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BIOLOGICAL EVOLUTIONARY SYSTEMS AND SOCIAL CHARACTER

by

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Can knowledge of biological evolutionary systems be of any relevance to sociology? For the Darwinists of the nineteenth century, the question itself might have seemed obvious. Having found the answer to what seems to be most of the biological problems of the day, it was only natural to apply the newly gained insights to the social arena.

More than anybody else, Herbert Spencer was responsible for applying Darwinism to sociology. Being one of the most influential intellectual figures of his time, he also popularized Darwinism by making terms like "the survival of the fittest" and "the struggle for existence" familiar conceptions. Social Darwinism proved to be a rather crude interpretation of Darwin's hypothesis, and a simplification of biological systems, but it served the purpose of justifying the ruthless competition of nineteenth century capitalism.

As social Darwinism became discredited, so were the attempts to apply biological theory to sociology. Particularly among the liberal tradition in sociology, and among Marxists, such attempts were seen as at best a confusion of biology with history, and at worst as a clinical apology for capitalistic society. However, by neglecting biology, sociologists lost sight of the biological anlage

Anlage

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from which the human condition emerges and consequently the concept of human nature became relegated to the role of a myth.

Do we still have to choose between biological theories, which, when applied to human affairs, truncate the very nature of humanity, and a historicism which is uprooted from its biological heritage? Perhaps not. This paper is based upon the premise that when one studies biological evolutionary systems in light of contemporary science, interesting lines of thought emerge throughout human evolution. There are a number of developments in biology (particularly the work of C. H. Waddington), genetic epistemology (J. Piaget), and psychoanalytic sociology (E. Fromm and his collaborators' research in social character theory) which make this dialogue fruitful.

I would like to pursue a comparison which intrigues me. Working in the field of social character research it has become clearer to me how a given social structure "selects" certain character constellations which in turn become a dominant type in the social scene. The values and social norms of the new class are closely integrated with the social structure. It occurs to me that if we pay attention to the selective interaction in human societies between a man made environment and the human response to it, there are certain strategies that are similar to the role "genetic assimilation plays in natural selection.

The concept of genetic assimilation was put forward by one of the great biologists of our time, C. H. Waddington in an effort to conceptualize the interaction between genetic structures and...



environmental pressures. The concept of genetic assimilation is a new paradigm within evolutionary theory which goes a long way in explaining the complexity of living systems in their dynamic interaction.

In writing this paper I have realized some of the many pitfalls that any such comparison entails. By putting the emphasis on the similarity of strategies observed between biological and human evolutionary systems I hope to avoid falling into a reductive or anthropocentric methodology. I am aware that in order to avoid these common pitfalls this precaution is insufficient. An interpretation of the ascent of man should be our first step.

It seems to common sense that in order to understand something of the nature of human evolution we first have to know what is human. Surprisingly biologists who study the human species rarely address themselves to this problem. The astonishing leap of homosapiens from his biological ancestry involves a revolutionary change. But to speak of revolutionary change within evolutionary systems might seem contradictory if not absurd. But is it? The fact is that major evolutionary changes are discontinuous. Waddington has described these discontinuities as the "principle of archetypes."¹ The principle operates on the premise that moderate changes in selective pressure may proceed through small, gradual steps for a considerable time. However, suddenly a new organization comes into being that is different in magnitude from anything else that has been demanded

¹C. H. Waddington, The Evolution of an Evolutionist (Cornell University Press, 1975), p. 306.

in the past.

According to Waddington, the new "organization" completely takes over from all the old and much less efficient phases that have led up to it; or it may be capable of being used in some radically new way which allows ancestral forms to survive only in much simpler contexts, where their ancestral relation to the novelty may be almost unrecognizable.

The recognition of these leaps in evolution becomes vitally important if one is to attempt any comparison between biological and human evolution. Methodologically, the logical way to proceed (in order to avoid a reductionist methodology) is to understand the nature of the novel organization that emerges through evolution (the new archetype) and only then attempt a comparison with lower phyletic levels. Let us then proceed and follow Waddington, Fromm and Piaget in their own interpretation of these "evolutionary leaps," and see if their contributions coming from different fields, can support each other and help us establish the basis for comparison we are seeking.

Waddington has pointed out that the salient and perhaps defining characteristic of man is that "He has developed, to an enormously higher degree than is found in any other species, a method of passing information from one generation to the next, which is alternative to the biological mechanism depending on genes. This human information-transmitting system is, of course, the process of social learning. This gives man a second evolutionary system superimposed on top of a biological one and functioning by means of a different system of information transmission."²

²Ibid., p. 290.



Waddington has called this a socio-genetic system. By means of a socio-genetic system, man has acquired, in a relatively short period of time, a vast amount of knowledge which gives him a great versatility in his capacity to adapt to new environment conditions, and is the basis for the development of civilization. Rather than having information processed only through the genetic system, he can transmit information by the much more effective means of language and symbolic communication.

