

AN EVOLUTIONARY HYPOTHESIS ABOUT TEACHING AND PROSELYTIZING BEHAVIORS

by *Robert B. Glassman*

Although it is tautologically obvious that an organism's hereditary material will survive only if its bearer behaves in such a way as to allow it to survive, there has been much argument related to this and other corollaries of the principle of natural selection that concern the affairs of human beings. My purpose is to try to resolve some of this debate about hereditary versus cultural sources of knowledge by offering a supplemental theory of human motivation. Psychological theories have dealt most clearly with human motivations such as feeding, temperature regulation, sexuality, and sleep, whose rituals must be played through relatively brief cyclic intervals. Other motivations such as those for friendship or creative expression have less obvious significances for survival and often have seemed more amenable to romanticism than to scientific theorizing. I will attempt to show the logical possibility that certain human motives, though associated neither with creature comforts nor with immediate life-and-death contingencies, are nevertheless part of our biological heritage, selected for their long-range survival value. While the arguments can be generalized to pertain to many behaviors of individuals in their relations with groups, the emphasis here is on the motives for and adaptive consequences of two similar sorts of behavior that are of

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the most central importance in the theory, that is, teaching and proselytizing.

The theory is two sided. Looking outward from the individual, toward the broad sweep of evolution, it attempts to show that evolutionary theorizing thus far has overlooked an implication of the principle of natural selection that teaching and proselytizing should occur in contexts outside of kin groups and contexts where benefits are unlikely to be reciprocated. Looking inward, and developing this implication for human psychology, it offers a brief outline of a theory of "weak interactions." Weak interactions are human social encounters that when viewed objectively can be said to be very probabilistic or when viewed subjectively can be said to be very much open to choice. These interactions sometimes add up to significant effects, shaping the morality and knowledge of a human society.

ACQUISITION AND MAINTENANCE OF ORGANIZATION

Respect for the high degree of organization of living systems is the main foundation of explanations that invoke the concept of natural selection. Even many of the simplest living systems possess a structural intricacy far beyond the creative potential of human individuals. The idea of natural selection is a suggested answer to the questions of how such order can have arisen and how it is maintained. Natural selection is a process by which environmental structure that is distributed broadly in space and time can participate in shaping a more narrowly circumscribed, organismic structure. In a sense the organism is a "reflection" of the conditions under which it originated—in Konrad Z. Lorenz's words, "the fin of a fish reflects the properties of water, much as a horse's hoofs reflects those of the hard, even ground of the steppe, or as an eye reflects the properties of light emanating from the sun."¹ But clearly organisms constitute "images" that have been transformed from mere exact copies of the "object." A very general aspect of their difference is that they cohere within relatively brief temporal intervals, and their skins enclose more restricted spatial regions than does the environment which shapes them. This broad conceptualization of matter-energy forms that are relatively localized in time and space, deriving structure from more distributed entities, may be taken also as a description of knowledge as it exists within the brains of human individuals who obtain it from multiple sources.

We easily fall into the habit of inflating the importance of local causal relations, initiated or linked by human decisions, but experience suggests that if conditions are not propitious—if the ecology is not right—then entropy shuffles human creations back into random-

ness. Human ideas and social institutions may be thought of generally as considerably less complex than are the organisms themselves from which these phenomena emerge (with their mitochondria, cell membranes, hormonal feedback loops, neuronal connections, etc.). However, many ideas and institutions do have so high a degree of organization, and some survive for so many generations, that we would be guilty of taking a great deal for granted if we failed to ask whether each idea or institution is merely a unique event or whether, as suggested here, there are some general factors that enable them to be maintained.

The principle of natural selection in its usual application to the anatomy of organisms is seen to be nonvacuous and compelling when the structures of organisms and their relations with their environments actually are described.² An abstract principle of natural selection cannot be applied complacently to a conceptualization of ideas and institutions without considering the human biological structures that are parts of the environment of ideas. As in thinking about anatomical evolution, the concept of environment must be taken to refer both to surroundings and to substrate. Knowledge is viewed here as a biological phenomenon.³ The critical question is how individuals and groups, whose gene pools continue to survive, come into association with and act as the substrate for ideas and institutions that continue to survive; people are the palpable, vulnerable entities that, together with books, buildings, etc., underlie culture.

RELATIONS BETWEEN GENES AND CULTURE

Because cultural evolution takes place much more rapidly than phylogenetic evolution, we discern some dynamics of cultural patterns within our lifetimes and tend to see phylogenetic evolution as a rather independent sort of operation. There are a few exceptions to this rule; for example, anthropologists cite archeological evidence indicating that the size of the human brain increased threefold since the time at which prehumans began to construct tools.⁴ Many thinkers have speculated that the shaping of the modern human brain has been as much the result of cultural developments including tool usage and language as the cause of these developments.⁵ More to the point, some authors have proposed formally a mechanism by which learned cultural activities can influence genetic evolution.⁶ The basic idea underlying this non-Lamarckian mechanism is that learned behaviors pave the way for analogous, genetically determined propensities by moving the organism into a new context, or ecological niche. C. H. Waddington discussed this principle in his book *The Ethical Animal* but

did not integrate it completely into his extensive theorizing about cultural evolution.⁷ One may get the impression from this and other writings that, while cultural evolution rests in a general way on a foundation of genetic potentiality, in some sense it moves freely over this foundation, perhaps only occasionally bumping into a genetically rooted barrier. It has been recognized that cultural developments may destroy our species physically, or that cultural innovations may compensate for deficiencies in our genetic preparedness and thus enable us to survive, but the relation between culture and genetics is not otherwise usually seen as a very intimate one.

