

Review Essays

FREE WILL HAS A NEURAL SUBSTRATE: CRITIQUE OF JOSEPH F. RYCHLAK'S *DISCOVERING FREE WILL AND PERSONAL RESPONSIBILITY*

by Robert B. Glassman

Abstract. Ably marshalling ideas from theology, philosophy, and neurology, personality theorist Joseph F. Rychlak criticizes mechanistic psychologists' neglect of will and responsibility; these human qualities involve dialectically considering alternatives. I disagree with Rychlak's suggestion of fundamental mystery in the mind's transcendence of the body and believe transcendent mind is intimately related to biological evolution and the brain. For example, dialectics, seen in simpler forms in lower animals, may require neural inhibition, feedback circuits, and topographic mappings. However, epistemologically speaking, neuroscientists strongly need the human insights of work such as Rychlak's to understand the alternatives, in planning investigation at more microscopic levels.

The person in the street would chuckle at the superfluoussness of exhorting him to recognize that his way of living is constantly influenced by his choice of purposes. He does not realize how much of the climate of contemporary life has been set by psychologies that leave little room for notions of purpose. Joseph Rychlak, in *Discovering Free Will and Personal Responsibility*, a book aimed primarily at the priests and pupils of modern psychology, ably puts modern-day attitudes about human free will into an historical perspective, tracing currents of ideas in religion, philosophy, and science.¹ I will try to summarize

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Rychlak's position, to outline important shortcomings, and to propose some solutions.

Rychlak repeatedly uses behaviorism as a foil. If psychologists are priests, then B. F. Skinner is the son of their god, Positivism. Even as Skinner and his disciples have been persecuted, they have won converts. Their notion that the richness of behavior is due almost exclusively to the shaping influences of environmental reinforcement contingencies also has influenced the unconverted by exemplifying and sharpening widespread ideological leanings toward a view of a human being as a *tabula rasa*. Although this book focuses too narrowly in attacking Skinner, for Rychlak's purposes Skinner's behaviorism is a useful caricature of modern attempts to apply scientific method to human problems.

NOTIONS OF CAUSALITY

Rychlak believes the modern social scientific way of thinking should be seen in the perspective of Aristotle's taxonomy of causation. The social scientist tends to interpret the universe in terms of what Aristotle called "efficient causation." Such causation, typified by the interaction between two billiard balls, is now overemphasized, Rychlak argues, because the social scientist confuses a methodological expedient—of viewing things in terms of independent and dependent variables—with an ontology.

In Aristotle's scheme, there were also three other types of causation: "material," the basic prerequisite that there be a substrate within which events might occur; "formal," the pattern or shape of something; and "final," the dependence of events on the purposes of the participants.

Rychlak, who limits the applicability of final causation to living beings, argues that it has been given short shrift in considerations of human psychology. Our failure to understand the degree to which we behave on the basis of "that for the sake of which" has resulted in the present state of free will as "a beleaguered concept" (p. 68). For example, Rychlak says that behavior therapists deceive themselves in their exclusive attention to the mechanistic side of human behavior. He argues that if a patient successfully revises his behavior because of assiduously repeating the steps in a prescribed regimen, we must give primary credit not to the regimen but to the patient for his freely willed fulfillment of a mission. In this sense, Rychlak contends, a person does not merely *respond*; rather it is appropriate to draw on the Greek word for purpose and coin the term *telosponse* for such a person's action (pp. 140, 162). Granting Rychlak's point, it might be noted that the behavior therapy patient is also acknowledging the

mechanical side of his nature by requiring himself to adhere to a self-training regimen rather than peremptorily willing the change in his personality.

Rychlak attributes the psychologist's aversion to teleological analysis to a fear of anthropomorphism (including a fear of anthropomorphizing human beings!) that is as great as the antipathy held by ancient churchmen towards science. While Rychlak makes a good point about limitations of contemporary reductionistic dogma, he does not seem to appreciate fully that the motivation for doing efficiently causal, reductionistic analyses is the desire to understand thoroughly and the refusal to cherish fundamental mystery. Further below, I explain in what sense and for what purposes efficient causations may be considered to underlie instances of final causation.

Rychlak notes that psychologists are fond of contrasting their efficiently causal reductionism with an image of a soft-minded, ubiquitously theological belief in free will. He points out that many theologians have seen human predestination as the obvious consequence of the almightiness of God; for example, Augustine accounted for the manifest goodness of some people by inferring that they benefited from God's grace. Here, Rychlak fails to note clearly enough that such a theological conception of determinism does obliquely encourage a person to act responsibly. One does so in order to verify to others and to himself that he has benefited from grace. The psychologist's brand of determinism also suggests passivity to the believer in a direct way but elliptically allows for responsible action. A behaviorist can account for his "responsible" (quotation marks obligatory) actions by surmising from his own behavior what rewards happen to be effective in his particular case. However, Rychlak is right that the predominant effect of behaviorism is to inculcate passivity; and this is what he intends to counteract. While insisting that Augustine did operate within a telic frame, he cites with some sympathy the efforts by Augustine's rival, Pelagius, to develop a theology that more clearly allowed for human free will (pp. 71-72).