Waddington's analysis, while making a fundamental distinction, has not asked what kind of structures have replaced genetically-programmed modes of learning in man. Piaget's work is particularly enlightening in this respect. The issue is of great importance, since cultural transmission is possible only after man has been able to acquire a new structure which overtakes its predecessor (instinctive learning).

What is the nature of this new structure? In order to answer this question, Piaget has developed a methodology in which he tries to build a "geneology of structures" where each new structure "inherits" from its predecessor a basic organization. However, each structure not only inherits its predecessor but a new constructive activity takes place which creates a new "whole" modifying drastically the previous relationships and structures that have been incorporated within this new whole. A reconstruction of such a geneology of structures facilitates the study of different levels of organization without falling into a reductive methodology.



Using this method Piaget has described the evolutionary leap from instinctive learning to human cognitive structures as the "bursting of instinct."³ What disappears with the bursting of instinct is hereditary programming. With the bursting of instinct two elements of instinctive structures are inherited and its component parts are further developed in two directions in man. On the one hand, instinct has a capacity to extend the program into individual and phenotypic actions. In man this capacity is extended not only toward learning but also into the ability to design experimental courses (a move toward exteriorization). On the other hand, cognitive structures in man also inherit the source of organization of instinct. The organized functioning is extended in man toward reflective reasoning (the move toward interiorization). The condition which must exist before this dual advance can take place is the construction of a new method of organization.

The new regulations have the capacity to become mobile instead of being set by a genetic program. That is, there are not only corrective, but also precorrective regulations. Thus, as Piaget puts it, "intelligence does inherit something from instinct, although it rejects its method of programmed regulation in favor of constructive-auto-regulations."⁴

Fromm's interpretation of the evolutionary emergence of man shares with Piaget and Waddington the belief that the instinctual

³Jean Piaget, Biology and Knowledge: An Essay on the Relations Between Organic Regulations and Cognitive Processes (The University of Chicago Press, 1971), p. 366.

⁴Ibid., p. 366.



equipment in man has reached a minimum, and that a new source of learning has developed. There is not an inherited program which tells man how to decide, or what course of action to take.

According to Fromm, the combination of minimal instinctual equipment, and a maximum development of the brain constitutes a completely new phenomenon. Fromm's contribution is that he asks a fundamental question (which is the basis for his conception of character): Does this extraordinary development, i.e., the development of intelligent thinking and the capacity for self-awareness and self-determination, make up for instinctive deficit? Fromm's answer is dialectical. Man's new capacities have also created new needs. This puts man in a state of disequilibrium, from which he will have to create a new state of harmony. To quote Fromm:

Each new need can be satisfied in different ways which vary according to differences in his social condition. . . . These different ways of satisfying the existential needs manifest themselves in passions, such as love, tenderness, striving for justice, independence, truth, hate, sadism, masochism, destructiveness, narcissism. I call these character-rooted passions--or simply human passions--because they are integrated in man's character.⁵

Fromm defines character as the "relatively permanent system of all non-instinctual strivings through which man relates himself to the human and natural world. One may understand character as the human

⁵According to Fromm, Man's needs have evolved from other species, in that he is concerned not only with surviving, but also with establishing a new equilibrium in which his new capacities have to be fulfilled in order to re-establish an equilibrium. These new needs include: a frame of reference and devotion, a need for roots, a need to make a dent--that is, to be effective, and a need for stimulation. The satisfaction of these needs can be achieved regressively or progressively. For instance, the need for a frame of reference and orientation can be satisfied either by creating a system of devotion which is idolatrous, in which man loses himself, or by affirming the unity of mankind. These alternatives are both socio-historical and individual categories.



substitute for missing animal instincts; it is man's second nature."⁶

Despite the different emphases among these men from such different fields, I think it is surprising to find a basic agreement that the nature of man can be defined from a biological perspective, (as a necessary, though not sufficient condition) if one takes in consideration the structural changes that emerge as new "archetypes" in our evolutionary heritage.

To sum up, Waddington has stressed socio-genetic transmission of knowledge which is not dependent on the genetic code. Piaget emphasizes the cognitive structures and how they have evolved from instinctive forms of knowledge. Fromm recognizes that these evolutionary leaps have created a new set of needs which have to be satisfied in order to re-establish a harmony with nature. The way these needs are satisfied are structuralized in a semi-permanent characterological makeup.

Having considered some of the novel evolutionary "leaps" that characterize man, we may be in a better position to pursue a comparison between biological and human evolutionary systems. Needless to say, the comparison can go in many different directions. In this paper I am mainly concerned to study the selective processes which operate in two different realms of evolutionary adaptedness, i.e., genetic assimilation and social character.

Genetic Assimilation

According to Waddington,⁷ transmission of genetic material has two "groupings." Genes are arranged in groups of neighbors held

Erich Fromm, The Anatomy of Human Destructiveness (New York, Chicago and San Francisco: Holt-Rinehart and Winston, 1974), p. 226.

⁶Ibid., p. 226.