The major problem for a general theory of human society which includes genetic considerations is that of accounting for the various forms of human cooperation, or altruism. The fact that altruism is sometimes observed presents a *prima facie* problem for the phylogenetic theory of natural selection because the fundamental idea in the theory is that it is competition that determines which variants will survive; by cooperating an individual organism would seem to be surrendering an advantage and decreasing its chances for survival.

The term "altruism" is used here in the same general, deliberately naive sense as it has been by sociobiologists.⁸ It includes any behavior on the part of one individual that in any way increases the chances of survival of another individual. Such helping behavior must be thought of simultaneously as at least in some small way decreasing the probability or duration of survival of the benefactor; even if the altruistic act involved no great risk, it took time that might have been spent in seeking food, keeping one's temperature better regulated, merely resting to conserve and restore bodily resources, etc.

Sociobiologists have offered three suggestions for resolving the paradox of altruism:⁹

1. *Reciprocal Altruism.* In a relatively closed group of members of an intelligent species, tacit or explicit social contracts are possible. Acts of helping eventually are reciprocated in return benefits to self or offspring.¹⁰

2. *Gratuitous Altruism.* Altruistic individuals might arise at random within a population as frequently as such individuals lose their lives helping others. Such altruism might arise as a variant of existing reciprocal altruism. Part of making an effective social investment by doing favors for others lies in convincing the others of one's patience in awaiting return dividends. But it is only a small, evolutionarily random step from a social investment in expectation of a distant return to a donation without expectation of return. Since organisms generally have limited insight into their genetically adapted charac-

teristics, we might expect this transition from investment to donation to occur rather frequently as random variation.

3. *Kin Selective Altruism.* Nurture is necessary toward offspring and sometimes toward other relatives in any species whose survival strategy is not simply to provide more offspring by sheer weight of numbers than are lost to predators and other factors in any given generation. Casual considerations of the evolutionary catch phrase "survival of the fittest" do not always reveal the implication that only those organisms which take steps to insure the survival of their genes will reproduce themselves and their genes successfully. Although nurturing offspring has painful aspects that are manifestly altruistic in the usual meaning of the term, it often provides a unique sense of gratification, suggestive of an innate motivation.

The emphasis of the theory offered here is a more general form of kin selective altruism. The theory is motivated by an extension of the insight that is so succinctly suggested by the title of Richard Dawkins's book *The Selfish Gene*; that is, the apparent paradox that altruism presents for the principle of natural selection can be resolved by shifting our focus from the individual organism to the information that the organism carries.¹¹ Although the three sources of altruism outlined above cover a lot of ground, these sociobiological hypotheses, derived largely from observations of animals, do not provide a convincing explanation for the extensiveness of human cooperation sometimes observed. By themselves they do not easily lead to an understanding of the long persistence over centuries of certain cultural institutions, maintained by cooperating human beings. Some writings on altruism point out that in human evolution selection will favor finesse in deception.¹² Can civilization be a mere epiphenomenon of selfishness?

Some authors have pursued the abstract analogy between genetic and cultural evolution by proposing that while in most species genetic evolution is the main determiner of the contemporary phenotype, human beings' capacity to learn is so great that we must think of the forms of human existence as joint outcomes of genetic and cultural evolution. The process leading to civilization has been conceptualized either as a kind of symbiosis or as a competition between genetic and cultural subsystems.¹³ While these two metaphorical extensions of evolutionary terminology are valuable, they unfortunately connote that the phylogenetic and cultural sources of knowledge are separately bounded entities. By themselves these explanations therefore miss the issue considered here. The interactions between genes and culture must be considered more intimate than implied by the term

“symbiosis” or “competition”; it must be borne in mind that any cultural development, however small, has potential immediate (less than a generation) survival significance for the genes of those organisms who bear this cultural development.

To illustrate, the hypothetical, extreme case of a genetically significant cultural movement is that of a group whose members arrive at a conviction that all reproductive activity is to be avoided. Somewhat more generally, any cultural pattern of imperatives about relations among women and men may have implications that lead a subset of the population to spend considerably more or less effort than others in activities related to reproduction or raising children. But, in most general terms, the network of society is so intertwined that one can imagine innumerable other ways in which a given feature of the society might have economic, political, or educative consequences that differentially encourage or enable certain groups to have more children or to raise healthier children.

Although some gene-culture interactions may have parameters that allow their cultural subsystems almost to run free for several generations, in the longer run these subsystems will survive only if the genes of those individuals who carry the relevant cultural messages are benefited rather than being slowly consumed by the cultural process. Peter J. Richerson and Robert Boyd have discussed the necessity for culture to increase genetic fitness, but they have dealt primarily with a global “capacity for culture” in their model, which enables behavior whose deviations from kin selection are based on group selection and concomitant reciprocal altruism.¹⁴ An optimistic conception of the sweep of history must view human civilization not as a temporary fillip doomed to end in a dark age but as a permanent evolutionary product. Proof of such a view must include plausible mechanisms by which any local instance of learning that contributes to the civilization can feed back, in some way, to maintain the genes that underlie it.