DIALECTICAL THINKING

In order to exercise free will one must see alternatives. Rychlak thus observes that a prominent feature of the thinking that underlies freely willed decisions is dialectical reasoning. He traces our awareness of this aspect of human thought through many historical sources, noting that, although John Locke was a champion of political freedom, he lost track of the dialectical nature of human reasoning. Rychlak equates "Lockeanism" with emphasis on efficient causation, "demonstrative reasoning" and the sort of formal logic practiced by

Alfred North Whitehead and Bertrand Russell (pp. 50-67, 139). In contrast, dialectical thinking always involves bipolarity of meaning. For every good or thesis the antithetical idea is close by. Rychlak explains that Freud "constantly employed dialectical psychological explanation without realizing that he did so. . . . Freud said that we all have . . . oppositional ideas taking form whenever we frame an intention. . . . Usually we can hold such self-defeating notions back, but in times of great stress . . . it is possible for 'the other side' of our healthier ideas to take over . . . *against our will*" (p. 131). Jung codified this conception of dialectical interplay in his notion of the shadow (p. 157).

Rychlak considers dialectical reasoning to occur more pervasively in the human mind than these psychoanalytic theories alone would imply. However, he does not go as far as those who see dialectical interactions as an inherent property of nature; they are in nature only insofar as they are a property of the human minds that influence the course of history. In Rychlak's view, dialectical reasoning is not a rigid see-sawing between two poles of meaning. As one's thoughts move back and forth dialectically, one discovers the diversity in a concept. Although Rychlak considers dialectical reasoning to be very different from associative reasoning, the meandering aspect of dialectical reasoning does seem to suggest an associative process, albeit one with an oppositional basis. "At the free side of mentation there are always opposites of opposites to consider as possibilities *ad infinitum*. The human mind is framed by either-ors but it is never trapped by these limiting alternatives . . ." (p. 158).

Psychologists who fail to perceive the dialectical nature of thought and who understand freedom to be embodied in the number of available alternatives "are simply restating the Lockean *tabula rasa* view that if one's past experience has 'programmed' or 'shaped' one's current response repertoire according to alternative patterns vis à vis any current stimulus situation, then one is freer today than someone who has not been so favorably manipulated" (pp. 83-84). These psychologists ignore both Aristotelean final causation and formal causation as they reason in terms of a "Lockean summation of efficient causes" (p. 74). Rychlak summarizes Karl Popper's criticism of the behaviorists. They have a tendency "to think of norms as tantamount to efficiently caused strings which, extending down from the supra-individual level, somehow manipulate people like marionettes to behave as the 'system' or 'society' or 'culture' would have them behave" (p. 144). He quotes Popper as saying that "it is possible to encourage those who have adopted [a] norm to hold fast to it, or to discourage them and to persuade them to adopt another norm. It is impossible to derive a sentence stating a norm or a decision from a sentence stating a fact" (p. 144). With this viewpoint Rychlak also

holds a certain lack of sympathy for the disadvantaged and an implicit conservative moral standard; he observes that while someone raised under a "perverted value system" is more likely to mature into "a neurotic life style . . . affirmed out of self-interest, . . . this actuarial truism should not blind us [to the principle that] the individual is always responsible!" (p. 205).

Rychlak suggests the idea of dialectical reasoning is compatible with the principle, propounded by the early twentieth-century physicist Ernst Mach, that all science requires an ability to see a given phenomenon in more than one way. Rychlak's analysis of Skinner's specious derivation of a behaviorism from some of Mach's ideas is fascinating. Like Mach, Skinner is circumspect about inferring causality, because he realizes that all the scientist can possibly observe is a correlation between independent and dependent variables. Both Mach and Skinner are wary about reifying hypothetical mechanical constructs in order to unify observations. However, while "one might have thought that Skinner would go on to conceptualize the person in phenomenological terms *a la* Mach, trying to understand how the individual uniquely perceived the waters of his life to be flowing along . . . , his theoretical outlook was totally extraspective, even though his Machian critique was written from the introspective perspective of the scientist doing the observing of controlled events" (p. 87). While Rychlak makes this point well, he endorses too readily the phenomenological excesses of those modern physicists who have retreated into a kind of mystical worship of the interfaces between their minds and the rest of reality. Physicists who are trying to perceive the external reality of subatomic or of supragalactic phenomena may still not fully comprehend all the ways in which they must modify their metaphors that are based on familiar experience with "middle-sized phenomena."

COMPATABILITY OF FINALLY AND EFFICIENTLY CAUSAL EXPLANATIONS

In his chapter on "Teleology in the Laboratory," Rychlak explains that the failure of behavioral scientists to recognize the telic side of events is surprisingly pervasive. He trumps the Skinnerians by noting they sometimes violate their beloved standard of empirical purity in appealing to hypothetical past influences; they do so in order to avoid acknowledging the manifestly telic character of some human behaviors. Rychlak suggests that the results of experiments using human subjects depend as much upon the predications of the subject as on the circumstances set up by the experimenter; yet even psychologists such as Martin Orne, Robert Rosenthal, and Jean Piaget have

failed to fully appreciate the evidence of final causation in their data (pp. 99-128).