⁷Waddington, op. cit., p. 289.



together by the material structure of the chromosome. This arrangement is a contingent one, and is more or less independent of genetic functioning. Another type of association takes place during development of specialized tissues such as the nervous system, muscles, etc. This form of functional grouping is dependent upon the way in which gene activities "interlock and interact with each other."⁸

Waddington has called this epigenesis--that is, an association which arises from genetic interaction during development. This epigenetic grouping is important in order to understand how acquired characters become genetically fixed (inherited), without postulating (as Lamarck did) that the environment has a direct effect on the genome, i.e., inheritance of acquired characters.

Ever since Lamarck's theory of the inheritance of acquired characters (by use or disuse of an organ) became discredited in favor of the Neo-Darwinism (mutationist) view, the matter seemed to be settled. The solution adopted was that random mutations and genetic recombinations (which occur spontaneously) were selected by the environment whenever there was a change that demanded a new adaptation. It is only a matter of chance that an adequate mutation will come about that is best "fit" to the new environment. In other words, the environment selects those mutations which are favorable at any given time, and naturally the progeny of these "mutants" thrive successfully.

The fact remains that there is a remarkable fit between organisms and their environment. It is highly improbable that this fit can be explained simply or solely on the basis of random mutations.

⁸Ibid., p. 289.



Attempts to overcome this difficulty by invoking some modified version of Lamarck's theories (a direct effect of the environment on the genome) have not been corroborated experimentally. The Neo-Darwinian explanation is also unsatisfactory since it leads to conceive of the environment and the organism in a radical split. There is no way to understand how the organism may acquire information from the environment, since selection occurs after the fact. The whole question of how an organism adapts to its environment becomes an enigma.

With the realization that the environment also selects the most adaptive response--that is, an epigenetic response--and that this response also had to be genetically determined, Waddington was able to bridge the gap between the Lamarckian and Neo-Darwinian hypothesis. Since the epigenetic grouping is associated functionally, and this association emerges throughout development, it is not anymore a matter of chance whether an organism becomes selected, but it is dependent on a complex grouping of genes which have come associated during development within a particular environment.

If an environmental change takes place, a new grouping will emerge which is best adapted to the new environment, and the most successful adaptation will be selected. Waddington has called this process "genetic assimilation," when the selected adaptation becomes "fixed." In other words, the genetic response becomes assimilated if, say, the organism is transferred back to its original environmental conditions, and it continues to exhibit the new traits that it had acquired with the environmental change. Thus, an acquired character

has become "inherited."

An example of genetic assimilation in natural conditions is the pond snail, *Limnae stagnalis*.⁹ *L. Stagnalis* usually has a large shape. But in some Swiss lakes it produces a variety of a shorter kind known as *L. lacustris*. In Lake Neuchate] and Lake Constance there is still a shorted variety (*L. bodemica*). In nature the shorter varieties appear only in very shallow water, where the lakebed is exposed to wind and wave action. The shorter varieties are much more contracted because during development they have to contract their columenar muscle in order to hold tight to the bottom when wave action threatens to dislodge them.

Piaget¹⁰ collected the contracted forms and bred them in still water in laboratory tanks. After many generations they still conserved their contracted phenotypes. Thus the acquired character (contracted forms of *Limnaea*) had become genetically fixed. Piaget was also able to show experimentally that contracted phenotypes can be produced as physiological adaptations to wave action. Finally, in order to prove definitely that the contracted forms were "fixed," Piaget took the eggs of the sixth generation of snails reared in the laboratory to a still, natural pool, and again they did not lose their contracted form. The contracted forms were also characterized by certain types of behavior. They "choose their environment,"¹¹

⁹C. H. Waddington, Genetic Assimilation in Lamnae in The Evolution of an Evolutionist (Cornell University Press, 1975), p. 92.

¹⁰Ibid., p. 94.

¹¹Ibid., p. 94.



i.e., they are free to migrate into greater depths where wave action would cease. However, there is no sign that they do so; they "chose" to stay in shallow waters. They also cling harder to the sides of the laboratory tanks, and are not easily dislodged.

Another important development in the field of genetics has been the transition from individual to population genetics. Geneticists, most notably the late Theodosius Dobzhansky, have stressed the importance of populations during the process of natural selection. In terms of populations, selection is a probabilistic event, rather than the outcome of individual mutations that prove to be of adaptive value. Populations are conceived as a mixture of genotypes, where the unit is the "genetic pool."¹² The genetic pool represents a hereditary potential that is distributed in any given population which tends toward equilibrium. Thus, genes do not function in an isolated state. Rather, the effect of genes "are woven together in the developmental level into a single system which undergoes orderly changes in time."¹³ As Dobzhansky has emphasized, Genes are not soloists, but members of an orchestra.

To sum up, genetic assimilation operates within populations. The "genetic pool" is the basis from which different epigenetic groupings emerge during development.

¹²T. Dobzhansky, *Mankind Evolving. The Evolution of the Human Species* (New Haven and London, Yale University Press, 1962), pp. 140-145.

¹³T. Dobzhansky, "What Is An Adaptive Trait?," American Naturalist 15 (November-December 1956):343.

