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Genetic and Cultural Pools: Some Suggestions for a Unified Theory of Biocultural Evolution[1]

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By introducing the concept of the natural selection of individual organisms, Darwin was able to cut through the mystification surrounding theological discussions of the origin of species. By placing the concept of an individual "struggle for satisfaction" in an analogous conceptual framework, a similar feat may be performed with regard to the mystification and reification surrounding much of contemporary social science. The proposed theory states that individuals are the generating force behind the origin, spread, and transformations of sociocultural complexes and that all sociocultural phenomena are explicable in terms of the differential replication of ideas by individuals as this is conditioned by selective pressures generated by particular material conditions of life. The theory is used to illuminate certain key issues in evolution, such as adaptation, group selection, and free will.

INTRODUCTION

> "History" is not a person apart, using man as a means for its own particular aims; history is nothing but the activity of man pursuing his aims. (Marx, in Selsam *et al.*, 1970, p. 88)

The central concern of anthropology is the understanding of culture, that "complex whole" associated with human populations, and the anthropological endeavor is, above all, the attempt to answer certain basic questions about man and culture: What are the laws governing the functioning and evolution of sociocultural systems? How do we account for the observed similarities and dissimilarities in the cultural heritage of different populations?

Anthropologists have reacted to these questions in a variety of ways. In the nineteenth century, social science tended to view this problem in terms of an

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inexorable movement through predetermined stages, culminating, most frequently, in nineteenth-century Euro-American civilization. Reacting to the ethnocentric and racist overtones of such schemes, twentieth-century social science attempted to view sociocultural systems in their own terms and, seeing them as self-perpetuating entities, concentrated on the manner in which the various elements contributed to the maintenance of the system or expressed the basic principles of the system. Recent decades, however, have seen a resurgence of evolutionary thought in anthropology. This newer evolutionary approach sees culture as the peculiarly human mode of adaptation to the environment and concentrates on how particular traits facilitate a population's adjustment to its environment. Associated with this evolutionary approach, there has been a widespread and growing feeling within the social sciences that the transformations of sociocultural systems can best be explained in terms of some sort of analogue to the synthetic theory of biological evolution, involving such concepts as variation, selection, and adaptation (e.g., Suttles, 1960; Campbell, 1965; Cohen, 1968; Lenski, 1970; Dunn, 1970). Yet attempts to specify precisely the conceptual elements of such a model have been few and unsatisfactory.

This paper represents an attempt to focus debate on this problem by proposing, for cultural evolution, a strict analogue to the synthetic theory of genetic evolution and by suggesting, further, that both may be placed into a unified conceptual framework. According to this unified theory, both the genetic and cultural heritages of populations are determined by selective pressures emerging from the material conditions of life of the population and acting on the individual members of the population.

STATEMENT OF THE UNIFIED THEORY

Although complex and refined in its detailed application by biologists, the basic conceptual framework of the synthetic theory is quite simple. Evolution is change in the statistical frequency of alleles in the genetic pool of Mendelian populations. Such change results from the fact that the individual members of the population inherit different genotypes and hence exhibit variable phenotypes, and some individuals contribute more than others to the genetic pool of succeeding generations. This differential reproduction results from selective pressures which are generated by the material conditions of life of the population. There is thus a dialectical relationship between the individual and the population such that the individual's genotype is merely a sample from the genetic pool of the population but the statistical configuration of the genetic pool is a result of countless individual encounters with the material conditions of life of the population.

This dialectical relationship continues in the cultural sphere. The

behavioral tradition of a population is made up of the activity of individuals and depends on the ideas existing in the minds of individuals. The variable behavior of individuals, then, may be seen as the expression of the ideas of the individuals. The sum total of the ideas, including psychological drives, motives, cognitive maps, symbols, behavioral rules, norms, values, and so forth, of all members of a population constitutes the *cultural pool.* As the ideas in the cultural pool are expressed by individuals, they acquire an objective character of their own, confront the individual as an independent reality, and are, in turn, reabsorbed by the individual in the process of enculturation (*cf.* the externalization, objectivation, and internalization of Berger, 1969). Obviously, those ideas which are reabsorbed at a higher rate in this dialectical movement will tend to increase in the cultural pool, so that the differential replication of ideas by individuals plays a role in continuity and change in the cultural pool analagous to the role played by the differential reproduction of individuals in the genetic pool. It is necessary, then, to examine in greater detail the process of enculturation itself: Why are some ideas replicated at a higher rate than others?

