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Evolving Consciousness: The Very Idea!

Abstract

Discovering an adequate explanation for the evolution of consciousness has been described as "the hard ***problem****" about consciousness that we would like to understand. This* ***difficulty*** *becomes compounded by the introduction of such notions as the unconscious or the preconscious as its counterparts, at least for species of the complexity of human beings. An evaluation of the prospects for unconscious factors as* ***exerting*** *causal influence upon human behavior, however, depends upon understanding both the nature of evolution and the nature of consciousness. This paper sketches a theoretical* ***framework*** *for understanding both phenomena in general with regard to their various forms and suggests the evolutionary* ***function*** *of consciousness in genetic and in cultural contexts. It becomes increasingly apparent that, given a suitable conceptual* ***framework,*** *the evolution of consciousness might not be such a "hard* ***problem",*** *after all.*

Key words

Consciousness, cognition, evolution, stimuli, signs, minds, semiotic systems, awareness, self-awareness, communication, signals.

The "Hard" Question

Philosophers spend most of their time dealing with vague and imprecise notions, attempting to make them less vague and more precise (FETZER 1984). When we are dealing with notions like "the unconscious mind", where we have only a vague notion of consciousness and an imprecise notion of the mind, it may be appropriate to propose a few suggestions in an effort to sort things out a bit better, especially when the role of evolution in producing mentality and consciousness appears to be poorly understood. This study attempts to shed light on these problems by exploring how consciousness of different kinds might contribute to evolution in relation to its causal mechanisms.

Why did consciousness evolve? has been called "the hard problem" and some have even denied that it can be an adaptation (HARNAD 2002). *So What are the adaptive benefits of consciousness?* and *How does consciousness enhance the prospects for survival and reproduction of species that possess it?* are crucial questions. But the correct answers necessarily depend upon the nature of consciousness itself. In his *Kinds of Minds,* for example, Daniel DENNETT (1996) suggests that consciousness is sensitivity plus some additional factor "x", yet he thinks there might be no such "x". If it is merely the capacity for sensation and sensation is no more than a propensity for undergoing change, then consciousness might even be separate from mentality. There might be nothing distinctive about consciousness nor motive for its evolution.

If consciousness is instead a sensory awareness of the sensible qualities of things, such as their colors, shapes, sizes, by comparison, it might make a difference and even imply the presence of minds. In *The Evolution of Culture in Animals,* for example, John BONNER (1980) describes E. *coli* bacteria as moving toward 12 chemotactic substances and as moving away from 8 others. Assuming the ones it moves toward are nutrient or beneficial, while the ones it moves away from are harmful or deleterious, it is not very difficult to imagine how evolution could have produced this result at this stage for those bacteria. Perhaps "the hard problem" might turn out not to be a hard problem, after all.

The "Black Box" Model

We tend to operate on the basis of a rather simple model—a "black box" model—for organisms. We have a stimulus S that brings about a response R by an organism O with a certain probability or propensity p (FETZER 1981, 1993a). The propensity p for response R by an organism O, when subject to stimulus S, can be formalized as,

Stimulus S ==> [Organism O =p=> Response R]

Figure 1. The black box.

or, alternatively, by exchanging the positions of the organism O and the stimulus S,

Organism O ==> [Stimulus S =p=> Response R]

Figure 2. The black box (reversed).

where different species and different organisms of the same species may be subject to different ranges of stimuli S and ranges of response R with different propensities.

This model does not offer any analysis of processes internal to O, which makes it a "black box" model. A more refined analysis, however, takes into account the possible existence of links that relate an initial INTERNAL response R1 to the occurrence of one or more possible additional INTERNAL responses Ri, where these responses may lead to EXTERNAL responses Rj of motion or sound by the organism formalized as follows:

(EXTERNAL) O ==>
(INTERNAL) [(S =p1=> R1) & (R1 =p2=> R2) &
(R2 =p3=> R3) & ...] =pj=>
(EXTERNAL) Rj

Figure 3. A more refined model.