I agree with Rychlak that complex behavior may be analyzed in telic terms, but the decision one makes whether to analyze in these terms or in terms of efficient causation depends on one's *purposes*. I will argue below that there is a serious gap of inquiry in brain research which must be filled using telic constructs and that it is unreasonable to expect the heuristic capabilities of scientists always to work well using the language of efficient causation. Nevertheless, when we can describe a phenomenon in terms of efficiently causal pushes and pulls we have done a more detailed job of illuminating the smallest mysterious crannies than when resting with a telic explanation. In failing to recognize this, Rychlak does not see the relevance of computer science to human psychology.

Although computer scientists have not succeeded to date in reproducing the most intriguing properties of the wet human brain on a dry electronic substrate, Rychlak errs in his chapter on "The Uncybernetic Brain" by taking Norbert Wiener's concern with stimuli as justification to accuse him of Lockean and even Pavlovian leanings. The cybernetic concept of feedback augments mechanistic theories of information processing in a highly significant way, but Rychlak misses the essence of this concept when he says the term feedback signifies control by actual rather than expected performance. The essential quality distinguishing a device using feedback from one that does not is its persistence in self-adjusting until the criterion of expected performance is met. Perhaps more people would be willing to show respect for such contrivances if they recognized that the inspiration to construct them is in the engineer's appreciation of the way in which living beings purposively seek and find. Rychlak appears to know few such details about the marvelous functioning of modern machinery.² His reference to Isaac Asimov's enjoyable and probably prophetic fictional stories about future progress with robots is a distraction in this context. Rychlak asserts that, unlike humans and unlike Asimov's fictional robots, computers cannot judge the grounds of their own programs. Certainly it is true that there are no computers having judgment approaching human complexity, but programs that have embedded subroutines do possess a rudimentary form of judgment. On the other hand, it is also clear that human beings do not have privileged introspective access to the grounds of all their own thoughts and behaviors ("programs"?). This is why we have psychologists, philosophers, and theologians.

Both natural and humanly constructed feedback systems can be described in linear cause-effect terms. For instance: (a) My house grows cold; the element in the thermostat bends; a circuit is closed;

the furnace ignites; the house warms; the thermostatic element bends the other way, breaking the circuit and shutting off the furnace. (b) My body grows cold; nerve cells in the hypothalamic area of my brain change their firing rate; neural connections to other parts of my brain and to my body are activated and hormonal signals are sent, causing (1) constriction of blood vessels in my extremities, (2) shivering, (3) increased metabolism, (4) motivation to eat, (5) motivation to put on a sweater, and (6) motivation to turn up my prosthetic warmer (the home-heating thermostat!). Then my body gets warmer; the hypothalamic cells reverse their firing pattern, and so on. Obviously, the physiological mechanism is more remarkable than the dry contrivance, but there is an important similarity in the underlying principle of operation.

It would take much more argument to prove that all purposive systems are likewise susceptible to being described reductionistically in efficiently causal terms. While I believe such explanation is always possible, such a reduction to smallest elements should not always be sought immediately. Such a prescriptive proviso is within the spirit of Rychlak's program. The sorts of units of analysis one uses should depend on one's analytical purposes. Sometimes telic elements are most useful while at other times the same phenomena might best be viewed in efficiently causal terms.

Contemporary brain research is an area that suffers from lack of realization of this principle. I believe we will understand the neural bases of human behavior only after we can translate smoothly back and forth between neural terms and well-developed psychological languages. This effort may require several stages of reductionistic analysis intervening between microscopic structures such as synapses on the one hand and holistic, purposive phenomena on the other. At one intermediate level of analysis it might be useful to postulate hypothetical neural constructs whose behavior is similar to more primitive organisms, for example ones that display kineses or taxes.³ At a higher hierarchal level, constructs similar to Sigmund Freud's id, ego, and superego, and some of Carl Jung's archetypes may be useful analytic devices.

It is an heuristically impossible task for a neuroscientist to construct his way to an understanding of the intelligent, purposive human mind from a knowledge of microscopic facts about the anatomical parts and chemical constituents of neurons, and knowledge of their connections.⁴ Such an attempt, which is now the prevailing program, is analogous to, but even more hopeless than, that of a hypothetical mathematician who tries to build a complex theoretical structure using only a conglomeration of basic axioms without help from mediating theorems. In working toward a unified conceptual framework, we

need to identify correspondences and conflicts among the various languages used to describe organismic phenomena.