We may begin by noting that the individual has various needs and desires which he tries to satisfy and suggest that the individual's "struggle for satisfaction" plays the same role in cultural evolution that his "struggle for survival" plays in biological evolution. The analogy is a good one since both phrases are misleading: they sum up important truths but distort truth so that a number of qualifications must be attached.

The "Struggle for Satisfaction" and Cultural Design

The individual, in seeking to satisfy his genetically based but culturally conditioned drives, is himself the motive force and primary selective mechanism of cultural evolution. The spread of technological and social organizational systems is overwhelmingly determined by the satisfaction they provide to their individual bearers. In making this statement, however, a number of caveats should be added.

It is not just the materialist needs of the individual which must be satisfied, but social and ideological needs as well. There is little sense in making elaborate generalizations independent of a specific context about what individuals will find satisfying, but we may note three general areas of individual satisfaction:

1. Satisfactions derived from interacting with environmental objects, such as food, clothing, shelter, air, and water.
2. Satisfactions derived from interacting with other members of the population, by exchanging expressions of love, affection, respect, hate, sexual lust, and so forth.
3. Satisfactions derived from the ideas themselves, from their logical consistency, explanatory power, sacredness, and so forth.

Needless to say, not only the forms of satisfaction but also the precise nature of the biocultural drives that require satisfaction are strongly influenced by the cultural pool through the enculturative process. The statistical strength of satisfaction in these areas is not equal, and, as Maslow (1970) suggests, there is likely a "hierarchy of needs" such that the lower-level needs are primary until they are satisfied, at which point the higher-level needs become stronger. The theory proposed here, then, is not intended to contravene either the well-established principle concerning the strength of the technoenvironmental and socioeconomic spheres in sociocultural causation or the general principle that individuals usually attempt to maximize their own wealth, power, and prestige.

Saying that there is an individual "struggle for satisfaction" should not be interpreted to mean that each individual is a social imperialist, ruthlessly seeking his own satisfaction independently of, or in opposition to, the rest of the population. Not only are the other members of the population themselves sources of satisfaction to the individual, but the individual himself generally finds his own satisfaction increased by cooperation with, domination over, or submission to other individuals, depending on circumstances. The result of this is not merely the summation of individual actions but the emergence of a distinct social level of interaction, of systems of cooperation, domination, and exploitation. Social structures themselves may be subject to positive or negative selective pressures depending on the degree to which they facilitate the satisfaction of individual needs and desires. Such systems, however, may not conform precisely to the wishes of any of their component individuals, since the actions of different individuals may conflict and produce unanticipated results. And the drives which require satisfaction may not be consciously recognized by the individuals themselves. Nonetheless, the motive force is still the individual. We suggest the term *cultural design* to apply to those sociocultural phenomena which are produced by the processes outlined above as well as to the processes themselves.

Importantly, the concept of cultural design can incorporate other sorts of explanations with only a slight shift of emphasis. Many of what have been called social needs are in fact needs of individuals. As Homans (1964, p. 814) recently noted about functional relationships, "Not the needs of society explain the relationship, but the needs of men." When it is said that trait X has function Y, this can usually be altered to say that trait X provides Y satisfaction to its bearers.