The Theory of Social Character

In order to study differences and similarities in selection occurring through genetic assimilation and selection of social character types, let us describe in more detail E. Fromm's concepts. According to Fromm; social character is a way to mold and canalize human activity within a given society in order to maintain social structure functioning. In other words, social structure guarantees that there will be a critical mass of individuals who "want to act as they have to act and at the same time find gratification in acting according to the requirements of the culture."¹⁴

The canalization of human activity is achieved through the vehicle of family structure, social institutions, religious and ideological beliefs which impress in a given population (particularly children) a series of characterologically-rooted attitudes which are most adaptive to the needs of a given social structure.¹⁵

For instance, nomadic hunters are characterized by their courage, determination and comadary toward fellow tribesmen. During childhood aggression is channelled toward hunting activities, while disregard for property, generosity and lack of competitive strivings in an economy where hunting skills are distributed unevenly are inculcated as dignified and dignifying virtues. As E. Erikson points out,

¹⁴Erich Fromm, "Psychoanalytic Characterology and It's Application to the Understanding of Culture" in S. Stansfeld Sargent and Mariam W. Smith, eds., Culture and Personality (New York: Viking Fund, Wenner Green Foundation for Anthropological Research, 1949), p. 5.

¹⁵Fromm has observed throughout his work that social forces are not the only historical determinants, but that man's strivings for freedom, dignity, solidarity, and truth also bring about historical change. The latter forces, however, are not supra-historical categories, but are rooted in man's evolution, which creates needs which are unique



the same activities "transplanted into our own system, the very expression of what was once considered to be efficient and aristocratic behavior--such as disregard for property and the refusal to compete--only lead to an alignment with the lowest strata of our society."¹⁶

Erikson has vividly pointed out the devastating effect which destruction of a mode of living, i.e., "social structure" based on a particular mode of production, can have on social groups. The Sioux were forced to become sedentary farmers, "only at the price of being a sick man, on bad land."¹⁷ Another example (from Fromm) in regard to the differences between nineteenth and twentieth century capitalism might highlight our discussion of how social forces canalize character.

Nineteenth century capitalism was based upon a ruthless competition among capitalists, "which led to the elimination of the weaker and less efficient among them."¹⁸ The adaptive social character was exploitative and believed that fierce competition was the law of nature. Indeed, Spencer's "survival of the fittest" slogan was just the kind of ideological cement which justified the state of affairs and made ruthless competition appear "natural." And in fact,

to our species. In other words, there are limits to social character adaptation, and these limits are rooted in man's emergence as a species. These unique human needs are also character-rooted and interact with forces which "canalize" social character.

¹⁶E. Erikson, Childhood and Society (New York: Norton & Company, Inc., 1950), p. 156.

¹⁷Ibid., p. 140. E. Erikson developed in Childhood and Society a concept similar to Fromm's concept of social character. For instance, in his study of the Sioux, anal character traits are not the result of bowel training, as classic psychoanalytic theory would have it, but the result of a particular mode of assimilation of hunters in a nomadic life that integrates economic and geographic conditions with cultural aspirations and values that give a sense of cohesion and homogeneity to the Sioux.

¹⁸Fromm, op. cit., p. 74.



ruthless competition was "natural" for many efficient capitalists. Authoritarian attitudes were based upon the methods of social control which were strictly patriarchal and supported by the authority of God and king.

In contrast, twentieth century capitalism, with its gigantic corporations that are centrally controlled and managed, does not require an authoritarian and exploitative character. Decisions are made in teams of technocrats who need to cooperate with each other and motivate their co-workers in order to "maximize" the productive forces within the organization. Rugged individualistic competition has given way to "team efforts"; individualistic efforts to control and compete, if present, are curbed for the benefit of the team, group, organization or corporation. Usefulness to the team has become the greatest virtue (in contrast to the nineteenth century capitalist who sees himself as a patriarch in competition with everybody else).

Needless to say, in twentieth century capitalism, the most adapted social character type is a "natural" team man. To put it in terms of managers, he or she has the "right attitude". In other words, he does not have to repress, say, an authoritarian character trait, because his character is already rooted in the reality of the social conditions which prevail in twentieth century capitalism. Given that the "team man" is becoming an observable phenomena, we can say that he or she is a new social character type that is emerging or has emerged.¹⁹

¹⁹Michael Maccoby has described this type of character as the "gamesman" in his recent study of social character types of managers in American corporations. Maccoby is of the opinion that



Thus, there is clearly a process of "social selection."
 In the book, Social Character in a Mexican Village, E. Fromm and M. Maccoby have given the following description of the process:

In a relatively stable society (or class) with its typical social character, there will always be deviant characters who are unsuccessful or even misfits under the traditional conditions. However, in the process of socio-economic change, new economic trends develop for which the traditional character is not well adapted, while a certain heretofore deviant character type can make optimal use of the new conditions. As a result, the "ex-deviants" become the most successful individuals and the leaders of the society or class. They acquire the power to shape laws, educational systems, and institutions in a way that facilitates the development of new trends and influences the character formation of succeeding generations.²⁰