In this regard, Rychlak excellently describes the stress between telic and efficiently causal ways of thinking and the effects of this stress on theoretical languages. He observes that Freud tried to press his language of purposive psychological processes into an efficiently causal mold, while William James vainly struggled to capture the essence of willful consciousness, using an impoverished, mechanistic language ("Determinism and Psychological Description," pp. 33-49). In reviewing pop-psych terminological salads Rychlak provides additional examples of awkward juxtapositions of telic and efficiently causal terms ("Why Popular Psychologies Work," pp. 210-44). This review is at once humorous and insightful, as illustrated by the following infelicitous quotation from Maxwell Maltz's *Psycho-Cybernetics and Self-fulfillment*: "Within your midbrain is a very small electronic computer, a tape recorder, an automatic servo-mechanism, a success mechanism that you can operate like an electronic computer . . ." (p. 226).

Unfortunately, there does not seem to be a sufficiently firm foundation supporting Rychlak's decisions against certain popularizers, and there is a certain air of the Inquisition about chapter 11 ("Why Popular Psychologies Work"). For instance, Rychlak pins the Lockean stigma on Thomas Harris (*I'm OK—You're OK*) for using a computer metaphor, even though the sentence Rychlak quotes from Harris's book is cast as much in a dialectical way as in terms of mechanism: "But my computer finally clicked and made me aware that there is another option open—My Adult [a construct in Harris's scheme] can evaluate the situation and intercede for my Child" (p. 224). In chapter 12 ("Our Human Nature and How to Keep it So") Rychlak himself drifts into the clutches of a mechanistic mode of expression by prescribing a four-step algorithm for solving personal problems.

TRANSCENDENCE IS A PROPERTY OF THE BRAIN

Complementing his attitude that telic and efficiently causal thinking represent dissociated realms of thought, Rychlak favors an extreme form of mind-body dualism in which the mind entity is separate from, but mysteriously influential upon, the brain. His main supports for this position are the aforementioned egocentric ontologies that sometimes emerge from modern physics and some questionable inferences from brain research. Let us consider the latter in more detail.

In carrying out certain therapeutic brain operations, the neurosurgeon Wilder Penfield took advantage of the fact that brain tissue feels no pain and used only local anesthesia on the scalp, cranium, and meninges. He then mapped the functions of large cortical areas by

electrically stimulating points, one at a time, while conversing with the conscious patient. Rychlak is fascinated by Penfield's observation that, when electrical stimulation caused a patient's hand to move, the patient did not feel that he was willing the movement; indeed in some cases patients reached over with the other hand to resist the elicited movement. Rychlak also cites similar observations by Jose Delgado in patients who had brain electrodes chronically implanted, and he goes on to mention Delgado's observation that, when one epileptic patient experienced anger as a result of stimulation of her amygdala, she was able to identify the extrinsic origin of the experience. She then succeeded in controlling herself by harmlessly tearing up a stack of papers, rather than tearing her scarf, which was the target of her initial impulse. On the basis of observations such as these, Rychlak asserts too readily that "if there is a physical mechanism involved in such 'mind control' there is surely something else going on as well" (p. 200). There are three reasons to be critical of such an inference.

First, the cited studies were not comprehensive regional explorations of the effects of brain manipulations. Some brain areas are concerned more with the "mechanics" of movements while other areas are best described as having motivational functions.⁵ It would not be remarkable to find that a patient can sense the extrinsic origin of a movement elicited by electrical stimulation of the motor cortex pyramidal cells that are only two synapses away from the muscles. But there are areas of the brain further removed from motor outputs or sensory inputs, where stimulation yields effects that might easily be interpreted as tampering with the will. Most notable are the many studies of the phenomenon of electrical self-stimulation by animals having chronically implanted wires in the hypothalamus and other areas, and reports from human patients of pleasurable feelings when the same brain structures are stimulated. Organisms can be taught to perform any arbitrary response for the reward of having these areas of the brain stimulated electrically. Most behavioristically inclined researchers who study this phenomenon tend to avoid such taboo terms as "will." However, to an outside observer the persistence and intensity of electrical self-stimulation responding, and the fact that such responding is often initiated after the experimenter administers a free "priming" stimulus, certainly gives the appearance of a capturing of the will. Furthermore, many additional findings from cases of accidental brain damage in human beings have suggested that the frontal cortex is another brain area that is important to our ability to will. Patients with massive prefrontal damage are apathetic and they show a deficient relation between their words and their actions.⁶

The second problem in inferring a strong form of mind-body dualism from the electrical brain stimulation results that Rychlak cites

is that investigators usually deliver electrical stimuli to a single electrode point at a time. Obviously this is an unusual way to activate brain tissue, and it should not be surprising if a brain can distinguish between such a perturbation and normal, spatiotemporally distributed events that are part of the intrinsic flow of activity. The human brain is highly organized spatially. It contains some tens of billions of interconnected nerve cells, many of which have fibers connecting with other cells several millimeters, centimeters, or even meters distant.⁷

Third, the patients cited by Rychlak understood beforehand that their brains were about to be stimulated electrically. Indeed, it has been argued by experimental social psychologists that until human subjects are tipped off about deceptive experimental conditions, they often cannot identify even ordinary, everyday stimuli that influenced one of their own responses. These psychologists assert that a person must often resort to the same sorts of plausible inferences about his own behavior that he would have to use in guessing at the reasons for another person's actions; they argue there is no privileged introspective access to the causes of behavior.⁸