Other Selective Mechanisms

In addition to the process of cultural design, there are a number of other processes at work in cultural evolution. The cultural transmission of ideas is

extrasomatic. It operates through social structures which may give the ideas of some individuals greater force than others, independently of the satisfaction potential of the ideas themselves. An individual does not receive half the ideas of his mother and half the ideas of his father but instead confronts the objectified cultural pool as a unit, receiving ideas from all members of the population with whom he has contact, and these are not randomly selected. Some individuals have a wider network of social relations or a stronger voice in the communication network than others and therefore have a greater effect on the cultural pool of succeeding generations. To cite and involved but by no means extreme example, the cultural pool of New Orleans contains a number of legal ideas drawn from the Napoleonic Code. That the ideas of an obscure Corsican were able to spread to this extent was due in large measure to the tumultuous events of the French Revolution, which in turn resulted from the political and economic weakness of French royal power stemming partly from France's defeat in the Seven Years' War, which resulted in the loss of French colonies. But a crucial battle in this war was lost because of the incompetence of a certain general who had been retained in his post due to the influence of Louis XV's favorite, Madame Pompadour. The configuration of legal ideas in the cultural pool of New Orleans, then, is not solely a result of the satisfaction potential of the ideas themselves but goes back to other ideas, in this case, sexual whims, of an individual an ocean away and centuries removed. But these interrelations were accomplished through certain social structures. As Plekhanov (1940) remarked on this case,

> Had it not been the king who had a weakness for the fair sex, but the king's cook or groom, it would not have had any historical significance. Clearly, it is not the weakness that is important here, but the social position of the person afflicted with it. (p.40)

Such processes, in which the spread of ideas is conditioned by factors unrelated to the satisfaction they provide their bearers, may be called *cultural drift.* The term was originally used by Herskovits (1948, chap. 34; *cf.* Lenski, 1970, p. 67) in a manner analogous to Sapir's (1921, chap. VII) "linguistic drift," that is, to apply to cumulative, directional changes resulting from small, barely perceptible variations. The present usage is related to, but somewhat different from, that of Herskovits. Cultural drift is undoubtedly ubiquitous in cultural evolution and, operating within the framework of cultural design, is usually the process determining the precise form of cultural traits.

Related to and subsumed by cultural drift is the founder principle, in which the sample from the cultural pool of an ancestral population carried by the founders may become the distinctive attributes of the cultural pool of the new population. It has been suggested by Vayda and Rappaport (1963) that this concept might help explain some of the cultural variations among island populations in Polynesia.

The differential replication of ideas may also be conditioned by the differential survival of the bearers of the ideas. To cite a rather extreme example, there was a religious sect in nineteenth-century Russia whose cultural pool contained a total ban on sexual intercourse. Lacking an adequate alternate method of recruitment, the sect disappeared and the idea selected itself out, even though it presumably was satisfying to its bearers.[3] On the other hand, the extinction of carriers may be a means of facilitating the spread of the ideas themselves. The ideas of John Brown, for example, certainly facilitated his early death, but his death in turn facilitated the spread of the very ideas that helped cause it.

The transmission of ideas in the cultural pool is a two-sided process, from a transmitter to a receiver, and it may be necessary to consider the satisfaction of the transmitter in many cases. Parents may desire to establish certain ideas in their offspring; leaders may desire to spread certain ideas among their followers. In order to encourage some ideas and discourage others, however, the transmitters will be altering the selective pressures operating on the receivers, by punishments or rewards, for example. Or, as a tough-minded general responded to the assertion that "you can't kill an idea," if you find everybody who has the idea and kill him, this may well kill the idea itself.

It is to be emphasized that all of the above mechanisms operate through individuals, not on any reified "superorganic" level. But this does not mean that all sociocultural phenomena are direct products of cultural design, even as this is modified by cultural drift. Cause and effect relationships may lead to phenomena which are only indirectly produced by the processes of cultural selection outlined above. It is not necessary to assert, for example, that the widespread poverty and starvation of the Third World are examples of cultural design, since they may be explained as *cultural effects* resulting from a world system designed to benefit certain groups in the advanced nations but not, in themselves, providing satisfaction to anyone.

