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VALUES: A SOCIOBIOLOGICAL ANALYSIS

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Introduction

Along with many other resurgent interests, the revolution of the 1960s brought back into focus the central importance of *values* in regulating the affairs of man. We are gathered here to examine *values* from the vantage of the inordinate advances in knowledge contributed during the recent past by the biological sciences. Implicit in this examination are the assumptions 1) that science has anything at all to say about values and 2) that possibly human values are biologically based. The alternatives to these assumptions have traditionally been accepted: The analysis of *values* has been the province of theologian, humanist and philosopher, and the description of the effects of *values* and value systems has been handled by social scientists such as economists, sociologists and anthropologists. Thus, our very act of convocation heralds that new ground is to be broken, that traditional views and rules are to be abandoned in favor of innovation.

In this spirit I will adduce data from the field of brain research in an attempt to develop a biologically based scientific model of the mechanism whereby values are constructed. This model will draw heavily upon the contributions of the social, i.e., behavioral, sciences and is thus best described as "biobehavioral" or "sociobiological." The model asserts the central place of the human brain in sociobiology both as a generator of biological givens and as the recipient time-binding organ that spins the threads of interpersonal and intergroup interactions into a social fabric. It is this assertion of the centrality of brain function that addresses the overall theme of the current conference: Are there any absolute values?

This paper will, therefore, first describe some relevant general biological and specific brain facts, then go on to organize them into a model within a

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broader sociobehavioral frame, and end with a discussion of the model for the issue of the existence of absolutes, i.e., universals.

Some Brain Biology

Let us begin by examining a biological paradox. Our respiratory mechanism is based on the ability of our tissues to metabolize food in the presence of oxygen. Without oxygen we quickly cease to live. However, the neural control over respiration is practically insensitive to oxygen deprivation—lack of oxygen is reflected only minimally, if at all, in a change in respiratory rate, discomfort or alarm. By contrast, very minute changes in the partial pressure of carbon dioxide, the end product (with water) of our respiratory metabolism, are sensed by cells in the brainstem which, when carbon dioxide accumulates, initiate increases in respiratory rate, feelings of discomfort and even alarm.

This illustration is but one example of the fact that biological control mechanisms are often indirect and circuitous. Sexual selection takes place for the pleasure it provides but assures diversity and survival for the species; food is chosen on the basis of taste but accomplishes the maintenance of energy sources for the organism; clothes are donned for adornment but protect against weather, etc. The immediate sociobiological control over behavior is exerted by a mechanism that is remote from the biological significance that the behavior entails.

There is evidence from the results of brain research that this universal biological paradox may apply to the organization of human values as well. Some twenty-five years ago we noted that monkeys whose brains had been subjected to removal of a specific part—the amygdala—would place all sorts of objects in their mouths, chew on them and if they were chewable would swallow them.[1] We first wondered if the animals taste mechanism had been disturbed and showed that their primary taste preferences were intact and that the area of the brain responsible for primary gustatory sensation was located elsewhere.[2] We next wondered whether some higher order system of preferences had been disrupted by the resections of the amygdala—that "good taste" had been abolished and gourmet had been turned into gourmand. But careful testing showed that the order of choosing food and non-food objects had not, in fact, been altered. What was preferred before the brain operation continued to be preferred in just the same order following the operation. Only the cutoff point beyond which unoperated monkeys would not accept non-preferred objects was changed. The monkeys with brain lesions accepted a much wider range of objects before stopping their oral behavior.[3,4] Even more elegant experiments later demonstrated that chemical stimulations of this part of the brain (the amygdala) though they would not initiate behavior, would regulate the amount of ongoing eating and drinking, the amount varying precisely with the volume of chemical injected.[5,6] In short, this part of the brain exquisitely controls the amounts of behaviors that satisfy one or another biological need once they are initiated but appears not to be involved in ordering the preferences that determine which behavior is to take place when. More of this later.

Utility, Futility and Preference

The brain mechanisms directly in control of one or another biological need are complex but lend themselves to classification into three major categories.[7] The mechanism just discussed that stops behavior and regulates the amount of the appropriate behavior engaged in (ordinarily called the satiety mechanism) constitutes but one of these categories. Another mechanism (centered on the basal ganglia of the forebrain) readies the organism to behave in a certain manner and initiates the appropriate behavior. A third mechanism (based on the hippocampal formation) coordinates these stop and go processes into a smoothly operating system within certain limits of tolerance. Coordination takes effort and shifts the type of control from a closed loop feedback homeostatic to a helical open loop feed-forward process. I have detailed elsewhere[8] the evidence that feed-forward mechanisms are the basis for voluntary intentional behaviors and for that special human ability philosophers call "intentionality." (Intentionality stands in relation to perception as intention stands to behavioral performance. Both intentionality and intention share the characteristic that they need not be realized in the extreme objective world.)