These points do not imply that a human being or a rat is *merely* the sum of the parts of his brain. For instance, the feedback systems described briefly above are at once mechanistically understandable and marvelous in their emergent properties. More generally, physiological systems built of levels upon levels of smaller subsystem units, and interacting with other systems, do regulate the activities of the individual microscopic parts of body and brain. If this conception of scientifically approachable holistic functioning is what Rychlak has in mind when he speaks of transcendence, then I agree with him. However, he is apparently unaware that self-reflexivity is a very common property of neural tissue (pp. 203-4). For example, some of the outputs of the somatosensory cortical receiving area are nerve fibers which modulate the activity of their own sources of input.⁹ It seems unnecessary to use the term transcendence to hint at disjunct, nonmaterial substrates of thought. Admittedly, the question of what is the nature of one's unique sense of a separate personal identity seems to be most refractory to a scientific approach, but it is nihilistic to use the persistence of this problem as an excuse to avoid reductionistic inquiry. We have a practical choice between such analysis and vague hand-waving or unanalytical cherishing of ourselves. Moreover, much current knowledge about the brain is intriguing.

THE RELATIONSHIP BETWEEN DETERMINISM AND FREE WILL

If Rychlak had actually ever tried to train a rat in a Skinner box he would quickly learn some things that Skinner, in his determinism,

tends to pass over lightly. Even in this impoverished environment rats are hard to control; they are "willful," they hesitate, and they "make decisions." (Following Konrad Lorenz's advice about animal behaviors that look amazingly like human behaviors, let us from this point dispense with the behavioristic-apologetic quotation marks.¹⁰)

Therefore, in inquiring into the evolutionary origins of the human capacity for dialectical thought, Rychlak overlooks the fact that rats in a learning situation provide a fine example of rudimentary dialectics.¹¹ He unfortunately takes as his main evidence of dialectical reasoning in animals results that gain meaning in part because the experimenters have not suppressed as many common-language terms as behaviorists traditionally do in interpreting their observations in what they believe to be a parsimonious manner. As a possible animal precursor of dialectical reasoning Rychlak cites the case of a gorilla that is one of many apes trained during the past fifteen years to use words of sign language; this animal was reported to use its signing ability to express contrariness. But what appears to be willful contrariness in animals is also seen in many other circumstances. Two examples: first, I once was acquainted with a caged Rhesus monkey in the University of Pennsylvania Anatomy Department who feigned a desire for social grooming, only to spin around and viciously grab at the friendly hand reaching toward his shoulder. Second, after roaming at night, my tomcat stands near the back door and calls but decides whether to accept the invitation to come in only after being given the opportunity; sometimes he changes his mind, turns, and walks away.¹²

There now exist factions of people who lean towards either a deterministic or free will-oriented way of philosophizing about human behavior; Rychlak joins the latter group. In my judgment, free will is the name we give to our functioning in the present. In making important decisions one engages as much of his whole being as he can muster at the time. Under such circumstances it makes no sense to try to predict (deterministically) what one's decision will be; the prediction is the decision itself.¹³ In contrast, a deterministic mode of thought is appropriate at moments other than ones in which we are actively deciding. At those more relaxed times, if we wish to act in a human manner, we should reflect on the influences that are likely to affect us. Intelligent decision making involves operating in this way right up to the moment of decision. Some time after a decision is made we must again reflect.

Free will is best exercised with the humility that comes of knowing one's own deterministic evaluation will follow. Indeed, important decisions should be made slowly, after testing vicarious ones in imagination.¹⁴ Often, other people can help a great deal by making their own imaginations available. The existential-phenomenological psycho-

therapists, whose positions appear closest to Rychlak's, seem not sufficiently to take into account the limited capacity of an individual person's conscious awareness and his limited ability to think an issue through effectively within a given time interval. Both the existentialists and Rychlak might be considered guilty of extolling the present instant or of encouraging an arrogance of momentary conscious awareness. A person should not usually be visualized at a point in space and time. Existential psychotherapy, largely an American phenomenon, may be thought of in part as an ideological movement which is both an effect and a cause of those familiar, constantly changing conditions of modern life which for good or ill tend to isolate individuals from longer term traditions and social groupings.

DOES INNER-DIRECTEDNESS HAVE A FUNCTION?

In trying to cope with modern life some individuals have turned to eastern religions. Rychlak celebrates the effectiveness of oriental philosophies in helping people to control their inner being (chapter 9, "East Meets West"). But if inner change has no implication whatsoever regarding an individual's interactions with the world outside his skin, then it is mere escapism. Eastern teachings that worldly cares are futile or nonsensical seem antithetical to maintaining a highly organized culture. Such religion appears tantamount to anesthesia. But it is difficult to say from our perspective whether rituals such as meditating on Zen koans do exercise the mind in some way so as actually to promote clarity of thought in worldly life or whether they blur vision.