Thus, for an ordinary organism of kind O, under suitable circumstances, an external stimulus S, which might be a sight or a sound, causes a pattern of neural activation R1, which in turn may (probabilistically) bring about a pattern of neural activation R2, . . . , which in turn may (probabilistically) bring about other patterns of neural activation, which may eventually lead to (public) external responses Rj, such as motion or sounds. The simpler the organism, the simpler these internal links (FETZER 1990, 1996, forthcoming).

This approach invites the introduction of at least three measures of complexity that could distinguish between species or even conspecifics as members of the same species, based upon various properties of such links as possible internal causal chains, namely: (a) the complexity of these internal causal chains, especially with regard to (i) number of possible links and (ii) their deterministic or probabilistic character; (b) the temporal interval between the initial stimulus S and the ultimate behavioral response R, if any; and (c) the complexity of those possible responses that organisms display themselves.

Human Behavior

A simple example in the case of human behavior might be making a date, such as to attend this conference. We may do so months in advance, but our behavioral responses to our commitments are only displayed when the time draws near. This reflects the consideration that human behavior arises as a result of the complex causal interaction between multiple factors of the kinds motives, beliefs, ethics, abilities, and capabilities, where behavior may be a probabilistic manifestation of their interaction:

MOTIVES (m1, m2, ... mn) &
BELIEFS (b1, b2, ... bn) &
ETHICS (e1, e2, ... en) & **=p=>** **RESPONSES r1, r2, ...rn, including motion and sounds**
ABILITIES (a1, a2, ... an) &
CAPABILITIES (c1, c2, ... cn)

Figure 4. Human behavior as a probabilistic effect.

The success or failure of the actions we undertake on the basis of those motives and beliefs, however, depends very heavily on our opportunities as the way things are, which reflects the truth and the completeness of our beliefs (FETZER 1989, 1990).

While one mental state may bring about another mental state through a series of transitions between links of the kind described above, the totality of factors that interact to (probabilistically) bring about our behavior consists of specific values of variables of each of these kinds, where one complete set of values for the variables motives, beliefs, ethics, abilities, and capabilities constitutes a context. The concept of a context turns out to be fundamental to meaning and mind (FETZER 1991, 1996).

The difference between deterministic and indeterministic behavior can then be spelled out as follows. Relative to a context, when the same behavior would occur in every case without exception, then that behavior is deterministic. When one or another behavior within a fixed class would occur in every case without exception, with a constant probability, then that behavior is *indeterministic*. Consequently, even persons in the same context C can manifest different behavior so long as it is among the possible outcomes that occur with a fixed propensity within that context.

With regard to motives, for example, if you like Heavenly Hash twice as much as you do Peppermint BonBon, where they are your clear preferences in ice cream, then we would expect that you would choose Heavenly Hash about twice as often as Peppermint BonBon when you enter Baskin Robbins.

You would not know which you would pick on any single visit, but over time you would pick one about twice as often as you pick the other. Frequencies are produced by propensities across trials, which can explain them and for which they function as evidence (FETZER 1981, 1993a, 2002a).

Meaning and Behavior

What holds for motives also holds for beliefs, ethics, and the other variables that affect our behavior. With regard to beliefs, for example, I happen to live at 2021 E. 4th Street in Duluth, MN. If someone were to believe instead that I lived at 2017, that would have multiple manifestations in their behavior, such as the directions they might give to get to my house, what they would write on a letter they wanted to mail to me, where UPS and FED/EX deliveries to me would be made, and the like.

This approach supports a dispositional theory of meaning, according to which the meaning of a belief; Bi, is the difference that Bi makes over alternatives Bj relative to every context consisting of specific values of motives, of other beliefs, and so forth, where, when there is no difference in the totality of behavior that would be displayed given Bj as opposed to Bi across every context, then the meaning of Bj is the same as Bi (FETZER 1991, 1996). And it turns out that meaning itself is amenable to degrees.