Therefore a general rule is that when particular habitual behaviors, ideas, institutions, etc., and their movements are examined, this must be done not only in the traditional manner of looking at historical antecedents and contemporary favoring conditions but also with consideration of the degree of likelihood that the ideas directly or indirectly preserve the genes of those who carry them.¹⁵ While this program of social analysis will require much detailed examination of nuances of particular institutions, ideas, and behaviors, and while it will require speculations about their ultimate, indirect repercussions for the genes that influence behavior (via their control over brain development), the cases of teaching and proselytizing behaviors are

relatively straightforward. Consideration of the probable genetic repercussions of these behaviors can serve as a model for further pursuit of the proposed program. The present argument, in short, is that those who propagate "valid" ideas by teaching or proselytizing are enriching the conditions for survival of sets of genes borne by nonkin that happen to be similar to their own.

GENETIC EFFECTS OF PROSELYTIZING

Why should any individual ever spend his valuable time listening to another's message? Attempts to convince generally are associated with a tacit or explicit claim that the message will help the listener. However, a naturalistic explanation of altruism also must recognize direct or indirect benefits to the genes of the teacher. Optimistic intuitions about the honesty of such altruism may be salvaged if we define the "true altruism content" of any act as being graded in proportion to the degree to which the return benefits for the doer are very indirect. Teaching then may be considered to have a high "true altruism content" because it reflects benefits to the genes of the actor (actually genes similar to those of the actor) in a much more indirect way than do the standard modes of reproduction and nurture. Concomitantly teaching often involves a broader diffusion of benefits than do family-oriented activities.

Teaching, as practiced by scholars, involves the deliberate expenditure of resources, with consequent reduction in individual and family fitness, to develop and to spread an idea. The celibacy of some clergymen provides an even more extreme case of sacrificing local genetic advantages in favor of a set of ideas. Many scholars and clergymen have a strong belief in ideas and an intense desire to see certain ideas survive. Ideas often are carried by one person alone to regions far from his family, thus precluding any likelihood of dividends returned to genes that are reproduced from his own body. Certainly there are many possible impure cases—for example, some of the seeds sown by an itinerant proselytizer may not be metaphorical ones. But my purpose here is to explore uncynically a logically possible way in which moral actions may sustain their substrates.

Recall that in any large population there is a range of variations for each genetically determined characteristic. It is this fact, underlying all of evolution, that allows for the possibility that an individual actually might create an ecological niche "artificially." The proselytizer need not do this using academic knowledge of the principle of natural selection. Rather, he may broadcast his message as best he can; if it is useful for survival in any way, then an advantage will be conferred on

those, be they blood relatives or nonrelatives, who find the message attractive enough to use it as a guide in altering their behavior. The bearers of the propagated message (and their genes) thus will be selected by the viability of the niche that the proselytizer occupies.¹⁶ The proselytizer has succeeded even if neither he nor receivers of the message personally identify each other; this is often the case with authors and readers. Indeed in many instances it is best if the learners are not too close to the teacher since the particular adaptation taught may require resources that are locally limited.

The preceding paragraph describes the core mechanism by which teaching can be non-self-serving—or, more accurately, nonserving of the physical self's embodied genes—and yet can be adaptive in a broader sense. By this mechanism, unselfish teaching and proselytizing that benefit the community can be seen as possibly being something more fundamental to human nature than an occasional accidental by-product of other processes that were naturally selected because they usually provide local advantages.

Some assumptions must be made explicit:

1. There is a significant genetic contribution to ideas. While it would be preposterous to suppose that the length of human generations would allow for enough naturally selective trials and errors that the details of most ideas could be sculpted and transmitted genetically, it is plausible to surmise that genes help determine the general range of individuals' emotional responsiveness, interests, aptitudes, and particular perceptive capacities. There are indeed data suggesting heritability of personality characteristics.¹⁷ Genotypic similarities among teachers and learners that are relevant to communicability of ideas need not be gene-for-gene likenesses. The hypothesized mechanism would function both so long as genetic aggregates had equivalent phenotypic effects and so long as they tended to be transmitted together, for example, if they were joined on a single chromosome. In some cases a teacher's message might merely play on emotional propensities; in others it might provide individuals with a useful skill which fulfilled their aptitudes. It follows from the foregoing arguments that variation of the genetic base could be a significant factor influencing culture from one generation to the next, without there occurring any cataclysms. Individuals' minds comprise many competing patterns and orthogonal patterns of ideas. Slight genetic variations, or cultural facilitation of previously latent, genetically influenced tendencies, could tip balances one way or another, affecting cultural commitments of many members of a population and thereby altering the selection pressures faced by the next generation.