The "Strategy of the Genes" and the "Strategy of Ideas"

We may adopt a somewhat different perspective and view biological evolution as resulting from, in Waddington's (1957) terms, the "strategy of the genes" to reproduce their own kind. In a similar fashion, we may view cultural evolution as resulting from the "strategy of ideas" to reproduce themselves in the minds of individuals. The competition between genes or ideas to reproduce their own kind, however, is not necessarily mirrored at the phenotypic or behavioral level, since a gene or idea for cooperation or altruism may, in certain

[3]This example, and the general point it illustrates, was taken almost verbatim from the comments of one of the *Human Ecology* reviewers of the original manuscript.

circumstances, outcompete a gene or idea for egotistical competition or self-aggrandizement. This perspective is useful, but the analogy should not be pressed too far. Genes are created, recreated, and altered by biochemical and physical forces completely independently of higher-level bioecological forces. Ideas, however, are created and recreated anew each generation by individuals. The motive force behind the evolution of ideas is not a blind, random, natural force but instead the genetically based drive of all members of the human race to become enculturated, to engage in what Berger (1969) calls "world building," the creation of an independent world of meanings, distinctions, and significances to permit interaction with the natural and social world. Although created by the blind, natural forces of genetic evolution, once created this peculiarly human drive functions as a material force in its own right.

The Material Conditions of Life

The material conditions which generate the selective pressures acting on the genetic and cultural pool have two distinct but overlapping aspects, the *ecological niche* and the *behavioral way of life.* The ecological niche, or the role of the population in the total functioning of the ecosystem (Odum, 1959, pp. 27-30), includes such things as relations of cooperation, competition, predation, and parasitism with other species and the place of the population in the food web of the ecosystem, what it eats and what eats it. A population's ecological niche generates many of the selective pressures operating on its genetic and cultural pools but not all of them. The behavioral way of life is the totality of the patterned energy expenditure of the population, or the manner in which the individual members of the population satisfy their needs and desires through the expenditure of energy in interaction with each other and with the environment. The energy expended interacting with the environment, in food-getting or in escape from predators, for example, is clearly related to the ecological niche occupied by the population. Energy expended in interacting with other members of the population, in mating behavior or play, for example, may not be related at all to the ecological niche. Selective pressures emerging from this latter area may result in features not directly related to the ecological niche of the population. The antlers of caribou, for example, are not used to fend off predators but only in contests with other males for mates. Thus, although the greater part of the behavioral way of life is directly tied to the ecological niche, there is a certain amount of free play involved. But just as parts of the behavioral way of life not directly related to the ecological niche may generate selective pressures, so parts of the ecological niche for which there are no behavioral counterparts, such as disease or parasitic organisms, may generate selective pressures. Neither of the two concepts in itself is sufficient to sum up the material conditions of life which control the course of biocultural evolution.

Importantly, the behavioral way of life of all human populations includes the modification of environmental objects into a culturally acceptable form through the expenditure of a particular form of energy, labor. Animal populations, by and large, satisfy their needs with unmodified environmental objects. By contrast, all human populations, since at least the time of the Australopithecines, have been dependent on the products of labor, and this dependence has generated the selective pressures controlling major aspects of the genetic and cultural pool of *Homo sapiens*. The distinctive aspects of man's body, his bipedalism and large brain, developed as a response to selective pressures demanding a body capable of labor (including tool use and tool making), a point Engels (1940) recognized 70 years before the emergence of the "new physical anthropology":

> The hand is not only the organ of labour, it is also the product of labour. . . . First comes labour, after it, and then side by side with it, articulate speech – these were the two most essential stimuli under the influence of which the brain of the ape gradually changed into that of man. (pp. 281, 284)

But if man's body developed as an instrument of labor, his culture also is profoundly dependent on labor. Accordingly, a major step in the explanation of any cultural phenomenon is the examination of how it is related to the system in which human labor is directed toward the production of use values and to the manner in which the exchange of these use values among members of the population is institutionalized in systems of cooperation and exploitation.

Niche Filling

A logical concomitant of the synthetic theory is that there will be a higher-level tendency for ecosystems to become more complex. Any empty ecological niche adjacent to an occupied niche will tend to become filled, since the selective advantage of variants entering it will initially be very great. Such a process reacts back upon genetic evolution, since as new niches become filled the old ones are altered, and hence the selective pressures operating on the various genetic pools of the new ecosystem will also be altered.