Those who know that my home is the fourth house on the block on the high side, for example, might be able to find it without great effort because of their other beliefs about how to get around in Duluth, but for other purposes the street number would be required. Some but not all of the same behavior would result from those overlapping beliefs. Two half-dollars, four quarters, and so on has the same purchasing power as a dollar, but in some contexts carrying a bill rather than bulky change might matter.

This account of meaning, which connects stimuli S with responses R by means of internal dispositions of an organism O, comports with a theory of concepts and even of mind. If we think of concepts as constellations of habits of thought and habits of action, then when an experience is subsumed by means of a concept, the expectable outcome is whatever behavioral effects would (probably) be produced in a context. Some concepts will be innate, while others may be acquired (FETZER 1991, 1996).

Another species that exemplifies these notions is that of vervet monkeys, which makes at least three different kinds of alarm calls. In his Introduction to Ethology, P. J. B. SLATER (1985) reports that one such call warns of a land-borne predator in the vicinity and, when the monkeys hear this call, they climb up into the trees to evade it. Another warns for an airborne predator in the vicinity and, when they hear it, they crawl down under the bushes for protection. And the third is for things on the ground, where they climb down and poke around so they can see just what is going on.

Our behavior, especially voluntary, turns out to be a partial manifestation of meaning to us, where the meaning of meaning to us turns out to be the multiple potentialities for behavior in the presence of something S, where I want to identify that S more precisely as a stimulus of a certain special kind, which makes a crucial difference to our behavior. The suggestion I am going to make is that an approach, which has not received a lot of attention as yet, but that was advanced by Charles S. PEIRCE—whom I consider to be the only great American philosopher--can help to clarify and illuminate the nature of mind.

The Nature of Signs I

According to PEIRCE, a sign is a something that stands for something else in some respect or other for somebody. A simple illustration is a red light at an intersection. For qualified drivers who know the rules of the road, that light stands for applying the breaks and coming to a complete halt, only proceeding when the light changes and it is safe to do so. Under ordinary circumstances—in a "standard context", let us say—that is precisely the behavioral manifestation that we expect to occur (FETZER 1988, 1991).

This would be an example of an appropriate behavioral response for somebody who understood the rules of the road and is not incapacitated from exercising that ability, as might be the case if, for example, they were blindfolded. And of course there can be other signs with the same meaning, such as, in this case, a stop sign or an officer with his palm extended, which have essentially the same meaning (of applying the breaks and coming to a complete halt, but only proceeding when the officer tells you to do so). PEIRCE called the complex of dispositions of a user to respond to a sign its "interpretant".

PEIRCE suggests there are three different ways in which signs can be "grounded" or related to those things for which they stand. The first is on the basis of resemblance relations, where the sign looks like (tastes like, smells like, feels like, or sounds like) that

for which it stands. Examples include statues, photographs, and paintings, when realistically construed. (Thus, PICASSO achieved a niche in the history of art when he violated the canons of representation of the nude female.) PEIRCE called these "icons".

My driver's license exemplifies an important point about icons. As you might or might not be able to see, my license photo looks a lot like me—maybe on not such a great day—but if you turn it on its side, it no longer resembles me, because I am just not that thin. What this implies is that even the use of the most basic kind of sign, an icon, presupposes ***a point of view.*** Anyhing incapable of a point of view, therefore, is incapable of using signs or of possessing a mind, a point to which we shall return.

The second mode of grounding that PEIRCE introduced is ***causal relations,*** where a cause stands for its effects, effects stand for their causes, and so forth. Thus, smoke stands for fire, fire for smoke, ashes for fire, and so on, while red spots and elevated temperature stand for the measles—which means that there may be special classes of individuals who are practiced in reading signs of certain kinds, such as scientists and physicians, but also those whose parallel claims may be suspect, such as palm readers and crystal-ball gazers. PEIRCE called these signs "indices" (as the plural for "index").