And further on:

In order to understand the process fully, one must consider the fact that aside from the extreme deviants who form a small minority, there are much larger minorities whose social character is different from the majority, but not enough to make them unable to function in their society. They may be said to have "secondary character traits" which are latent as long as the social structure remains unchanged.²¹

On the other hand, to establish an equilibrium there must be a "critical mass" within a class or social group who shares the same social character; otherwise the dominant group will in the long-run be unable to maintain a social cohesiveness that is necessary in any given society. One last example may illustrate the process:

the "gamesman" is selected in roles of leadership given the conditions that prevail in our society. See his book, The Gamesman. The New Corporate Leaders (New York: Simon and Schuster, 1976).

²⁰E. Fromm and M. Maccoby, Social Character in a Mexican Village (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1970), p. 232.

²¹Ibid., pp. 232-233.



The new merchant class that developed in Europe and North America from the seventeenth and eighteenth century onward was characterized by a hoarding productive attitude. The class was characterized by the hoarding productive attitude. It was adapted to the need for capital accumulation (rather than consumption), personal industriousness, sobriety, the obsessional drive to work, and the absence of compassion. Only those who shared all, or at least some elements of this "obsessional-hoarding-productive" character syndrome could become successful under the new conditions of developing capitalism. The same social character would have not been adaptive to the medieval artisan whose character grew out of the pre-capitalistic mode of production in which not saving and obsessional work, but a tendency to enjoy life, including work, was outstanding.²²

An interesting parallel can be observed between the selective process operating through genetic assimilation and the selection of social character types. Since attempts to carry out genetic assimilation from inbred lines have been quite unsuccessful, this fact has provided almost conclusive evidence that the process depends upon the utilization of genetic variability present in the original stocks. Thus, there is a genetic pool whose variability guarantees the possibility of epigenetic groupings. As we have mentioned before, the development of social characters is also dependent on the availability of "secondary character traits" that cluster together and "canalize" through a given social structure. The strategy of the genes consists of selecting epigenetic groups which will prove to be phenotypically of selective value. Waddington has called this process "canalizing selection." The strategy in the selection of social character types operates on a similar principle by grouping from a wide range of developmental possibilities specific character traits that are best adapted to prevailing conditions.

²²Ibid., p. 234.



I would like to mention in passing that Piaget had gone beyond C. H. Waddington in the theory of genetic assimilation. Piaget observes that an epigenetic response to the environment is only partially determined by the genetic system. He suggests that the information from the environment not only acts by creating a functional regrouping of the genetic system but that the genetic system may modify the genome by constructing through genetic re-combinations new genetic arrangements that were not present originally.²³ Piaget conceives the interaction between the genome and the environment as a two-way traffic rather than a model based on linear causality. Piaget's bold formulation runs counter to one of the most important dogmas in biology, namely that the environment does not modify the genome. It should be clarified that Piaget is not saying that the environment has a direct effect on the genetic system but that during epigenetic interactions the environment operates by creating new recombinations in the genetic system.²⁴

Piaget's suggestions aside from being revolutionary are not without interest for our discussion. Following our analogy one may say that secondary character traits are not simply "selected" by social conditions but are created by them. In other words, one can conceptualize secondary character traits not only as a reservoir that exists "preformed," as it were among the population; but that changed conditions of existence by operating as a social filter that determines

²³See J. Piaget, op. cit., pp. 293-95.

²⁴For a critical response of Piaget's hypothesis see C. H. Waddington, "Genetic Assimilation in Limnae," op. cit., pp. 94-97.

experience create the character traits that exist as a potential among the population. Once the new social character becomes crystalized it will reinforce the social conditions of existence through ideological, political and judicial reforms.

Waddington provides an interesting example of how the strategy of the genes may operate in a hypothetical situation:

Let us suppose that some environmental change puts a natural selective pressure on a population of *Drosophila* to increase its speed or its flight. Now, simplifying rather drastically, the flight of a fly is brought about by rapid periodic contraction of a series of muscles running between the upper and lower side of the thorax. These change the curvature of the flexible body wall, to which the wing is attached by a complex three-dimensional link, which is designed in such a way that, as the body wall changes shape, the wing moves up and down.

The forward motion of the insect through the air depends both on the shape and the wing-stroke, which is in some more or less figure-of-eight-shaped-path, and on the exact aerodynamic property of the wing blade. A speeding-up of the flight could be achieved by modifying various parts of the mechanism. We know mutant genes, with developmental effects strong enough to make them useful tools in a laboratory, which effect several of the components. Our present knowledge of population genetics would suggest that other weaker-acting genes are almost certain to be present in any wild population, and therefore available for natural selection to utilize.

For instance, alteration of the wing-beat or in the exact path followed by the wing tip might be produced by altering the mechanical or geometrical properties of the surface of the thorax. This can be done by such genes as *dumby*, *humpy*, *thick*, *thicoid*, *dachs*, *dachsous*, etc. Alternatively, the property of the muscles might be altered, or the supplies of the enzymes or substrates which provide the energy resources. Not much is known about genes affecting the parts of the system, but they certainly must exist. Again we know little of the genes affecting the wing structure.