Similar processes are at work in cultural evolution. Man's evolutionary history has been characterized by a constant shift into new ecological niches, with increasingly extensive and intensive utilization of environmental resources. Until a few thousand years ago, every ecological niche occupied by human populations involved the active participation, in the form of a labor input, in a productive system. With the establishment of large, sedentary populations based on food production, however, populations appeared which occupied a new type of ecological niche, one involving the appropriation of the products of human labor without a corresponding and proportionate labor input into a productive system. How did this occur?

We suggest that, to the extent that labor is not satisfying in itself, there will be a mini-max principle operating in cultural evolution in which the individual attempts to minimize his own expenditure of energy in labor but still maximize his own satisfaction. When applied to the environment, this results in the increasing efficiency of the technology and organization of labor. When applied to the rest of the population, however, it may result in attempts to substitute the labor of others for one's own and to develop techniques for exploiting human labor. In certain types of ecological situations, where small, highly mobile populations utilize the environment with a relatively unproductive technology, for example, such exploitation may threaten the system of cooperation and mutual interdependence on which the entire population depends for the satisfaction of basic needs, and hence be subject to strong negative selective pressures. As technology becomes more productive and as populations become large and immobile, on the other hand, this mini-max principle has greater scope for expression, and a new ecological niche opens, one based on the exploitation of labor. The origin of social stratification, then, can be seen as an extension of a more general principle of niche filling. The filling of this new ecological niche occurred solely because the satisfaction of the individuals entering the niche was thereby maximized in the changing ecological situation.

As a result of the filling of this exploiter-niche, a predator-prey relationship emerged between populations of *Homo sapiens* similar to that existing between animal species except that the stakes involved were not the food-energy locked up in animal flesh but instead the labor-energy that the human animal can expend in production. The appearance of these exploiter-niche populations, or ruling classes as they are sometimes designated, transformed the ecological niche of the remainder of the human species, just as the introduction of a pack of wolves into the habitat of a herd of antelope would alter the ecological niche of, and hence the selective pressures acting on, the herbivores concerned. By creating selective pressures favoring certain types of organizational structures and ideological complexes, this predator-prey relationship has been and continues to be one of the major generators of sociocultural change and must be considered in the explanation of cultural phenomena associated with complex populations (*cf.* Ruyle, 1971, 1973).

Once this predator-prey relationship breaks the human population down into smaller Mendelian populations with a complex pattern of energy flow between them, new ecological niches open up as individuals attach themselves to the thermodynamic system through differing patterns of energy expenditure and exchange, the process known to the sociologist as the division of labor. The various behavioral ways of life which emerge in a complex population are functionally related to and mutually dependent on each other, but not in terms of the system as a whole, only from the standpoint of each individual and class attempting to maximize his own satisfaction and control over energy within the

limitations laid down by the ruling class. Maintaining the integrity of the system as a whole may be a source of satisfaction to the individual, but, in actual fact, this maintenance is often accomplished mainly by members of the class which is the major beneficiary of the system and hence stands to lose most if the system is altered.

It should not be concluded from the above that ruling classes are all-powerful, all-knowing Unmoved Movers, however. They are as locked into the ecological system as a pride of lions in the African veldt, or, more properly, a band of Paleolithic hunters. But although the techniques by which they dominate and exploit the remainder of the population may not be consciously recognized as such (and it is, above all, in stratified populations that ideology takes on its Mannheimian function of concealing the real world), such techniques must exist and be properly manipulated by a ruling class. If not, it will lose its ability to rule and its place will, most likely, be taken by a new ruling class, as has happened again and again in human history.