The Nature of Signs II

The third mode of grounding PEIRCE introduced involves mere ***habitual associations*** between signs and that for which they stand, where the most familiar examples are the words that occur in ordinary languages, such as "chair" and "horse" in ordinary English. These words certainly do not look like or resemble nor are they causes or effects of that for which they stand. Unlike icons and indices, which might be thought of as "natural" signs because they are there in nature whether we notice them or not, these signs are ones we have to make up or to create. These "artificial" signs are known as "symbols".

In order for a specific something to stand for something else in some respect or other for somebody on a specific occasion, that somebody must have the ability to use signs of that kind, s/he must not be incapacitated from exercising that ability, and that sign must stand in an appropriate causal relationship to that sign user. If a red light were invisible to a driver because of a driving rain (a dense fog, overgrown shrubbery, or whatever), it could not exert its influence on that sign user on that occasion any more than if s/he had been temporarily blinded by a flash of lightning or an oncoming car (FETZER 1990, 1996).

Even more interesting, perhaps, is the realization that the specific something for which something stands in some respect or other need not exist. We can have signs for persons who do not exist, such as Mary Poppins and Santa Claus, or for species of things, such as unicorns and vampires, that do not exist, without incapacitating those signs from standing for things of those kinds. We can even make movies about alien visitations and American werewolves in London. Which means that the use of signs has enormous scope and range with respect to those things for which they can stand. They do not even have to exist!

The Nature of Minds

The sign relationship, therefore, is three-placed (or "triadic"), where a something, S, stands for something else, x, (in some respect or other) for somebody, z. The meaning of a sign is then the totality of causal influences it would exert across possible contexts, Ci:

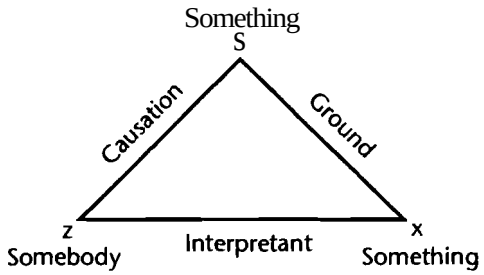

Figure 5. The triadic sign relationship.

When we pause to consider more precisely the kind of thing for which something can stand for something else, however, it becomes extremely attractive to entertain the hypothesis that ***the capacity to use signs*** might be exactly what distinguishes minds.

Let us focus on the sign user z rather than the sign S and avoid taking for granted that the kinds of things for which something can stand for something else have to be human by abandoning the term "somebody" and use the more neutral term "something". Then anything, no matter whether it happens to be human being, (other) animal, or inanimate machine, for which something (a sign) can stand for something else in some respect or other ***possesses a mind.*** And let us refer to systems of this kind as things that are capable of using signs as ***semiotic systems*** (FETZER1988, 1989, 1990).

Semiotic Systems

"Interpretant" thus stands for a system's semiotic dispositions as the totality of ways it might respond (probabilistically) to the presence of a sign within different contexts. Its behavior in context Ci can therefore differ from its behavior in Cj in the presence of the same sign (FETZER 1991). And a semiotic system z can be diagrammed as follows:

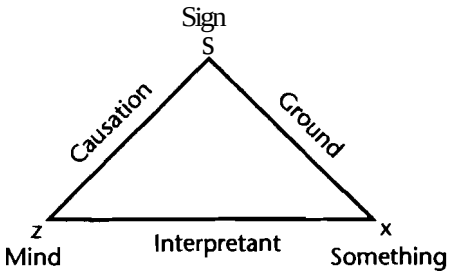

Figure 6. A semiotic system.

The grounding relations between signs and that for which they stand (by virtue of relations of resemblance, of cause-and-effect, or of habitual association, as we have discovered), are therefore crucial to the nature of semiotic systems. Unless that causal connection between the presence of something and the (potential or actual) behavior of a system obtains because it functions as an icon, an index, or a symbol for that system (by virtue of its grounding relation of resemblance or of causation or of habitual association), it cannot be a semiotic connection (FETZER 1990, p278).