We need information about the sorts of social structures that give material sustenance to the teachers of these doctrines of inwardness; we also need information about the degree to which the common person adopts these doctrines as he struggles at the same time to keep his body and his children's bodies alive. This is a fertile arena for sociobiological inquiry. For example, here is one hypothesis: such forms of religion may function adaptively (in the biological sense of promoting survival) at a group-selective level. They may indeed be a kind of anesthetic which preserves for the gene pool the characteristics of the most intelligent, philosophically-oriented people. This function of a culturetypic phenomenon might be useful under economic and political conditions where the possibility of solving significant worldly problems is hopeless.¹⁵ Without such an "anesthetic," strong phenotypic expression of genes underlying exceptional intelligence might frequently lead the human bearers of these genes to destroy themselves in quixotic missions. An alternative evolutionary hypothesis is that the messages spread by eastern religions function as

a culturetypic counterbalance to fine tune some biologically innate characteristic, perhaps the tendency to worry. Such a tendency could reach a maladaptive extreme as a result of normal genetic variability in some individuals, or as a result of widespread cultural evolution that makes obsolescent the level of this innate tendency in most people. In helping an individual to control his fears, a religion might enable him more effectively to pursue everyday necessities for physical survival.¹⁶ Indeed, it is for this very reason that many westerners have taken up certain eastern practices, such as Yoga or Transcendental Meditation, instead of relying on tranquilizing drugs. This is not to say that all religious experience has passive or inhibitory implications. Perhaps in a future age, as in past ages, more creative functions of religious experience will be revealed.¹⁷

AN HYPOTHESIS ABOUT DIALECTICS AND THE BRAIN

Rychlak's convincing exposition of the dialectical nature of thought may be looked upon as pointing up a most important property of the brain. Contemporary neuroscience is highly preoccupied with phenomena at the level of microscopic parts and chemical constituents. The pattern of inquiry suggests a prevalent belief that understanding can be built from the bottom up. Often, only incidental attention is paid to the holistic phenomena that such efforts are presumably designed to build toward. The dialectical characteristic of thought is an example of such a phenomenon, and it is also an ideal candidate for neuro-reductionistic examination.

The fundamental adaptive value of a dialecticlike form of information processing may be as a kind of buffer on the ability of organisms to learn. Without this mode of mental activity organisms might have too strong a tendency to develop associations and to quickly adopt new habits. Investigations of maladaptively stereotyped behavior in animals and humans have been carried out in conjunction with neuroscientific research programs dealing with schizophrenia, frontal lobe damage, damage to the hippocampus, and the effects of amphetamines and related stimulant drugs.¹⁸

The dialectical nature of thought may be understandable at the cellular level in terms of inhibitory interactions among nerve cells.¹⁹ For example, in many neural systems electrical excitation of one region is accompanied by an inhibition of neural activity in the immediately surrounding area, and this suggests a possible neural fragment of dialectical thought. Much or all of the cerebral cortex may have the property of being inhibited in this manner.²⁰

Another widespread property of the nervous system is the existence of topographically organized mappings of one region onto another.

For methodological reasons it has been convenient to study this characteristic most in sensory and motor systems, but it is also seen in intrinsic systems of connections of the brain.²¹

These two properties of the brain, inhibitory relations and area-to-area mappings, suggest an explicit, empirically-oriented hypothesis regarding a "mechanism" of dialectical thinking: *the brain is organized in such a way that for every pattern of neural activity there arises a "negative image" in some other region.* Although seeking empirical evidence of such spatially organized patterns is an extremely difficult task, it is more important to note here that the sorts of holistic considerations that Rychlak offers may be crucially necessary to discovering major principles of brain organization. The present hypothesis is merely an illustration. Even if correct, it is still far from a complete explanation of dialectical thought. We must recognize that a complete study of organisms at physiological levels will require recurrently returning for clues and integrating ideas to an understanding of psychological and social phenomena in their own terms.