2. Ideas are linked to a tendency to spread these ideas. While it may well be that some individuals are content with silent understanding, we certainly have little chance of finding out whether this is so. Those ideas that take hold in a group must have been propagated actively in some way. A general conception of human society as a substrate for vigorously competing ideas is analogous to the biological conception of organic species as a substrate for genetic competition among would-be adaptive characteristics in a gene pool. Evolution of orderly combinations of biological characteristics takes place only because these are linked to a mechanism that reproduces. Some aspects of biological adaptation are integral parts of this reproducing mechanism (e.g., sexual signals), but most characteristics are closely relevant to other survival concerns (e.g., feeding behaviors) and thus only indirectly are related to the ultimate success of reproduction.¹⁸ The same logic holds for cultural propagation of ideas. An idea survives only if linked to a behavioral tendency to spread the idea; conversely the organism's tendency to spread an idea, by itself, is no good unless it is linked to an idea that favors organic survival and hence is adaptive in the context where the spreading occurs. Just as organisms' reproductive patterns are partly independent of their other characteristics, individuals' tendencies to propagate ideas may be in part independent of the characteristics of the ideas themselves. In fact in individual humans the urge to convince does seem to arise in ontogeny considerably before the ability to formulate an idea clearly. Human development therefore may be conceived at least in part as an ongoing attempt to discover the significant aspects of oneself and to propagate these patterns in some way.

3. Genetic random variation and selective retention are sufficiently powerful to constitute a natural source of the proposed teaching mechanism. Although the functioning of the mechanism requires a human mind, and while it takes a body of theory and a human mind to understand the process, a human being did not deliberately create it. The process itself is amazing, but no more so than many other organized characteristics of living systems. More particularly, that proselytizing can arise for the reason suggested is no less plausible than the principle that our genes tell us to be altruistic to family members. For this process to work (and in view of assumption 2 above) it must be that among those characteristics possessed by the beneficiaries of altruism there are similar altruistic characteristics toward the next generation. The tendency to proselytize is not so complex as to defy the possibility of arising by random variation. This tendency is the sort of thing that could grow in small, evolutionary

steps, and in fact it would arise more easily in any organism that already had the tendency to teach family members actively. Moreover, some of the same tendencies to perceive and affiliate with family members having morphological and behavioral characteristics like one's own might be modified by a slight random variation to apply to outsiders who did not possess the whole complement of family characteristics. A further possibility is that proselytizing might arise first among the extended family, as an effort to filter out those members whose tendencies are most divergent with one's own and to maximize the effectiveness of local altruism in preserving one's genes. An example, perhaps less common today than years ago, is the rejection of an offspring who marries outside of the family religion.

These last comments about an extended principle of kin selection may be thought of as a reply to the question "What has posterity ever done for me?"¹⁹ Once a sociobiologist points it out to you, it is obvious why you ought to—and why you want to—help near kin. But the principle of kin selection suggests no more reason for a human being to worry about his direct descendants several generations down the line than for him to worry about distant cousins. The possibility of cultural propagation of messages provides just such a reason, which allows the individual to leap across generations, as well as across contemporary kin lines, and to filter through to those who most aptly use his messages because they received more of his genes in the intervening random assortments. This principle, if modeled mathematically, might relieve some of the burden on conceptions of group selection and might explain why the degree of altruism seen in humans exceeds the extrapolation based on the correlation among species of genetic relatedness with the degree of altruism.²⁰

A fossil can be used more than once if you study it rather than burn it. Storage and transmission of information do not entail the same losses as do storage and transmission of energy. In fact the more broadly distributed a particular package of information, the more likely the entire legacy is to last for a long time, and the more likely it is to be augmented eventually. Therefore identification of apt pupils is not necessarily a serious problem for teachers, who often may use a strategy of casting their messages broadly. However, many things cannot be taught without more intimate and extended contact, and some ideas that are broadcast may be resisted actively. I will not try to enumerate the methods by which teachers of diverse clumps of knowledge and their students identify each other. The terms "teacher" and "student" apply legitimately not only to those who formally adopt these titles but also to many personal relationships of

varying durations and closeness. It is relevant to the present theory that often inhering in such interpersonal interactions are rewarding feelings that are not due to any immediate, tangible payoff. Anticipation of these joys is a likely factor motivating people to enter into such relationships. For example, it partly must be intangible, emotional responses that lead an individual to decide that he has found the right fraternity, corporation, or religious congregation to join; "these are my kind of people."

SOCIAL ORGANIZATION

A difficulty with the foregoing arguments is that under certain conditions one is in competition with, and is aggressive toward, those having similar propensities; as Lorenz notes, it is often the case that "like avoids like."²¹ The problem of competition versus cooperation is one that is resolved in many ways in the relations among species and among individual members of species. In attempting to use the present hypothesis to help in the understanding of how advanced civilizations, comprising a diversity of cultural elements, are maintained it is relevant to bear in mind (1) the phylogenetic principle of competitive exclusion, that is, two distinct species cannot coexist in the same ecological niche, (2) the related fact that living systems consist of discrete species rather than a continuum of forms, and (3) the principle that stable symbioses can form among quite different species.²² Symbiotic partners form complementary niches for each other; their cooperation constitutes a reciprocally altruistic relationship that may be more stable than that which is ever achieved among members of the same species.

The danger of cooperation among similar systems is that the partner may seize an advantage. This danger is particularly acute among humans—who perceive it clearly—with their capacity for imitation and other sorts of cultural communication of adaptive information. In fact it is the case that in various ways human cultures permit certain aspects of ideas to be implemented only by some classes of individuals and not by others; such restrictions are based on acquaintanceships, wealth, institutional position, age, etc. All such factors may be considered to constitute alternative (competing) forms of genetic selfishness.