Semiotic systems for which things function as signs afford a basis for separating systems that have minds from others that do not, such as digital machines, which lack the grounding relationship relating signs to those things for which they stand. This difference can also be diagrammed to display this crucial difference as follows:

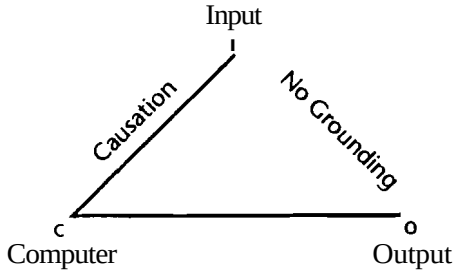

Figure 7. An input-output system.

Thus, although they are designed to process marks on the basis of their shapes, sizes, and relative locations, those marks mean nothing to those digital machines, say, as inventories or as dollars and cents. They should therefore be characterized, not as semiotic systems, but as input/output systems instead, where the inputs that exert causal influence upon them are properly understood to function merely as stimuli rather than as signs. They can be called "symbol systems", provided that does not imply that they use symbols in PEIRCE's sense (FETZER 1988, 1990, 1996, 2002b).

Communication and Convention

Another important distinction that can be drawn is that communication between semiotic systems is promoted when those systems use signs in similar ways. When a sign-using community reinforces common sign-using behavior by means of some system of institutions, such as schools, those customs, traditions, or practices take on the status of conventions, which promotes the objectives of communication and cooperation, thereby facilitating the pursuit of community goals (FETZER 1989, 1991).

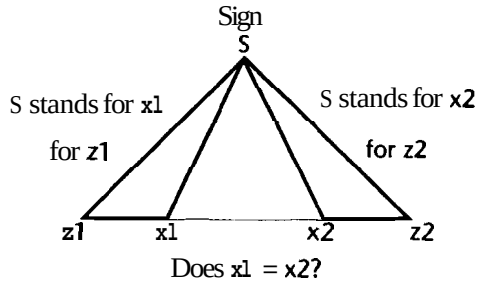

Figure 8. Communication situations.

When one semiotic systems uses signs to communicate with another semiotic system, then those signs assume the character of *signals*. There thus appears to be a hierarchy between mere stimuli, signs, and signals, because every signal is a sign and every sign is a stimulus, but not vice versa. Causes that can produce changes in inanimate objects, for example, are stimuli but not signs, just as things that stand for other things are signs for those systems even if they are not signals. While all three—stimuli, signs, and signals—are possible causes that can affect the behavior of different systems, only signs and signals entail the presence of minds.

Consciousness and Cognition

Even more important, however, the theory of minds as semiotic systems also provides illuminating conceptions of consciousness and of cognition, where both turn out to be adequately defined only relative

to signs of specific kinds. Thus, a system z is ***conscious (with respect to sign. of a specific kind S)*** when (a) z has the ability to use signs of kind S and (b) z is not incapacitated from using signs of that kind within its present context C. ***Cognition (with respect to a specific sign of kind S)*** thus occurs as the effect of a causal interaction between a system z and a sign S when (a) z is conscious with regard to signs of kind S and (b) a sign of kind S occurs in suitable causal proximity to z, which brings about the activation of its mental states as the outcome of a suitable opportunity (FETZER 1989,1990,1996).

Consciousness (with respect to signs of kind S) = df ability +capability (within a context)

Cognition (of a specific sign of kind S) = df an effect of consciousness + opportunity

Figure 9. Consciousness and cognition (informal).

The conception of minds as semiotic systems (sign-users) thus not only brings with it the definition of mentality as semiotic ability but useful conceptions of consciousness and of cognition. Informally expressed, consciousness (with respect to signs of specific kinds) combines the ***ability*** to use signs of that kind with the ***capability*** to exercise the ability, while cognition (relative to a specific sign) combines ***consciousness*** with respect to signs of that kind and the ***opportunity*** for causal interaction with a sign of that kind. That definition can be complemented with a general criterion of mentality, which is the capacity to make a mistake, since anything that can make a mis-take has the ability to take something to stand for something, which is the right result (FETZER 1988, 1990).

