became prevalent.⁸ An intermediate kind of culture between egalitarian cultures and the first "states" was that in which individuals (dubbed "Big Men") specialized in "managing" intensification and redistribution (Harris, 1974, 1977). At first through methods involving interpersonal behavior and a history of having organized successful feasts, Big Men convinced producers to work harder, produce more, and contribute heavily to the Big Man's feast (thereby sharing some of the Big Man's status). At the feast, the Big Man gave away the food and other items to those in his own village (and sometimes to guests from other villages). The Big Man himself, in the early stages of the practice, worked harder than anybody and got less than anybody at the feast ("bones and stale cakes"). In short, the Big Man got the status, and the little people got the "meat and fat"; everybody worked hard.

This practice functioned to redistribute each year from the haves to the have-nots of a given community, keeping the permaclone intact. When expanded to include feasts between different permaclones (that may exchange members through marriage), the practice maintained both permaclones through redistribution.

Agricultural practices evolved and intensified as increasing labor efficiencies (associated with advancing agricultural technologies) allowed individuals to keep more of the children they conceived, thereby avoiding some aversive and dangerous abortions and infanticide. But the human race dug itself into an intensification trap: "Despite the fact that irrigation agriculture was five times more productive per man-hour than horticulture, the entire 9,000 year sequence of intensifications, depletions, and technological innovations [from the beginning

of agriculture to the present] resulted in an overall deterioration in nutritional status [of people in general]" (Harris, 1977, p. 35).

Cultural systems became more complex; individuals came to participate in multiple permaclones (e.g., as fathers, as canal-builders, and as firefighters), each comprised of different individuals. Permaclonic systems emerged, in which individuals contributing to a cultural outcome never interacted with most of the other participants engaged in the cultural practice. The *nonreciprocal* behavioral contingencies that accompanied and characterized "the descent of the world from freedom to slavery" (Harris, 1977, p. 102) were institutionalized in large and complex cultures.

Rise of the state. The transition from agricultural economies with "chiefs" to states with "kings" was one in which the interlocking behavioral contingencies gradually shifted. No individual behaved very differently from one day to the next. But gradually, over time, the practices changed. The changes supported the growing cultural requirements for central planning to coordinate wars and, later, production projects such as hydraulic farming, which eventually became necessary if the ever-increasing population was to be fed (Harris, 1977, chap. 13). The shifting behavioral contingencies of reinforcement can be discerned in Harris's description of the changes in the practice of competitive feasting. Big Men took more and gave their followers less. The practice still had the cultural function of intensification, but hereditary chiefs gained more and more control over community resources. Once certain individuals controlled resources, they had the power of nonreciprocal aversive control over others. Chiefs, unlike the earlier Big Men, did not have to depend on the generosity of their followers; they had the power of coercion. Once individuals held positions of "relative rank" in a community, those with rank were in a position to control the behavior of others through institutionalized negative reinforcement. Because rank was associated with control of production practices,

⁸ Richard W. Malott has provided what he has termed a "microanalysis" of behavioral contingencies in cultural practices where indirect-acting contingencies play a significant role (Malott, 1988). Such indirect-acting contingencies would seem likely to have become more prevalent at about this point in cultural evolution.

tools, land, or goods produced, social reinforcement was backed up by concrete reinforcers closely related to primary reinforcement.

The rest is, indeed, history. As cultural outcomes supported practices with ever-diminishing behavioral reciprocity, the behavior of individuals was locked into these practices by the contingencies provided by others participating in the practice. The interlocking contingencies themselves continued to be selected by an environment that required more and more intensification and centralization for survival (given the increasing population levels). Centralization necessitated bureaucracies and further separation of those individuals controlling the resources from those producing the resources.

Technology in the industrial age. Increasing intensification at the cultural level has been matched by decreasing reciprocity at the behavioral level throughout most of human history. Only once in human history has technology advanced fast enough to overtake the intensification trap that leads to declining efficiencies. That once has been during the past 150 years (Harris, 1977, chap. 15). In those sociocultural systems where technology overtook intensification (i.e., Western Europe and the United States), practices emerged that began to reverse the long decline of behavioral reciprocity. The infrastructure of industrial nations could give rise, for the first time since the paleolithic era, to domestic and government practices that fostered a trend toward more reciprocal behavioral relations among rich and poor, men and women, and governors and governed.

These changes in domestic and political practices have been accompanied by what Skinner (1971, p. 61) calls "the literature(s) of freedom and dignity." Explication of the relations between those literatures, the reemergence of reciprocal behavioral relations in Western structural practices, and the changing metacontingencies that have supported both may clarify the importance of a synthesis of behavior analysis and cultural materialism. In ending this article, I shall outline

briefly what appears to be the nature of those relations.