From the perspective of the present hypothesis the fundamental problem that any individual has is how much of his life's effort to invest in his genes by the usual methods of sexual reproduction and maintenance of family interests and how much to invest, via alternative cultural methods, in conferring advantages on similar, nonkin

genes. All of the phenomena of human motivation may be considered to be directly or indirectly significant regarding one or the other investment. Because random variation and selective retention yield instincts that provide us with general clues but not with well-articulated answers, some expressions of motivation may be manifestations of either of these investments that are maladaptively exaggerated and not well integrated within other motivations.

These remarks do not yet go as far as they might to resolve the problem of the dangers of cooperation; they show a way in which an investment involving cooperation may pay off, but the danger of a mistaken investment still seems to be strong if our conception of society is one in which all individuals participate in a free-for-all scramble for the same goals. This problem is brought closer to a resolution if we recognize the existence of complex, reciprocally altruistic, symbiotic relationships among diverse social groupings. One such form of symbiosis might be represented by the relationship between a class of learners who show themselves to be apt at a skill, or inclined to become assiduous practitioners of a set of rituals, and a smaller class of individuals who may be better at teaching than practicing. Over generations these classes may nurture each other to mutual benefit. Thus culturally transmitting benefits to genotypic facsimiles of individuals may be a two-stage or even a multistage process.

A culturogenetic analogue of the genetic principle of competitive exclusion and of the formulation of discrete species leads to a conception of a drastically reduced field of competition for any individual. If such a principle were true it would mean that interaction in a free society was less of a genetic competition than a mutual education or a "shaking into place."²³ Although the foregoing statement by itself is precariously similar to the instinctivist view of predetermined roles that some people have found deplorable, the present proposal leaves considerably more room for individual success in attempts at creativity within the area of culture. There is always the chance for an individual to participate in the creation of new culturogenetic "species." The present proposal also suggests that deliberate social exclusions according to one characteristic (such as race or gender) buy the bigot's genes less than nothing with regard to his other characteristics. The validity of this last comment hinges on what is perhaps in part an ideological assumption—that while many significant human psychological characteristics are genetically based, few are genetically linked together. It appears to be true that many characteristics that are relevant to human participation in advanced civilizations vary widely, independently of one another. To illustrate hypothetically, a

particular Slav may find that his own cousin is not as good a chess partner, nor is he as interested in chess as an institution, as is someone he meets in China.

No attempt will be made here formally to prove culturogenetic principles of competitive exclusion and discreteness of species. It is simply suggested that the complexity and character of cultural system interactions, involving transactions of goods and exploitation of environment, seem comparable in many ways to those occurring in biological nature. Such comparability would seem to favor evolution of similar phenomena. Intuitively we already know that culture does comprise discrete groups: There are fishermen and farmers, violinists and pianists, scholars and clergymen, with relatively few transitional types or hybrids.

It must be recognized also that individuals rarely are committed monolithically to a cultural niche. While it is not meaningful to conceptualize transitional types among pianists, violinists, corporate executives, carpenters, etc., there are certainly individuals who play several such roles. Pursuing the thesis of this paper, one may assume that such multiple roles often reflect multiple genetic propensities. This point will not be developed further here, except to mention that it provides for human life that is richly equivocal, with ample opportunity for conflicts occurring within the same individual, for doubts about who really are the members of one's "kinship" group, and for shifting alliances. Politics may provide a fruitful source of metaphors for a biologically based study of individuals and their social interactions.

Under this proposed mechanism there is less chance that an individual's set of cultural investments will be in overall conflict with his genetic ones. Such conflict is fundamental to Richerson and Boyd's formal model of human evolution as a variable sum, two-person game.²⁴ In a complex, advanced society there is a great deal of division of labor, specialization, and mutual dependency of cultural institutions, analogous to symbioses of different species or, even more extremely, analogous to the relations among organs of an individual body. Bodily organs, like ants in a colony, do not compete with one another because they share a common reproductive mechanism ("kin" selection) and because they are tightly coupled subsystems, mutually dependent for survival (reciprocity).

A society in which there is a free sharing of ideas will optimize the discovery by individuals of culturogenetic niches, at the same time optimizing the overall functioning of the society. There are two limitations on the degree to which individuals are likely to want to support

this freedom. One limitation is the obvious one, mentioned earlier, that each individual has an alternative and often easier opportunity of putting his investment directly into genetic reproduction and nurture of kin. The other limitation is more interesting; it is the benefit gained by carefully targeting ideas that are not amenable to a broadcasting strategy. The propagator of such an idea must evaluate how effectively it has been incorporated by any given seeker and must evaluate the degree to which the idea truly resonates with the seeker's temperament. Thus there is still room for a kind of conservatism or slowing of process in the present scheme. At first glance it might seem unimportant if a seeker seized advantage from a propagator since the propagator's idea and its genetic substrate thereby would be guaranteed survival. However, this superficial consideration fails to ask how the propagator can be assured of optimal transmission. The long-term success of propagation of certain ideas and institutions requires that teachers both find optimal substrates for their propagation and insure that within these substrates there are no additional characteristics which, though perhaps not immediately relevant to the particular ideas or institutions, would prove detrimental to them in the long run.