The outcome of this approach is the introduction of a theory of mentality that is applicable to human beings, to (other) animals, and to inanimate machines, if such a thing is possible. It yields a system of types of minds of increasing strength, from iconic to indexical to symbolic, where symbolic presup poses indexical and indexical iconic, but not vice versa. These types and criteria of their presence are shown in Figure 10, where an evidential indicator of the presence of iconic mentality is the capacity for ***type/token recognition*** of instances as instances of specific kinds; of indexical is ***classical PAVLOVIAN conditioning*** as the generalization of a cause inducing an effect; and of symbolic mentality ***SKINNERIAN operant conditioning,*** where one thing comes to stand for another based merely upon habitual association (FETZER 1988,1990).

Higher Modes of Mentality

This approach invites the evolutionary hypothesis that various biological species are predisposed toward mentality of specific types, which would be expected to be distributed as a reflection of their evolutionary standing, the lowest organisms with the lowest levels of mentality, the higher with higher. Indeed, there appear to be at least two higher modes of mentality that are characteristic of human beings, which are the capacity to fashion arguments as ***transformational mentality*** and the ability to use signs to stand for other signs as ***metamentality,*** especially for the purpose of criticism, where sign-users can subject signs to changes intended to improve them, as Figure 11 displays.

Among the virtues of the conception of minds as semiotic systems is that it allows for the existence of modes of mentality that are less sophisticated than those involved in the use of language, which appears to be a relatively late phenomenon in evolution (DONALD 1991; FETZER 1993b, 1993c). The extraordinary attention to which it has been subject by Noam CHOMSKY'S work on grammar as a species-specific innate syntax and Jerry FODOR'S work on meaning as a species-specific innate semantics has reached its latest incarnation in work such as that of Stephen PINKER (1997), who holds that the human mind is a computer for survival and reproduction, and of Euan MACPHAIL (1998), who maintains the key to the evolution of consciousness is the evolution of language.

	Mentality		
	Type I	Type II	Type III
Definition	iconic	indexical	symbolic
Criterion	type/token recognition	classical PAVLOVIAN conditioning	SKINNERIAN operant conditioning

Figure 10. Basic modes of mentality.

	Higher Mentality	
	Type IV	Type V
Definition	transformational	metamentality
Criterion	logical reasoning	criticism

Figure 11. Higher modes of mentality.

If the evolution of language were the key to the evolution of consciousness, then, insofar as language is a phenomenon relatively late in evolution, it would be rather difficult to imagine how consciousness could have evolved at all. Preoccupation with language truncates consideration of multiple modes of meaning and non-human kinds of minds. Not only are iconic and indexical mentality more primitive than symbolic, but preoccupation with linguistic transformations and syntactical structures manages to focus on higher modes of mentality to the neglect of lower, while even placing the syntactic cart before the semantic horse. As Thomas SCHOENEMANN has argued (and I agree), that syntax evolved as an emergent response to semantic complexity affords a better explanation of the phenomena than its innate alternatives (SCHOENEMANN 1999).

Conceptions of Consciousness

The idea that the mind is a computer that evolved through natural selection, of course, takes for granted that, at some appropriate level of description, both minds and machines operate on the basis of the same or similar principles, which already appears to be false given the difference in grounding relations. But modeling minds after machines also confounds languages as products of the evolution of culture with species as products of the evolution of genes. The relative adequacy of alternative theories (of consciousness, mentality, and language) may be assessed by extent to which they are able to explain the full range of related phenomena (of consciousness, mentality, and language), where, I would submit, the semiotic conception encounters no serious rivals.