THERORETICAL IMPLICATIONS OF THE UNIFIED THEORY

The relationships between the various concepts we have been discussing are diagrammed in Figure 1. I have tried to present a logically consistent theory

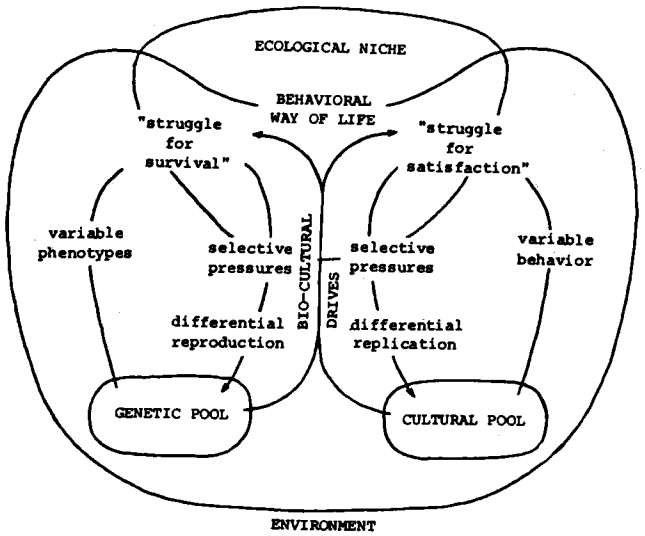

Fig. 1. Unified theory of biocultural evolution.

sufficiently elaborate to invite and even provoke meaningful criticism. A number of hazy areas remain, for example, the problem of the formation of biocultural drives and the nature of "ideas," but rather than dwell on these I should like to use the theory to discuss certain key issues in evolutionary thought.

Free Will and Determination

It may be thought that by assigning individual satisfaction a central role in cultural evolution the way is opened for cultural voluntarism and subjectivism. This is not the case. The individual is certainly free to hold whatever ideas he wishes and to do whatever is satisfying to him in a particular context, yet the raw material out of which he constructs his free will is the cultural pool formed out of the countless free choices of other individuals, and his freedom is effective as an agent in sociocultural evolution only to the extent that it influences the free will of countless other individuals. Moreover, material conditions of life generate the selective pressures which transform free will and voluntarism at the individual level into probabilistic determination and statistical law at the population level. The situation may be compared to behavior of gases, although the analogy is not perfect. The physicist cannot predict how any individual gas molecule will behave, yet as the molecules increase sufficiently in number the behavior of gases follows definite laws.

Adaptation

The term *adaptation* has at least two distinct but closely related meanings. In its narrow sense, adaptation refers to the process of differential reproduction within a population resulting from natural selection and to genetically determined traits which have been produced by this process. There is also a broader, less precise meaning of the term which refers to the fit between the population and the environment (*cf.* Harris, 1960).

It is clear that the process of adaptation, in the narrow sense, must maintain adaptation in the broader sense. Three-legged lions, baboons which give birth to chickadees, and gazelles with flippers do not fit into any environment, and should such maladaptive variations occur they would be rapidly and decisively eliminated by the process of natural selection.

It is also clear that the process of cultural design must also maintain adaptation in the broader sense, since behavioral patterns which do not fit into a given environment are not likely to give satisfaction to the individual. The construction of canoes which cannot float, the planting of crops where they cannot grow, and the gross violation of grammatical and phonetic rules in speech are all examples of behavior which does not fit and would therefore be rapidly eliminated by the process of cultural design.

Thus both adaptation and cultural design contribute to the adaptation, in the broad sense, of a population, and it is possible to explain, in a loose, general way any biological or cultural phenomenon by showing how it fits into a particular environment or sociocultural context, by showing, in other words, that it is an adaptation in the broader sense of the term.

The use of the concept of adaptation as an explanatory tool, however, is likely to lead to difficulties of two sorts. First, adaptation to the environment is only one of the processes at work in biocultural evolution. As noted in our discussion of the material conditions of life, intragroup behavior, most notably mating behavior, may produce traits which are not adaptations in either sense of the term.

Second, measures of adaptation or of evolutionary success cannot be used as explanatory devices. Just as all physical bodies are equally successful in conforming to the laws of gravity, so all species and cultures are equally successful in conforming to the laws of biocultural evolution. Any measure of adaptation or evaluation of evolutionary success, whether it be on the basis of population size, biomass, rate of increase, stability of population size, or even a statement that living species are successful, extinct ones are not, is necessarily arbitrary and subjective.