On the other hand, we know a great many genes affecting wing size, shape and aerodynamic properties. The overall size can, for instance, be altered by genetic systems affecting the size those cells attain. We know both single genes with strong effects (such as *miniature*, *dusky* which reduce the size of the wing cells), and also complex polygenetic systems affecting cell size and cell numbers, such as those studied by Forbes Robertson. Again, they are genes affecting the shape of the wing outline, and they can do it



in at least two different ways: some such as broad and narrow, affect the rates of cell divisions orientated along the length or across the width of the wing. Others, such as Dumpy and Lenceolote, affect the manner in which the wing contracts from a fat, inflated condition which it has in one period of its development. Such changes in wing shape certainly affect the aerodynamic properties of the wing. These could also be altered by changing the flexibility of its different regions. The leading edge of the wing is stiffened by a thick vein, and there are four others running from the base of the tip of the wing with two cross veins between them, but the posterior margin of the wing remains flexible.

Now, we know a whole battery of genes, operating in several different ways, which can affect the pattern of the venation and thus the flexibility of the wing blade. For instance, vainlet removes all the tips of the longitudinal vein; cubitus interruptus produces breaks in the fourth and fifth veins; cross veinless removes the posterior cross vein; and so on. Finally, there is another group of genes such as Curly, curved, and many others which cause the whole wing-blade to be more saucer-shaped with a concavity either upwards or downwards. All these could affect the aerodynamic properties of the flight mechanism.

It is from this large array of possibilities that natural selection has to find some solution or other that brings about an increase in the speed of the insects' flight. This is a very different task from that envisaged in the phrase "random search," which is usually taken to imply that the population has to wait for a new gene to turn up which produces by itself a more or less specific effect which natural selection is demanding.²⁵

Now, if one compares the process by which genetic assimilation operates, with the process of "social selection," it is clear that in both cases selection is based on the capacity to combine or cluster different traits that are potentially present in the organism or in a population and that come together developmentally in order to meet the challenge of the environment, i.e., the phenotypic response depends on epigenetic groupings that arise during development in order to meet environmental changes.

²⁵C. H. Waddington, Does Evolution Depend on Random Search? in The Evolution of an Evolutionist (Cornell University Press, 1975), pp. 186-88.



Despite the similarities, basic distinctions remain: genetic assimilation operates through the "genetic filter" and to speak of genetic assimilation the acquired traits have to become "genetically fixed," i.e., inherited. Is there any parallel to the genetic fixture in the process of social character selection? It might be preferable, however, not to assume a priori that the two processes are different, and to ask if indeed character traits become inherited (that is, are they genetically assimilated?).

Fortunately, we have the possibility to observe the results of the Indian caste system in order to answer the question. As the late T. H. Dobzhansky observed the caste system, "is the greatest genetic experiment ever performed in man." For over two millenia the Indians attempted to induce specialization of work of the caste system. This obviously involved the formation of social characters which were best adapted to the working conditions. If genetic assimilation operated in the formation of character, there would have been enough generations to "fix the character." What has been the outcome? To quote Dobzhansky:

The evidence is as yet insufficient to rule out the possibility that some average differences between the caste system exist. This much is certain: although India has far to go to abolish inequalities of status and opportunity, all castes have produced persons of ample competence to acquire non-traditional occupations.²⁶

And further on, Dobzhansky makes this very interesting observation:

Wastage of talent is in fact a fatal vice of all caste systems and rigid social systems. When social mobility is interdicted or seriously impeded, individuals qualified for their abilities to enter an occupation are not admitted and unqualified ones are retained.²⁷

²⁶Dobzhansky, op. cit., p. 30.

²⁷Ibid., p. 33.



According to Dobzhansky, the reason for the failure to fix a genetic endowment is based genetically on the fact that human beings have an enormous store of genetic variability, so even strong artificial selection or inter-breeding would not wipe out the genetic variance. However, as we observed previously, there might be another structural reason why social character does not become genetically fixed.

To put it simply, although differences in character traits must have genetic "loadings," the character structure as such is not genetically determined. This is because, as Fromm observes, character is man's "second nature." Character has replaced instinctual behavioral patterns. Or to paraphrase Piaget, character structure "rejects the method of programmed regulation," i.e., genetically determined programming.²⁸ In the case of character, the program that emerges has its own auto-regulations which do not pass through a genetic filter but are canalized through social structures.

Needless to say, the genome is the basis of any epigenetic structure, and there are genetic predispositions toward the development of certain character traits and a certain reactivity associated with character which is genetically determined (reaction norms). However, the systems organizing and regulating character do not pass through the genetic filter. Indeed, the most important aspect of character is that it is constructed (in Piaget's sense) as a result of the interaction between biological structures and environmental pressures. The consequence of this lack of genetic programming is

²⁸Piaget, op. cit., p. 366.

twofold: (1) There is a greater mobility in the expression of different character constellations. This is obvious when one observes the much larger repertoire of emotions and behavioral patterns which are observed in man in comparison to even our closest relatives. (2) There is a greater capacity to adapt to new and unforeseen conditions.