As an illustration, consider the multiple modes of consciousness that can be differentiated within the scope of this approach. Those that do not make reliance upon signs lack the semiotic dimension distinctive of mentality. The DENNETT hypothesis that consciousness may be nothing more than sentience qualifies thermostats, litmus paper, and thermometers as "conscious", yet is not sufficient to endow them with mentality (FETZER 1997). They are thus examples of sensitivity as the susceptibility to stimuli that does not implying mentality as a species of "consciousness" without minds. Let's call this (C-1).

A stronger mode of consciousness would combine sensitivity with semiotic ability, which implies the presence of mind. Call this (C-2). A third mode of consciousness would combine semiotic ability with self-awareness involving the use of signs to stand for the sign-user itself. Call this (C-3). Yet a fourth mode of consciousness would combine self-awareness with the capacity for articulation, which we shall call (C-4). A fifth mode of consciousness would combine self-awafeness with the capacity for articulation and the ability to communicate with others using signs as signals. Let us call this final mode (C-5).

(C-1)	**Sensitivity**
	stimuli with causal influence but does not imply mentality: thermostats, thermometers, litmus paper as a kind of mindless consciousness
(C-2)	**Semiotic ability**
	sensitivity regarding stimuli that stand for something in some respect for something; hence, (C-2) implies (C-1) and the presence of mind
(C-3)	**Self-awareness**
	semiotic ability that includes signs that stand for the sign user itself for the sign user; so (C-3) implies (C-2) with self-referential ability
(C-4)	**Self-awarenesswith articulation**
	semiotic ability that includes signs that stand for the user itself with the ability to articulate that self-awareness; so (C-4) implies (C-3) with articulative ability
(C-5)	**Self-awarenesswith capacity for communication**
	semiotic ability that includes signs standing for oneself and other conspecifics, which promotes cooperation, so (C-5) implies (C-4) with signals

Figure 12. Five modes of consciousness.

This schema does not represent the only possible kinds of consciousness but rather serves as a template to consider the prospective roles of consciousness in evolution. In this case, for example, each mode of consciousness implies each of the lower modes, where (C-5) implies (C-4), (C-4) implies (C-3), and so forth. If there are cases of communication involving signals, which presumably would be at the level of (C-5), such as vervet monkey alarm calls, where their use of signals may or may not be accompanied by self-referential ability at the level of (C-3), then it has exceptions that would display the desirability of deviant typological schemes.

Evolution and Consciousness

Evolution understood as a biological process should be characterized in terms of three principles, namely: that more members are born live into each

species than survive to reproduce; that crucial properties of offspring are inherited from their parents; and that several forms of competition between the members of a species contribute to determining which of them succeeds in reproducing. The mechanisms that tend to produce genetic variation include genetic mutation, sexual reproduction, genetic drift, and genetic engineering, while the mechanisms that tend to determine which members of existing populations tend to survive and reproduce are natural selection, sexual selection, artificial selection, and group selection (FETZER 2002c).

The question with which we began, you may recall, was, ***Why did consciousness evolve?,*** which is amenable to alternative formulations that include, ***What are the adaptive benefits of consciousness?*** but also ***How does consciousness enhance the prospects for survival and reproduction of species that possess it?*** Having clarified the nature of consciousness sufficiently to make these questions meaningful (or at least interesting) enough to pursue them, the objective becomes to consider each of these causal mechanisms in turn to ascertain whether consciousness of any of these five modes would provide adaptive benefits in order to answer "the hard question".

The following table reflects the big picture, in general, as the intersection of the eight different evolutionary mechanisms with those modes of consciousness that might enhance them or benefit from them. The first four are modes that promote variability in the gene pool. Consciousness beyond sensitivity would appear to make no difference to the occurrence of genetic mutation, which of course presupposes consciousness (C-1). Similarly for sexual reproduction and genetic drift, understood as causal processes apart from the mechanisms that determine who mates with whom and under what conditions.

Mechanism	Consciousness
(1) **Genetic mutation**	(C-1)
(2) **Sexual reproduction**	(C-1)
(3) Genetic drift	(C-1)
(4) Genetic engineering	(C-5)
(5) **Natural selection**	(C-1) **to** (C-5)
(6) Sexual selection	(C-2) **to** (C-5)
(7) Group selection	(C-5)
(8) Artificial selection	(C-5)

Figure 13. Adaptive roles of modes of consciousness.