General Evolution

The idea has been expressed (e.g., White, 1959; Sahlins and Service, 1963) that although evolution in the short run, or specific evolution, is indeed a matter of the differential reproduction of individuals, evolution in the long run, or general evolution, involves a raising of the general level of complexity, the incorporation of increasing amounts of negentropy, increasing freedom from environmental limitations, and increasing adaptability which cannot be explained simply in terms of cumulative specific evolution but instead must be explained by different principles, such as the general laws of thermodynamics, of life, and of culture. It is clear that these secular trends have indeed characterized the course of cultural evolution, and there is nothing to prevent anyone from calling one or more of them "general evolution" or even "progress." But doing so does not explain them, and there is no reason to suppose that their explanation calls for mechanisms additional to those we have postulated above. General evolution is epiphenomenal in the sense that it is derivative, resulting from the processes of specific evolution. The sorts of cultural phenomena referred to by the term *general evolution* are explicable in terms of the process of cultural design and cause and effect relationships emerging from this process.

Group Selection

A major argument of this paper is that the selective mechanisms involved in biocultural evolution operate solely at the individual level. Unless one is to credit the cultural pool itself with the power to determine its own content (an approach which appears to be implicit in much sociological and anthropological writing but which merely conceals the problem of explaining cultural similarities and differences), there are only two possibilities; they operate either at the individual level or at the group level. Although few would deny that selective mechanisms at the individual level are operative, many feel that the more important selective processes occur at the group level.

In biology, the sentiment has been widely expressed that in addition to natural selection at the individual level, selection also takes place at the group level, by one better-adapted group replacing another, so that adaptations which are deleterious to the individual may occur if these contribute to group survival. Williams (1966), however, has persuasively argued that alleged examples of group-related adaptations are due either to misinformation or to misinterpretation and that group selection has been a negligible factor in bioevolution.

In my opinion, Williams' argument can be extended to the cultural sphere, but this idea runs counter to the dominant climate of opinion among those concerned with the problems of cultural evolution. Here the idea is widely expressed that adaptation is a matter of group survival and that the decisive mechanisms of cultural evolution lie at the societal rather than the individual level. Cohen (1968, p. 3), for example, writes that the facilitation "of the reproductive and survival capacity of the group . . . is the essence of adaptation." In spite of the widespread acceptance of this idea, there has been little effort to specify the precise mechanisms involved in group selection and how these would account for particular cases. The most extended attempt is probably in a new textbook, Harris's *Culture, Man, and Nature* (1971):

> The most successful innovations are those that tend to increase population size, population density, and per capita energy production. The reason for this is that, in the long run, larger and more powerful sociocultural systems tend to replace or absorb smaller and less powerful sociocultural systems.
>
> The mechanism of innovation does not always require actual testing of one trait against another to determine which contributes most in the long run to sociocultural survival. Given a choice of bow and arrow versus a high-powered rifle, the Eskimo adopts the rifle long before there is any change in the rate of population growth. In the short run, the rifle spreads among more and more people not because one group expands and engulfs the rest, but because individuals regularly accept innovations that seem to offer them more security, greater reproductive efficiency, and higher energy yields for lower energy inputs. Yet it cannot be denied that the ultimate test of any innovation is in the crunch of competing systems and differential survival and reproduction. But that crunch may sometimes be delayed for hundreds of years. (p. 152)

Here we note that allowance is made in the short run for mechanisms of the sort discussed above. Individuals find the prospect of a secure future satisfying; individuals find the prospect of watching their children grow to maturity

satisfying; individuals find the prospect of more food for less work satisfying. But although mechanisms at the individual level are an essential part of the explanatory scheme offered by Harris, he seems to be arguing that the truly decisive mechanisms are those at the group level. But it is by no means clear how a mechanism which may wait hundreds of years for its operation can be effective in sociocultural causation.