It is important that certain ideas, particularly very complex ones, be transmitted carefully since, as in phylogenetic evolution, most variations will turn out not to be viable. In addition, deceit is something that has arisen phylogenetically many times, for example, in the mimicry by young cuckoos of the begging of the hosts' offspring. Certainly deceit is a culturogenetic possibility, that is, a seeker may find it expedient to adopt certain characteristics of the propagator's message while refusing or being unable to adopt other characteristics. It is up to the teacher to be certain that the most significant characteristics of his message have been incorporated by the learner. "Deceitful" learners may look something like the teacher or be more apt at learning conspicuous correlates of a message (e.g., mannerisms and a style of speaking) while others may be better at handling conceptual aspects of the message. Statistically teachers' abilities to carry out these evaluations are probably very imperfect but must be partially effective.

A more complex possibility than discussed above is that a cultural message which originates largely in one individual may comprise aspects that are maintained subsequently by more than one individual. The clearest such case is the founding of a movement, but sharing of viable ideas does not usually take this extreme form. There is little reason here to pursue possible detailed scenarios. The point is that the present scheme of culturogenetic propagation is consonant with some known dynamics of social interaction.

The present hypothesis will be still more compelling if it turns out that systematic considerations of past events are well interpreted in its light. For example, it seems that the exertion required to proselytize might be more likely to take place during hard times when it is impossible to support a family. Under such circumstances one might as well invest whatever resources he has in the attempt to confer an advantage on already embodied, nonkin genes. There have been enough instances of hard times and death, and of failure and success of proselytizing, in human history to make plausible the speculation that the inclination to proselytize has been naturally selected to vary systematically with economic conditions. Of course other possible payoffs for proselytizing complicate the picture. Thus, while the present hypothesis both is logically possible and has empirical implications, it will take astute historical analysis to arrive at a judgment of the extent to which the proposed mechanism actually has determined human behavior.

CHARACTERISTICS OF LEARNERS AND SEEKERS

The failure or success of proselytizing depends on the characteristics of the receivers as well as of the senders of messages. The innate disposition to learn can be broadly conceptualized in two aspects after the manner of the European ethologists: a tendency to learn certain behaviors more easily than others and a tendency to accept information only from certain sources.²⁵ Both aspects may be taken as evidence of the evolution of a brain substrate adequate to record a limited variety of orderly patterns without having to go through the cumbersome process of phylogenetic variation and selection repeatedly in producing each competent individual. Donald T. Campbell refers to the phylogenetic savings in each individual as “vicarious selectors.”²⁶ We could never rise above a primitive level of behavior without vicarious selectors. In the present example of innate dispositions to learn, it can be seen that these are not simply expansions of capacity of living material, that is, nondiscriminating repositories, but that there is truly a selection process occurring which acts as an early line of defense against environmental contingencies that would involve more critical, life-or-death selection processes. An individual who acquires information too indiscriminately falls easy prey to exploitation—children learn to cope with aspects of the environment from skilled relatives, but they should be careful about listening to strangers.

There must be an ongoing natural selection process, balancing apt learning of information against too ready acceptance. The age and experience of the learner must be factors in this process, that is,

evolutionary processes may be expected to lead to successive critical periods in ontogeny for given categories of learning.²⁷ Only a limited degree of prescience can be built into our mechanism for discriminating good from bad messages; as with all biological characteristics, whatever prescience is built in represents a gamble that future contingencies will be analogous to past ones in some general way. There remains a strong element of guesswork (prescience plus analysis plus random variation) in idea adopting.

What form does such prescience take? The preceding two paragraphs present a simplified picture, hinting at separately encapsulated innate and learned components of behavioral mechanisms. Reality, in its presently evolved stage, is probably more complex. Thus it seems likely on the one hand that some predispositions to learn are not wholly innate but are in part the outcome of experiential factors and on the other hand that some individual skills are not wholly learned but in part have been shaped by the more cumbersome evolutionary process of phylogenetic variation and selective retention; this can be true if the particular modern skill bears a strong similarity to those necessary to fulfill historically recurrent contingencies. It is the former possibility that is particularly important in the present context. It is offered as a possible explanation of human beings' ritualistic association with other individuals or groups. A hypothetical mechanism will be outlined below in which the predisposition to learn particular categories of information comprises an innate, motivational component plus a learned component by which individuals discriminate with whom to associate and what responses are appropriate in the contexts of those associations. To see this mechanism in its broad, evolutionary perspective it will help to introduce the closely related concepts of "weak motivation" and "weak interactions."

"Weak interactions" are defined by analogy with weak interactions in atomic physics.²⁸ They are due to innate social motivations which, in any given individual at any point in time and space, compete only weakly with the "strong forces" of sexuality, hunger, pain avoidance, etc.; however, they exert a significant influence in the aggregate and in the long run. By their nature, motivations underlying weak interactions dominate conscious experience less than the more carnal urges. As with other concepts offered here, this one is associated with an implied program, that of classifying human motivations according to their local strength in space-time versus their aggregate strength over historically significant, larger expanses of space (space in the sense of geography, space as occupied by individuals and groups) and longer intervals of time. The particular weak interactions most relevant to

my discussion about teaching and proselytizing are those whose underlying motivations lead individuals to participate in the social institutions of schools and religions. Let us briefly pursue here the case of religion; some of the same considerations will be easily seen to apply to the respect that civilized people have for schooling.