NOTES

1. Joseph Rychlak, *Discovering Free Will and Personal Responsibility* (New York: Oxford University Press, 1979). Page and chapter references are cited in the text.
2. Robert L. Solso, "Artificial Intelligence" in *Cognitive Psychology* (New York: Harcourt Brace Jovanovich, 1979); Margaret Boden, *Artificial Intelligence and Natural Man* (New York: Basic Books, 1977); Neill Graham, *Artificial Intelligence: Making Machines "Think"* (Blue Ridge Summit, Penn.: TAB Books, 1979).
3. These behaviors are described by Irenaus Eibl-Eibesfeldt, "Orientation in Space" in *Ethology, the Biology of Behavior* (New York: Holt, Rinehart & Winston, 1975), and by Konrad Z. Lorenz, *Behind the Mirror* (New York: Harcourt Brace Jovanovich, 1977). Lewis Thomas has offered an analogous speculation in his essay "On Thinking about Thinking" in *The Medusa and the Snail: More Notes of a Biology Watcher* (New York: Viking, 1979), pp. 125-28. In addition to the simple-organism metaphor, Thomas borrows terms from chemistry ("Brownian movement") and astrophysics ("docking," "orbits") in trying to describe the characteristics of the elements of thought. Also see Robert B. Glassman, "Selection Processes in Living Systems: Role in Cognitive Construction and Recovery from Brain Damage," *Behavioral Science* 19 (1974): 149-203 and "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, 1978), pp. 9-13.
4. It is interesting that, in growing or regenerating, nerve cells often appear as if they are seeking targets. See, e.g., Lloyd Guth, "Axonal Regeneration and Functional Plasticity in the Central Nervous System," *Experimental Neurology* 45 (1974): 606-54; R. K. Hunt and Marcus Jacobson, "Neuronal Specificity Revisited," *Current Topics in Developmental Biology* 8 (1974): 203-59; C. M. Pomerat, *Dynamic Aspects of the Neuron in Tissue Culture* (Gaithersburg, Md.: Tissue Culture Association Film Library). Although something like final causation thus appears to operate even on a cellular level, the relationships between these microscopic processes and more holistic psychological functions is for the most part unknown.
5. Peter M. Milner, *Physiological Psychology* (New York: Holt, Rinehart & Winston, 1970), pp. 57-101, 297-423.
6. James Olds, *Drives and Reinforcements: Behavioral Studies of Hypothalamic Function* (New York: Raven Press, 1977); Robert G. Heath, "Pleasure and Brain Activity in Man,"

Journal of Nervous and Mental Disease 154 (1972): 3-18; Elliot S. Valenstein, *Brain Control: A Critical Examination of Brain Stimulation and Psychosurgery* (New York: Wiley, 1973); A. R. Luria, *The Working Brain* (New York: Basic Books, 1973).

7. Ernest Gardner, *Fundamentals of Neurology*, 6th ed. (Philadelphia: Saunders, 1975); Theodore H. Bullock, Richard Orkand, and Alan Grinnell, *Introduction to Nervous Systems* (San Francisco: W. H. Freeman, 1977); Mary A. B. Brazier and Hellmuth Petsche, eds., *Architectonics of the Cerebral Cortex*, International Brain Research Organization Monograph Series, vol. 3 (New York: Raven Press, 1978).

8. Richard E. Nisbett and Timothy DeCamp Wilson, "Telling More Than We Can Know: Verbal Reports on Mental Processes," *Psychological Review* 84 (1977): 231-59.

9. Arnold L. Towe, "Somatosensory Cortex: Descending Influences on Ascending Systems," in *Handbook of Sensory Physiology, Somatosensory System*, ed. A. Iggo (New York: Springer-Verlag, 1973), 2:701-18; George Gordon, ed., *Active Touch* (New York: Pergamon Press, 1978).

10. Konrad Z. Lorenz, "The Bond," in *On Aggression* (New York: Bantam, 1966), pp. 159-211. In general, the work of European ethologists, who study animals in natural habitats, provides rigorous descriptions of animal behavior that are richer and in many ways more easily comparable to human behaviors, than does the work of behaviorists, in which laboratory studies are emphasized more. Rychlak uses an impoverished description of "straw animals" when he makes reference to Skinner's ideas (see esp. p. 88). See also Eibl-Eibesfeldt (n. 3 above).

11. Skinner's is the most antimentalistic behaviorism. Consideration of choice making in rats ("vicarious trial and error") has been a prominent part of the work of other behaviorists. See Ernest R. Hilgard and Gordon H. Bower, *Theories of Learning*, 4th ed. (Englewood Cliffs, N.J.: Prentice-Hall, 1975), pp. 143-44. When cats are learning to choose one of two different discriminative responses depending on which of two stimuli has been given, they frequently stop after making one response only part way, and then perform the other response. Cats in which the prefrontal cortex was experimentally damaged after thorough pretraining were recently observed to display a deficit in sustaining an appropriate posture, preparatory to performing a discriminative response, during a delay of five seconds following the stimulus presentation. After about three seconds of postural orientation in the direction of the correct response they switched to the incorrect response. Thus, an exaggerated tendency to "think dialectically" on the part of prefrontally damaged animals caused them to make more errors in the delayed discriminative response task than if they had responded at random! Robert B. Glassman, Doris E. Cook, and Harriet N. Glassman, "Prefrontal Lesions and Cutaneous Responsiveness of Cats: Learned Discrimination, Delayed Response, Orientation-Localization, and Transfer," *Physiology and Behavior* 26 (1981): 107-16.

12. Lorenz's books for a lay audience contain many delightful examples of "anthropomorphic" behaviors in animals. See especially *On Aggression* (n. 10 above), *King Solomon's Ring* (New York: Thomas Y. Crowell Co., 1952), and *Man Meets Dog* (Baltimore, Md.: Penguin Books, 1953). In *Behind the Mirror* (n. 3 above) he presents a more technical analysis of "The Roots of Conceptual Thought," pp. 113-66.