When the effort mechanism reaches its limits of tolerance, coordination breaks down and the organism reverts to homeostatic control. Under such circumstances homeostasis may also not work efficiently, with the result, either that the organism experiences, a) upset due to loss of control, or b) obsession, compulsion or boredom due to overcontrol. Very little is as yet known about the management of either upset or overcontrol, processes that are continuously faced in the psychiatric clinic and in everyday life by clinical psychologists. As we will shortly see, the "utility" theory of economic behavior has provided a starting point for understanding voluntary controls demanding effort. Perhaps what is also required for a full understanding of the problem of human values is a "futility" theory to deal with the "games people play" such as that proposed by Berne[9] to deal with upset, compulsion and boredom.

Although the discussion thus far has centered on the control of biological needs, brain research has clearly established that the mechanisms described above regulate a wider range of psychological functions. We already noted that the effort mechanism is involved in intention and intentionality. Similarly, the homeostatic satiety and readiness mechanisms control attention[7] and other aspects of behavior such as reactivity, e.g., sleep and alertness, and posture.

As indicated above, in addition to the readiness (go), the satiety (stop), and the coordinating (effort) mechanisms, there are other more remote parts of the brain which when injured, affect sensory discriminations in which choices are to be made between one cue and another.[10] Behavioral analysis has established that the discriminative choices used in animal research of this sort indicate preferences as they are understood in describing human choices.[11] There is thus substantial evidence that the brain systems involved in establishing preferences are separate from those regulating the satisfaction of biological needs.

Some Economic Theory and More Brain Facts

In an influential volume on the theory of games and economic behavior, Von Neuman and Morgenstern outline the elements of a quantitative approach to the problem of value based choices that regulate competitive behavior.[12] In common with other economic theorists, they distinguish behavior that meets the needs and desires of the individual, his estimate of the probability that the occurrence of the need-satisfying behavior will in fact meet a particular need, and an overall preference frame into which these needs and estimations can be fitted. Needs and desires are measurable in terms of the amount of behavior entailed in their satisfaction, provided a zero point or anchor and a scaling of increments of that behavior become available. Von Neuman and Morgenstern use the illustration of measuring temperature. A zero point must be chosen (e.g., the freezing point of water) and a scale (e.g., adding this quantity of heat raises the temperature that much) developed. Measurement is relative to the zero chosen unless some absolute zero is discerned and agreed upon.

Von Neuman and Morgenstern's theory appears to reflect some of the brain biological facts outlined in the previous section: A measurable incrementally controlled (scaled) mechanism of need satisfaction based on a "zero" or "goal" has been detailed. Further, another different mechanism that establishes a preference frame was described. To complete the evidence for the theory a mechanism must be available that estimates the probability that the occurrence of a particular need satisfying behavior will result in the satisfaction of the biological need. Such evidence comes from studies of primate frontal lobe function in which it was shown (using the fixed-interval operant conditioning technique) that monkeys with resections of their frontal lobes failed to distribute their responses probablistically on the basis of prior experience as do intact monkeys.[13] In terms of human endeavor, we have all observed that students tend to distribute their work between examinations so that maximum activity takes place just before the critical moment when tests are given. We urge them to plan differently—and the experimental result obtained with monkeys described above suggests that if they were deprived of their frontal cortex, even this amount of distribution of activity might cease and the students would come completely unprepared to "the moment of truth." In fact, patients with frontal lobe tumors or excision behave in just this fashion—unable to plan, to distribute their responses according to an estimate of the probabilities that the responses will be effective.

There are thus discernible three distinct brain mechanisms that fit the demands of the theory of economic behavior. The theory asks further that the amount of need or desire and the estimate of the probability of satisfaction are multiplicatively related in a term designated as the "utility" function. The brain facts support this conceptualization (albeit as yet not in quantitative terms) because the frontal cortex which was shown to be involved in probability estimation is closely linked both anatomically and functionally with the brain systems (such as the amygdala) that regulate biological need satisfaction.[14] The brain mechanisms involved in setting preferences are by contrast substantially more remote and separate anatomically and functionally.