It is generally accepted that a function of regular religious observance is to remind people of which options for social behavior are acceptable ones. Although arguments may be made that this in fact is the sole *raison d'être* of religions and that all other facets, including central doctrines, are actually peripheral "myths," it is not necessary to face these questions here. The proposition that long term survival of a community is facilitated by religious behaviors can coexist consistently either with radically materialist positions, devoutly spiritual ones, or a range of intermediate beliefs. The proposition implies a natural selection factor leading to innate religious motivations.

Campbell has pointed out that religious imperatives often have the character of setting limits on motivations that lead to more immediate, selfish benefits.²⁹ He sees this interaction as an example of conflict between cultural (religious) knowledge and genetic (hedonistic) tendencies. But, as argued above, there is a contradiction inherent in viewing any long-surviving pattern of social behavior as being transmitted purely by cultural means. If no genetic benefit is provided when effort is repeatedly expended in a behavior, then this behavior must select against itself incrementally with each generation. Therefore some aspects of moral or religious behavior must be innate.

It already has been argued above that highly articulated skills cannot be innate in creatures who have such long generation times as humans and whose entire history is too short to have allowed the haphazard process of natural selection to shape a skill. Insects breed much more quickly and have remarkable innate skills.³⁰ Perhaps exceptions to this generalization about human "skills" may be made about those such as locomotion and digestion, whose history goes back much farther than does our species, but uniquely human social skills have to be learned in large degree. It must be emphasized that this is true not only of religious behaviors but also of the behaviors that religious imperatives warn against. In both cases the innate component must be a vaguer, more global tendency such as the motivation to perform, while the actual, skilled performance must be enabled by a learned overlay on this foundation.³¹ For example, the skills involved in theft or in bearing false witness are so complex they must in large degree be learned; however, the selfish motivations that lead to these

behaviors can be thought of quite plausibly as innate. Similarly the specific words and gestures of religious rituals must be learned, but the impulses toward religious behavior and the joys of engaging in such behavior may well be the innate aspect. The prescience possessed by seekers of knowledge therefore may be thought of as a combination of genetically determined, weak motivational factors, which include some sort of vague perceptual criterion of what kinds of social situations are weakly rewarding, plus an experiential factor consisting of habits of devotion, habitual attendance at chosen ritualist events, association with particular authority figures, etc.

While selfishness and religiousness share the property of having both innate and learned aspects, they are clearly different. However, the difference is not as dichotomous as Campbell suggests. Aside from the detailed, formal differences in sundry selfish behaviors and religious behaviors, the most important general difference is an overall one in the strength or weakness of the innate motivations toward these social interactions. This difference in strength reflects priorities related to survival. If something is choking you, you fight for air and only then worry about your hunger. When severely hungry you tend first to eat and only later to worry about athletics or other recreations, etc. Moral and knowledge-seeking behaviors, although dominant in some people, places, and times, tend to have a relatively low priority, statistically speaking.

The reason is that while short-term survival is possible without long-term survival, the converse is not true. For this reason, natural selection will tend to bias the set of motivations so that, as far as genetic determination is concerned, those that are most immediately relevant to local survival are the strongest. However, weak moral motivations also have an adaptive value which is related to their roles in supporting complex social structures based on reciprocal altruism and related to their roles in maintaining social structures within which teaching and proselytizing can take place. It is well known that forms of morality and respect for knowledge are predominant under relatively orderly, stable social conditions. In the present perspective, stable conditions are both cause and consequence of the weak interactions' strong aggregate effect. Under stable conditions people regularly return to a place of worship or in other ways are reminded regularly of propriety; consistent messages are directed at children from many sources. The "strong motivations" take over during severe social decay. This is not to say that all stable societies are "good" ones. Some concrete realizations of the foregoing description involve exclusiveness and prejudice. Additional questions about the nature of progress and desirability of social change will not be pursued here.

The foregoing arguments imply that public messages are not for everybody, even when they are broadcast widely. Historically many messages which have purported to be for everyone, and which have been responded to positively by a large number of people, have led to benefits for a few, often those in a position of political leadership, at the expense of many followers. The kind of proselytizing discussed here involves no such duplicity; it works well when it does not draw in too many followers. Therefore it cannot be done in a heavy-handed way.³² The idea is to filter out individuals bearing similar tendencies to those of the teacher, and this process will work only if there is a free self-selection of followers. The richness of human society may be seen in part as resulting from the fact that a follower does not need to be like a leader in all aspects. Our special, human dissociability of ideas means that the same individual can be a substrate for ideas from many sources, some of which may intersect and lead to new syntheses, others of which have no relevance to one another. Some complements of ideas borne by individuals may include ones with contradictory implications which are never detected. Depending on circumstances, such an individual's effectiveness as a "culturogenetic vector" may be compromised, as suggested above in considering how a teacher may need to be careful in selecting learners of certain kinds of ideas; but reality is sufficiently complex that there may be circumstances in which such an individual's effectiveness is actually enhanced!