13. This principle of "fundamental surprise" is attributed to Kenneth E. Boulding by Alfred Kuhn, *The Logic of Social Systems* (San Francisco: Jossey-Bass, 1974), p. 439.

14. Ralph Wendell Burhoe speaks of the "erasable blackboard on which the brain tries out a symbolic model" and tests it against the existing value structure. "Evolving Cybernetic Machinery and Human Values," *Zygon* 7 (1972): 188-209. Donald T. Campbell uses the term "vicarious selector" to describe internal characteristics that protect the organism from having to confront environmental selectors that might threaten survival. See "Unjustified Variation and Selective Retention in Scientific Discovery," in *Studies in the Philosophy of Biology*, ed. F. J. Ayala and T. Dobzhansky (Berkeley: University of California Press, 1974), pp. 139-61.

15. The general possibility of symbiotic relationships between genetic and cultural sources of information has been discussed by Ralph Wendell Burhoe, "The Human Prospect and the 'Lord of History,'" *Zygon* 10 (1975): 299-375; idem, "The Source of Civilization in the Natural Selection of Coadapted Information in Genes and Culture," *Zygon* 11 (1976): 263-303. I would argue additionally that whenever a longstanding

cultural phenomenon is observed, it is likely itself to be supported in part by a genetically influenced disposition to learn. See Robert B. Glassman, "An Evolutionary Hypothesis about Teaching and Proselytizing Behaviors," *Zygon* 15 (1980): 133-54. In the present instance this argument suggests an innate bias toward learning certain religious practices.

16. This is a variant of Donald T. Campbell's suggestion that preaching emanating from the social system functions to counterbalance a genetically influenced propensity toward selfishness. "On the Conflicts Between Biological and Social Evolution and Between Psychology and Moral Tradition," *American Psychologist* 30 (1975): 1103-26, reprinted in *Zygon* 11 (1976): 167-208.

17. Karl E. Peters, "Some Further Possibilities of *Toward a Scientific Theology*," hand-out accompanying lecture for the Advanced Seminar in Theology and the Sciences, 30 September 1982, Meadville/Lombard Theological School, Chicago. Peters argued that Ralph Wendell Burhoe's theology emphasizes religious ideas and actions, because it is concerned with function; Burhoe tends to neglect religious experience, which comprises a more passive aspect of religion. I believe that if the relevance of Burhoe's theology to religious experience is developed, experience will be found to have active as well as passive functional implications.

18. Jeremiah P. Collins and Henry Lesse, "Cocaine-Induced Stereotyped Behavior: Ongoing Responses Determine Drug Effects," *Neuroscience Abstracts* 5 (1979): 644; Solomon H. Snyder, *Madness and the Brain* (New York: McGraw-Hill, 1974); A. R. Luria, "The Frontal Lobes and the Regulation of Mental Activity," in *The Working Brain* (New York: Basic Book, 1973); D. Devenport, J. A. Devenport, and F. A. Holloway, "Hippocampal Superstition: A Case of CA-Mediated Stereotypy," *Neuroscience Abstracts* 6 (1976): 420. Also, Sherwood O. Cole, "Brain Mechanisms of Amphetamine-Induced Anorexia, Locomotion, and Stereotypy: A Review," *Neuroscience and Biobehavioral Reviews* 2 (1978): 89-100; H. J. Markowitsch and M. Pritzel, "Learning and the Prefrontal Cortex of the Cat: Anatomico-Behavioral Interrelations," *Physiological Psychology* 4 (1976): 247-61; R. B. Glassman and H. N. Glassman, "Oral Dyskinesia in Brain-Damaged Rats Withdrawn from a Neuroleptic: Implication for Models of Tardive Dyskinesia," *Psychopharmacology* 69 (1980): 19-25.

19. T. H. Bullock, et al. (n. 7 above); Stephen W. Kuffler and John G. Nicholls, *From Neuron to Brain: A Cellular Approach to the Function of the Nervous System* (Sunderland, Mass.: Sinauer Associates, 1976).

20. Vernon B. Mountcastle, "An Organizing Principle for Cerebral Function: The Unit Module and the Distributed System," in *The Mindful Brain: Cortical Organization and the Group-Selective Theory of Higher Brain Function*, ed. Gerald M. Edelman and Vernon B. Mountcastle (Cambridge, Mass.: MIT Press, 1978).

21. W. I. Welker, ed., "Neocortical Mapping Studies," *Brain Behavior and Evolution* 13 (1976): 241-343; Ulf Norrressell, "Behavioral Studies of the Somatosensory System," *Physiological Reviews* 60 (1980): 327-54; J. Kievit and H. G. J. M. Kuypers, "Organization of the Thalamo-Cortical Connexions to the Frontal Lobe in the Rhesus Monkey," *Experimental Brain Research* 29 (1977): 299-322; Malcolm B. Carpenter, "Anatomical Organization of the Corpus Striatum and Related Nuclei," in *The Basal Ganglia*, ed. M. D. Yahr (New York: Raven Press, 1976), pp. 1-36.