Given these differences, is there any parallel between the fixation of acquired traits in biological systems and the "fixation" of social character types? I think one can speak of a "fixation of social character" even if the structure is not "fixed" by genetic programming. Instead of a genetic program, there are two forces interacting together that account for the "fixation" of character:

(1) The very nature of character structure makes it very difficult for individuals to make radical changes in their personality. Psychoanalysis, the only method that attempts to study the dynamics of these radical changes, is constantly confronted with this phenomena. There is a strong tendency to "hold on" to a character structure, even if this "holding on" creates great discomfort or suffering (a phenomena known as resistance in psychoanalytic psychotherapy).

(2) If a given character is adapted to prevailing conditions, character structure is "cemented" through religious, educational, and ideological means through the social filter which determines experience. However, even when a particular social character becomes maladapted to new social and economic conditions, there is a great resistance to change.

Seen from an epigenetic perspective, this resistance to change is characteristic of epigenetic structures. According to Waddington, epigenesis is canalized. By canalization, Waddington refers to the buffering effect which is observed in the development of

organs and complex structures.²⁹ That is to say, "the capacity to produce a particular end-result in spite of certain variability both in the initial situation from which development states and in conditions met with during its course."³⁰ Needless to say, even the most well-canalized character is never entirely invariant. Strategically, however, the advantage of canalization of development is that it protects the individual from fluctuations of the environment. Here again it would seem likely that character structure is epigenetic, and hence the developmental process has genetic constraints built into it. Nevertheless, as we have suggested before, the character structure organization as such is not genetically programmed, which accounts for the greater flexibility to accommodate to changing conditions which is observed in man.³¹

²⁹Waddington, *op. cit.*, p. 99.

³⁰*Ibid.*, p. 235. Waddington describes the sum of developmental paths particular to an organ or embryo that are channeled as an Epigenetic system. The epigenetic system is equilibrated by the interaction of the genetic system and the environment and not only by individual genes. For a discussion of these concepts see: C. H. Waddington, *The Strategy of the Genes* (New York: MacMillan Company, 1967).

³¹There are many historical examples of this incapacity for new accommodations. For instance, the feudal aristocracy in seventeenth century France had long become an anachronism, given the middle class merchants' greater efficiency and mobility which had overtaken the rural-based economy of the aristocracy. However, the French aristocracy, instead of creating enterprises where they would accumulate capital and become part of the new economic reality, entrenched themselves in their ways, and hence facilitated their overthrow.

Fromm and Maccoby give the following explanation for the lag between economic change and character:

Social character is formed by socioeconomic conditions which have existed over centuries and have resulted in the formation of ideologies, customs and methods of childrearing. This cultural tradition determines the character of parents, so that even though traditional culture no longer fits changed economic conditions, the children--through mediation of the traditional social character of their parents and the old educational methods, ideologies and values



I would like to attempt to touch on an important consideration that has remained implicit through this paper. What is the nature of the selective process in man and how is it different--or is it different--from natural selection? Natural selection ultimately depends on the survival of offspring of a given stock; that is the "survival of the fittest." The concept of "fitness," however, is not as easy to define as it would seem. As J. Maynard Smith observes,³² if you define "fittest" as meaning "most likely to survive" you end up with a boring tautology, namely those most likely to survive will survive.

Although any Darwinian concept will have to account for evolution in terms of survival or survival capacity, the interesting question is to know more about "just which organisms do leave more offspring."³³ The problem is more complex than simply stating that mutations and genetic recombinations are selected by the environment. Any theory of fitness will have to take in account the following: (1) Selection impinges on phenotypes, not on genotypes. (2) In "canalized selection" an epigenetic response is being selected and not simply a random mutation. (3) A genetic pool is the fundamental unit of selection, rather than individual genotypes. (4) Populations select their environment as well as being selected by it. (5) The environment is not homogeneous but heterogeneous (is constantly changing). The

--are still determined by the past, even if they acquire the knowledge necessary to be effective in a changed economy through their school system, their traditional character stands in their way.

See Fromm and Maccoby, op. cit., p. 235.

³²Quoted by Waddington, Does Evolution Depend on Random Search, op. cit., p. 249.