A PRESCRIPTIVE IMPLICATION

The biggest pitfall in reasoning about evolution is the possibility of abusing such theorizing for prescriptive purposes which justify exploitative capitalism or imperialism, as occurred with Social Darwinism in the nineteenth century, or justify racism.³³ This is the main concern of contemporary, vigorous protesters against sociobiology. Potential confusion about the roles of description and prescription is characteristic of theorizing in the social sciences, far exceeding what may occur in the so-called natural sciences. Elementary particles are subject to indeterminacy when they are influenced by a measuring operation, but at least they have the decency not to read the physics journals or even popularizations of physics. Undoubtedly in the heat of the scientific enterprise many physical scientists exhort their particles to behave in accordance with pet theories, but it is doubtful that the particles listen. People, however, do pay attention to theories about themselves, obeying or disobeying as their individual agreeableness or righteous perversity dictates.

We must recognize the possible confusions between prescription and description and then must go ahead and try to complete social theoretical efforts by suggesting some possible prescriptions. This helps justify the theoretical enterprise as something more than echoes in the ivory tower.

In the case of the present hypothesis there is an opportunity for a kind of gentle prescribing that avoids the naturalistic fallacy.³⁴ Rather than saying "because things have been such a way in the past, they must continue to be the same in the future," we can say "here is an opportunity, a way in which people can be effective." The hypothesized mechanism represents a way in which many people already are trying to be effective, but a way that is not yet completely understood by them. A truly free society, in which nurture and competition are based more on ideas and less on family-oriented special interests than is our present culture, may be characterized by more rapid advancement than at present. Current psychological theorizing has a hedonistic orientation that, by emphasizing the needs of the individual person in his search for self-fulfillment, has a certain tendency to fragment society.³⁵ The present theory suggests that committing oneself to principles and to a sharing of ideas with others can lead to a more enduring fulfillment.

NOTES

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3. Lorenz; Donald T. Campbell, "Evolutionary Epistemology," in *The Philosophy of Karl Popper*, ed. P. A. Schilpp (La Salle, Ill.: Open Court Publishing Co., 1974). In theoretical papers I have reviewed additional literature and have discussed the problem of organization as it concerns the brain: "A Neural Systems Theory of Schizophrenia and Tardive Dyskensia," *Behavioral Science* 21 (1976): 274-88; "How Can So Little Brain Hold So Much Knowledge? Applicability of the Principle of Natural Selection to Mental Processes," *Psychological Record* 2 (1977): 393-415; "Does the Brain Activity Maintain Itself?" (with B. Malamut), *Biosystems* 9 (1977): 257-68; "The Logic of the Lesion Experiment and its Role in the Neural Sciences" in *Recovery from Brain Damage: Research and Theory*, ed. S. Finger (New York: Plenum Publishing Corp., 1978).
4. S. L. Washburn and F. C. Howell, cited in J. S. Bruner's "The Course of Cognitive Growth," *American Psychologist* 19 (1964): 1-15; J. Buettner-Janusch, *Origins of Man* (New York: John Wiley & Sons, 1966), pp. 145, 349.
5. "Origins and Evolution of Language and Speech," ed. S. R. Harnad, H. D. Stelklis, and J. Lancaster, *Annals of the New York Academy of Sciences* 280 (1976); H. J. Jerison, *Evolution of the Brain and Intelligence* (New York: Academic Press, 1973), pp. 420-32.
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12. Donald T. Campbell, "On the Genetics of Altruism and the Counter-Hedonic Components in Human Culture," *Journal of Social Issues* 28 (1972): 21-37; *idem*, "On the Conflicts between Biological and Social Evolution and Between Psychology and Moral Tradition," *American Psychologist* 30 (1975): 1103-26 (reprinted in *Zygon* 11 [September 1976]: 167-208); Dawkins.

13. Ralph Wendell Burhoe, "The Human Prospect and the 'Lord of History,'" *Zygon* 10 (September 1975): 299-375; *idem*, "The Source of Civilization in the Natural Selection of Coadapted Information in Genes and Culture," *ibid.* 11 (September 1976): 263-303; Robert Boyd and Peter J. Richerson, "A Simple Dual Inheritance Model of the Conflict between Social and Biological Evolution," *ibid.*, pp. 254-62; Peter J. Richerson and Robert Boyd, "A Dual Inheritance Model of the Human Evolutionary Process: Basic Postulates and a Simple Model [I]," *Journal of Social and Biological Structures* 1 (1978): 127-54; *idem*, "A Dual Inheritance Theory of the Human Evolutionary Process: Costly Culture and the Genetic Control of Cultural Fitness [II]" (manuscript, June 1977).

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16. These comments (and those surrounding n. 32) are strongly reminiscent of the parable of the sower (Luke 8:1). While my arguments apply most clearly to instances of knowledge that are useful to relatively small subgroups (analogy with kin selection), it is intriguing to consider possible extensions to the issue of universal sharing.

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31. See my "Selection Processes in Living Systems: Role in Cognitive Construction and Recovery from Brain Damage," *Behavioral Science* 19 (1974): 149-65.
32. I thank Donald T. Campbell for suggesting this implication.
33. A. Montagu, *The Nature of Human Aggression* (New York: Oxford University Press, 1976). In my opinion Montagu seriously overstates the case; see my review of his book in *Contemporary Psychology* 22 (1977): 109-11.
34. Waddington (n. 6 above), chap. 5.
35. Campbell, "On the Conflicts" (n. 12 above).

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