Technology was able to overtake intensification for the first time during the industrial age because three infrastructural changes occurred: these Harris (1977, p. 280) calls "the fuel revolution, the contraceptive revolution, and the job revolution." The fuel revolution involved the massive increase in labor productivity made possible by the use of engines run by way of conversions of electrical and chemical energy sources as opposed to biologically derived energy (i.e., work animals and people). This increase in labor efficiency was accompanied by the availability of relatively safe mechanical and chemical contraceptive devices, allowing individuals the opportunity, for the first time in history, to control reliably the number of infants they produced without having to resort in the worst case to infanticide and traumatic abortion. The job revolution motivated individuals to limit the number of children they bore to a very small percentage of the number they were biologically capable of producing. Industrialization changed the cost/benefit ratio of rearing children; they are of little economic benefit and of great economic cost in sociocultural systems where complex skills and long education are necessary before individuals have economic usefulness.

So infrastructural metacontingencies in the industrial age allowed for the emergence and selection of new kinds of production and reproduction practices. These practices, in turn, produced a population whose skills as individuals were more important in the industrial process. Individuals who, in earlier times, would have been "behaviorally interchangeable" developed unique behavioral repertoires as they interacted with ever more complex environments. A large middle class emerged, acquiring some degree of economic countercontrol (a function of their "buying power" and possibly of the need of government and industry for their specific skills).

The possibility for countercontrol allowed the reemergence of reciprocal behavioral contingencies. When cultural

practices involve individuals in interlocking behavioral patterns in which many individuals have unique control over some resources needed by others, reciprocity again becomes possible. A trend toward parity in behavioral relations making up infrastructural practices could be amplified, next, in cultural structures, as has indeed been evident in the United States as suffrage was extended from property owners to all white males, to all races and, finally, to women. Increased parity in domestic practices, of course, awaited infrastructural changes that made women in the work force economically useful to producers (Harris, 1981, chap. 5).

Infrastructural and structural practices that involved increasingly reciprocal behavioral contingencies were, then, maintained by the metacontingencies of a rapidly changing technological environment. These changing practices were supported and amplified by the superstructural literatures of freedom and dignity, which were an amalgam of prescientific conceptions of human nature and accurate labeling of the nonreciprocal behavioral contingencies which humans have universally escaped and avoided whenever possible (cf. Skinner, 1971).

Both Harris and Skinner, as well as many other writers, agree that modern cultures are at a crucial crossroad. The entire world faces overpopulation, ecological imbalance, resource depletion, and threat of nuclear annihilation. Our own culture faces serious economic and social problems. A critical problem may be that the outcomes of current practices are so far removed from the behavioral contingencies supporting individuals' behavior that unproductive variations of cultural practices continue being replicated. The solution to this problem may involve bringing behavioral contingencies within reach of cultural outcomes.

Harris suggests this can be accomplished by

radical decentralization . . . scaling down America's military-industrial complex . . . stimulating the development of the right kind of solar and other forms of decentralized energy production . . . energy efficient machinery to be used in small manufacturing

plants and in the home . . . development of legal barriers against takeovers of new energy technologies . . . the passage of legislation favorable to small businesses and community-based cooperatives. (Harris, 1981, p. 182)

Skinner's fictional utopia, *Walden Two* (1948), is a sociocultural system in which both contingencies of reinforcement and metacontingencies are portrayed as supporting a technologically sophisticated society comprised of productive, creative, and happy citizens. Every citizen has equal access to resources; behavioral contingencies are reciprocal; and intensification does not exist. The distribution of work and leisure rivals that of our hunter-collector ancestors, and every individual has opportunity and encouragement to develop his or her unique abilities for art, music, literature, and science. People live in attractive, comfortable, and private quarters, eat healthful and tasty food, dress as they wish, and develop interpersonal relations with those of similar interests or mutual attraction. *Walden Two*, in short, is portrayed as combining the best characteristics of both paleolithic and modern cultures.

Each in his own way, Skinner and Harris outline what needs to be accomplished in order to avert calamity. Such accomplishments will necessitate, of course, changes in the interlocking behavioral contingencies that characterize current cultural practices. If anybody is going to suggest how behavioral contingencies can be modified to accomplish those changes, surely it will be behavior analysts. If anybody is likely to provide a cultural analysis that will give direction to the changes needed, surely it will be cultural materialists.

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