The fact that larger and denser populations are able to exist where certain cultural practices (such as food production, redistributive networks, or state organizations) are present is a cultural effect, not their cause. Once a more efficient technique of food production is devised, it will spread because individuals find it satisfying, not because of something which may occur hundreds of years later. The individual members of large, technologically sophisticated, complex populations regularly find their satisfaction maximized by cooperating in the exploitation or extermination of the members of less advantaged populations, and population replacement in *Homo sapiens* is typically due to disease or to superexploitation and genocidal excesses permitted by overwhelming military superiority. When the members of one population adopt elements of the cultural system of another population, they do so because they find the prospect of change more satisfying than the prospect of domination and exploitation; the question of population survival is rarely involved. Once a more efficient technique of warfare is devised, it will spread because individuals find victory or even stalemate in warfare more satisfying than defeat. Thus, for example, Japan westernized because its ruling elite feared domination by the West, not because its survival or rate of reproduction was at stake. The "crunch of competing systems" is solely a matter of competition involving individual satisfaction; it is unnecessary and superfluous to suppose that long-range reproduction or survival is involved in any way other than as the contemplation of such long-range trends affects individual satisfaction. Unless examples can be given which cannot be explained in terms of the mechanisms outlined above, the scientific principle of parsimony may be invoked to reject intersocietal selection and long-term group reproduction as explanatory devices.

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REFERENCES

Berger, P. L. (1969). *The Sacred Canopy: Elements of a Sociological Theory of Religion,* Doubleday, Garden City, N.Y.

Campbell, D. T. (1965). Variation and selective retention in socio-cultural evolution. In Barringer, H. R., Blanksten, G. I., and Mack, R. W. (eds.), *Social Change in Developing Areas: A Re-interpretation of Evolutionary Theory*, Scheckman, Cambridge, Mass., pp. 19-49.

Cohen, Y. A. (ed.) (1968). *Man in Adaptation: The Cultural Present,* Aldine, Chicago.

Dunn, F. L. (1970) Cultural evolution in the late Pleistocene and Holocene of Southeast Asia. *Am. Anthropologist* 72: 1041-1054.

Engels, F. (1940). *Dialectics of Nature,* International Publishers, New York.

Harris, M. (1960). Adaptation in biological and cultural science. *Trans. N.Y. Acad. Sci.* 23: 59-65.

Harris, M. (1971). *Culture, Man, and Nature: An Introduction to General Anthropology*, Crowell, New York.

Herskovits, M. (1948). *Man and His Works,* Knopf, New York.

Homans, G. C. (1964). Bringing men back in. *Am. Sociol. Rev.* 29: 809-818.

Lenski, G. (1970). *Human Societies: A Macrolevel Introduction to Sociology*, McGraw-Hill, New York.

Maslow, A. H. (1970). *Motivation and Personality,* 2nd ed., Harper and Row.

Odum, E. P. (1959). *Fundamentals of Ecology,* 2nd ed., Saunders, Philadelphia.

Plekhanov, G. (1940). *The Role of the Individual in History,* International Publishers, New York.

Ruyle, E. E. (1971). The political economy of the Japanese ghetto. Unpublished doctoral dissertation in anthropology, Columbia University, New York, 387 pp.

Ruyle, E. E. (1973). Slavery, surplus, and stratification on the Northwest Coast: The ethnoenergetics of an incipient stratification system. *Curr. Anthropol.* (in press).

Sahlins, M. D., and Service, E. (1963). *Evolution and Culture,* University of Michigan Press, Ann Arbor, Mich.

Sapir, E. (1921). *Language: An Introduction to the Study of Speech,* Harcourt, Brace & World, New York.

Selsam, H., Goldway, D., and Martel, H. (eds.) (1970) *Dynamics of Social Change: A Reader in Marxist Social Science,* International Publishers, New York.

Suttles, W. (1960). Affinal ties, subsistence and prestige among the coast Salish. *Am. Anthropologist* 62: 296-305.

Vayda, A. P., and Rappaport, R. A. (1963). Island cultures. In Fosberg, F. R. (ed.), *Man's Place in the Island Ecosystem,* Bernice P. Bishop Museum, Honolulu, pp. 135-142.

Waddington, C. H. (1957). *The Strategy of the Genes: A Discussion of Some Aspects of Theoretical Biology,* Allen and Unwin, London.

White, L. (1959). *The Evolution of Culture,* McGraw-Hill, New York.

Williams, G. C. (1966). *Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought,* Princeton University Press, Princeton, N.J..