To summarize: Both theory and brain research make a good case for distinguishing between utilities and preferences. Utilities are based on biological needs, quantitative controls over the behavior which leads to their satisfaction, *internal controls* which are subject to probability estimation based on experience. Preferences, by contrast, devolve on a separate and distinct mechanism which involves the ability to discriminate between *situations* that lead to satisfaction. In short, *utilities are state dependent whereas preferences are situation specific.*

A Sociobiological Theory of Values

As human primates we go about our activities estimating the probability that a particular need satisfying behavior will on this occasion satisfy a need, distributing its occurrence according to our experience. For example, after a tennis game we are thirsty and set to drink a specific quantity on the basis of the tissue "concentration of water" (i.e., of the electrolytes dissolved in the water) which is sensed by the brain. On the basis of prior experience, we either gulp down the required amount of liquid rather indiscriminately, or having on several occasions experienced cramps as a result of drinking too rapidly or because the liquid was too cold or had too much caffeine in it, we sip more casually instead, sitting down to share a leisurely afternoon iced tea or relaxing alcoholic beverage.

But it is peculiarly human that we might never have had the experience of cramps induced by too rapid satiation of thirst with inappropriate liquids. We might simply follow the guidelines for appropriate behavior given to us by our caretaking elders or our peers. We then say that we *prefer* the civilized behavior that is defined by the situation we call our "tennis club."

I believe that this example can be generalized to a description of how human values come to be organized. *The experienced utilities (and futilities) of individuals become encoded in culture to be presented to others as preferences*. Preferences are from time to time checked against utilities by individuals or by groups of individuals as in the recent revolutionary decade of the 1960s. Alternatives are explored and if the situation has changed sufficiently (e.g., the advent of the birth control pill) new preferences may emerge.

Preferences clearly imply alternatives. With respect to utilities and futilities, the problem is somewhat more complex. As noted above, control is exercised by way of feedback mechanisms called homeostats that operate much as do thermostats. Over the past 15 years, investigators [15,16,17,18,19] have begun to distinguish between such simple feedback organizations and the somewhat more complex mechanisms represented by thermostats whose settings can be controlled externally. A small wheel is usually attached which alters the gap between two pieces of metal which, when they touch, close the switch that turns off the heat source. Heating the metal also closes the gap—thus the critical distance between the pieces of metal is controlled by two sources operating in parallel, heat and the dial setting. The dial biases the setting, provides a range of settings around which temperature (the measure on the amount of heat) will fluctuate.

These more complex biasing mechanisms have become known as feed-forward or information processing mechanisms. The organization of feed forwards is open loop or helical rather than closed as in the case of feedbacks. This helical aspect of the system can be experienced especially when the response mechanism is sluggish—say an old-fashioned hot water radiator system. The unwary will continue to change the setting of the thermostat upward as long as the effects of the change fail to be felt. Unless a safety device (a cutoff) is installed on the furnace, this continuing upward adjustment of the thermostat might well lead to an explosion when the water tank becomes heated too rapidly, resulting in overheating before adequate circulation has been initiated.

The mechanism processes information because alternatives are involved. True, the alternatives are simple—the furnace is to be turned on or off, just as in the case of feedback organization. However, the turning on and off is no longer based on a repetitive recurrence—variety has been introduced by the dial to the extent that the dial can be turned to a range of settings. The mechanism computes the appropriate response to this variety of settings.

Utilities are organized in this flexible fashion. Experience introduces a bias on the homeostatic regulations of the organism such that on each occasion the variables involved in satisfaction are taken into account and the response appropriate to the occasion is computed. We ordinarily also take into account the limits over which control can be exercised before breakdown or futility occurs. Thus, such computations are referred to as entailing estimations of risk or the cost-benefit ratio of undertaking the behavior. As noted earlier, these computations are not only state dependent but also involve the attentions and intentions of the organism. New computations are required on different occasions, each occasion or episode involving different momentary intensities of need states, attention to external or internal cues as well as readinesses and intentions to act.