³³C. H. Waddington, Paradigm for an Evolutionary Process in



environmental change requires new phenotypes that will be adapted to it, and conversely, the emergence of new phenotypes creates new environmental conditions. Or as Waddington puts it, "The evolutionary appearance of a new species automatically creates new environmental niches ready for exploitation by some further new form ('Big fleas have little fleas, upon their back to bite 'em and little fleas have lesser fleas, and so ad infinitum')."34

Thus, there are two different forces operating through evolution: new genes that are manifest as environmentally conditioned phenotypes and new environments. The presence of new genes is guaranteed by the variability of the genetic pool. The interplay between these factors has been pictured allegorically by Waddington in the following terms (an allegory which he applied to man, but is equally, in Waddington's view, applicable to other species):

Man in the world is like a caterpillar weaving its cacoon. The cacoon is made of threads extruded by the caterpillar itself, and is woven to a shape in which the caterpillar fits comfortably. But it also has to be fitted to thorny twigs--the external world --which support it. A puppy going to sleep on a stony beach--a juggle fit--the puppy wriggles some stones out of the way and curves himself in between those too heavy to shift. That is the operational method of science (and of evolution).35

The allegory helps to visualize the dialectical relationship between the organism and its environment in its constant interaction and transformation. From this perspective the role of selection may be more aptly conceived in terms of enhancing the interactive process. Environmental processes tend to create an optimal fit between organism

The Evolution of an Evolutionist (Cornell University Press, 1975), p. 252.

³⁴ Ibid., p. 241.

³⁵ Ibid., p. 246.



and environment "minimizing the misfit between the environment and the phenotype."³⁶

The view advanced by Waddington by which selective processes operate on phenotypes rather than genotypes and that the selective process minimizes the "fit" between phenotypes and their environment is a radical departure from the usual "atomistic" version of evolution that conceives selection as a blind process that "chooses" a genotype by random mutation or genetic recombinations. In this view selection "maximizing" fitness, i.e., survival capacity without any information from the environment. In contrast, for Waddington and Piaget fitness is not a random process but the result of equilibrium states between selective processes and environmentally canalized phenotypes.

In fact, as Waddington observes the selective pressures influence the process "in a helpful direction."³⁷ That is to say, the interactive process minimizes rather than maximizes the discrepancy between organism and environment. According to Waddington this view implies that "there can be a considerable variation of the phenotype without any change in its survival capacity."³⁸ (Italics mine.) Does this not also imply that survival capacity, i.e., fitness, is not, in and of itself the most important criteria for evolution, but rather that the evolutionary process itself, with its constant search for balanced ecological systems must be the ultimate criteria

³⁶ Ibid., p. 257.

³⁷ Ibid., p. 262.

³⁸ Ibid., p. 257.



by which evolutionary systems must be evaluated? In other words, must not selective processes be evaluated in terms of whole ecological systems rather than simply in terms of the survival of one of its component parts?

But here we must break off, for as interested laymen in biological sciences we are not in a condition to take this line of inquiry any further. We hope that a future dialogue with biologists who are studying the problems of adaptation may throw light into these fascinating, albeit complicated, issues.

In terms of social character studies the views advanced by Waddington and Piaget are more in line with what we know of "social selection" where the emergence of a given social-character type is not a random process, but is intimately dependent on socio-historical conditions that "canalize" human development.

For instance, in terms of survival capacity, the emergence of social character types does not guarantee a greater (quantitative) survival capacity, but indeed the number of offspring may actually be reduced. The merchant class of the eighteenth century, rather than increasing their offspring, probably reduced it. But if one thinks in terms of the greater mastery the class as a whole had over the most productive forces of society, their adaptation to the new social, cultural and economic conditions (that the class helped to create) was undoubtedly superior to the feudal aristocracy and to the peasant class.



At any rate, that the element of chance in human evolution is quite limited, at any rate more limited than in other species, since in contrast to even its closest relatives, the selective pressures are man made. This phenomena is quite evident when one observes that historically "social selection" is based on the fact that successful social character types impose their own ideology over other human groups due to their greater mastery and control over the productive forces operating in society.

I am aware that to conclude that character and social forces are interactive may lead to an ethical relativism, for a given group may impose conditions that are degrading for other men. From the point of view of selective pressures it would make no difference whether one group or another is exploited as long as the dominant group maintained a balanced state of adaptability. However, it seems to me that this conclusion is unwarranted, which takes us back to the necessity of understanding the uniqueness of our evolutionary capacities. As man emerged from his animal heritage his greatest gift, the capacity for self-awareness, becomes the most important instrument in directing human evolution towards conditions that can potentially create cultural and socio-economic structures that will foster the full development of his specific human needs. Needless to say, self-awareness does not guarantee that man will not exploit and destroy. The point I am trying to make is that seen from an evolutionary perspective, the human plight is not meaningless, but quite the contrary, man is the only animal where purpose and meaning are not only part of the human condition, but like the biosphere that

sustains us, meaning and purpose are the spiritual atmosphere from which we live and die.

Thus man is thrust into a unique evolutionary role. Like in Waddington's allegory, man is forever transforming himself by transforming his environment; but unlike a caterpillar man can purposely direct his activity to create the conditions that widen his awareness in ever increasing circles of meaning. In the process, as Erich Fromm has observed, nature within man will cease to be crippled and nature outside of man will cease to be sterile.³⁹



³⁹ Erich Fromm, You Shall Be As Gods: A Radical Interpretation of the Old Testament and Its Tradition (Holt, Rinehart and Winston, 1966), p. 127.

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