Brain and behavior research has shown that preferences are organized rather differently. Preferences reflect the invarient properties of the situation, those aspects which do not change. Most situations are sufficiently multivariate that invariences are recognized despite considerable differences among the situations. These invariences are called perceptual constancies and are the basis of assigning "identities." Identification by means of "signs" is thus the mechanism by which preferences become organized. In the kaleidoscope of human social and cultural situations the identification of signs, the signification of preferences becomes much more difficult than it is in the perception of physical situations. An experimental demonstration illustrates this point. Subjects are placed in a situation in which they are asked to describe the occurrence of lights in a matrix of possible positions. Correct and incorrect descriptions are said to be signified by a token reward or deterrent ("correct" or "incorrect" is stated). However, the tokens are in fact given randomly. Despite this, most subjects come up with ingenious descriptions of the paths of light placements—some incredibly complex.

Identifications signifying assumed actual organizations of occurrences abound in such social situations. Once the identification has been made the subject defends it against dissolution despite being given additional information (such as "your corrections were randomized"), probably because invariences were not strained beyond the perceptual tolerances of the subject. He prefers the description he has achieved to one handed to him belatedly, although he can become convinced to change his mind if the new evidence becomes sufficiently strong. Preferences, in contrast to utilities (and futilities) become automatic regulators of behavior.[20] They are not computed anew for each situational episode since they are grounded in the invariences obtaining in the situation, not its variety.

Values and the Paradox of Absolutes

The results of this biobehavioral analysis return us to the biological paradox described at the outset of the analysis. Just as in the brain's control over respiration, feeding, drinking and sexual behavior, the control of the organism's values is ordinarily accomplished by way of his preferences. These are situationally derived but *appear* to be "absolute" because they reflect invariences. Man is thus shaken when he finds his preferences dissolving under the onslaught of major situational change. He is forced to relinquish his automatic mechanisms of information processing and rely on the computation of recurrences of variables from one episode to another. Such computations entail risk (the dangers of futility) as we have seen, and are thus likely to be accompanied by upset, such as dogmatic reassertion of an "absolute" which has become obsolete, relinquishing of all values and anomie, or reactive overcontrol.

Does this mean that there are no absolute values? I do not believe so. It means only that, understandably but paradoxically, we have identified absolutes with our preferences rather than with our utilities and futilities. The paradox consists of the fact that utilities, since they deal with episode and state dependent variables, *seem* so unreliable. But as long as episodes do not differ catastrophically, and as long as the brain's computational machinery is universal to all mankind, absolutes *can* be derived from such computations. In fact, as we saw above, preferences are often a cultural representation based on computed universals, i.e., absolutes.

The paradox penetrates further. Identifications signifying invariances constitute knowledge, especially scientific knowledge. (The term science is derived from the Latin *sciencia*, to know.) Knowledge at any moment is, therefore, finite, bounded by the limits that describe the situations over which the invariances hold.

Computations of variations recurring among episodes have no such bounds. Variety can be as infinite as possible recurrences, as infinite as the computing power of the brains involved. Further, the oscillations of biological states which continuously reset the computations recur infinitely as long as life lasts. Such infinitely complex computations often result in solutions that appear to be paradoxical and even enigmatic—just as in mathematics dividing a line of infinite length results in two lines of infinite length—thus one half equalling the whole. Ordinarily we speak of computations and solutions that involve paradox as demanding wisdom.

Wisdom is at home with paradox. Solomon's apparent cruelty in dividing a baby in two proved the humane solution to a difficult dilemma. The mother's "giving up" her infant paradoxically resulted in her retaining it as is so often the case in interpersonal transactions. G. Spencer Brown in his "Laws of Form"[21] provides a mathematics for handling paradox by "inventing" an imaginary Boolean descriptor. Spencer Brown addresses the Russell-Whitehead paradox ("I am a liar") but his formulations are applicable to a wider range of problems in the domain of the infinite.

Thus, another way of stating the results of this biobehavioral analysis is to point out that preferences reflect knowledge (the identification of finite invarient properties of situations), while utilities depend on wisdom (the computation of recurrences among an infinite variety of episodes). The point of this contribution can, therefore, be summarized as suggesting that contrary to common but not religious belief, absolute values reside not in knowledge but in wisdom. In keeping with its rootedness in paradox, however, wisdom, though in the realm of the infinite, is not unfathomable. Slowly it is yielding the secrets of its structure to scientific knowledge while carefully harboring its contents. For wisdom is displayed in episodes in an infinite variety that paradoxically partakes of absolutes. It is the fact that variety provides absolutes which is the paradox of wisdom.

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