Genetic engineering, by contrast, requires highly sophisticated mental abilities that would appear to benefit from reasoning skills and critical thinking up to the level of (C-5). The emergence of consciousness at levels far beyond (C-1) would provide adaptive benefits. In the case of natural selection, all these modes would be beneficial in competition with conspecifics for food and other resources. Success in sexual selection, moreover, would benefit from self-referential abilities and the capacity for articulation, not to mention the ability to transmit appropriate signals. Artificial selection and group selection could not operate without communication.

If these considerations are well-founded, then they suggest that the potential adaptive benefits of consciousness are both obvious and profound. In response to the question, different modes of consciousness appear to enhance the prospects for survival and reproduction by species that possess them. Intriguingly, the motives for consciousness to evolve differ in relation to different evolutionary mechanisms. It should come as no surprise that natural selection and sexual selection should both benefit from consciousness up to the highest kinds, where genetic engineering and artificial and group selection could not function without consciousness around (C-5).

Minds Are not Machines

What this exercise has secured is a plausibility proof that evolution can produce consciousness among its varied manifestations, since organisms with these kinds of abilities would secure advantages in competition with nature and with conspecifics across a wide range of evolutionary mechanisms. This means that there would be adaptive benefits from possessing consciousness of these various kinds that would enhance the prospects for survival and reproduction among those possessing them. It should also be observed, however, that this analysis could be improved upon by, for example, systematically integrating consideration for different kinds of minds.

There should not be much room for doubt, for example, that higher modes of consciousness tend to presume higher types of mentality, where transformational mentality and metamentality can greatly extend the abilities of organisms in dealing with conspecifics and their environments. All of this may even seem to reinforce the claim that the human mind is a computer for survival and repro-

duction. That claim, however, trades upon an ambiguity. There is some general sense in which the human mind is a processor for survival and reproduction, but this, from the point of view of evolution, is a trivial claim. The sense in which the human mind is a computer, alas, implies that they operate on the basis of the same or similar principles, which is false.

We have already seen that digital machines lack a grounding relation that typifies not just human minds but every mind. (Compare Figure 7 with Figure 6.) So that is one important difference, which we might call "the static difference". Another is that these machines function on the basis of algorithms implemented by using programs, which execute operations in specific sequences of steps. They have definite starting points and definite stopping points, where their application is perfectly general and they always yield a correct solution to a problem in a finite number of steps. When you think about it, these are important differences between computing and thinking.

How many kinds of thinking have these properties? Certainly neither perception nor memory nor dreams or daydreams come close. None of them ordinarily qualifies as solving problems. None of them has a definite starting point and another definite stopping point. None of them can be counted upon to yield correct solutions in finite steps. We might call this "the dynamic difference". What this means is that digital machines and human beings do not function on the basis of the same or even similar principles. They exemplify the static difference and the dynamic difference, which means that they are systems of distinctly different kinds. Human beings surely are systems for survival and reproduction, but that does not turn them into computers. PINKER is wrong, because minds are not machines (FETZER 1990, 1994, 1996, 2002b).

Genetic vs. Cultural Evolution

In an earlier book, Steven PINKER (1994) embraced the hypothesis of a uniquely human "language instinct", while acknowledging that this species-specific conception does not appear to be logically compatible with modern Darwinian theory of evolution "in which complex biological systems arise by the gradual accumulation over generations of random genetic mutations that enhance reproductive success" (p333). His solution is to explain that the history of evolution produces a bushy structure, not an ordered sequence, where his account is not endangered by its incapacity, for example, to show that monkeys have language. But surely it would be more reasonable to suppose that our evolutionary relatives, including monkeys, have some counterpart ability to use different yet comparable methods for communication. A broader semiotic framework would relate the use of signs to the subsumption of experience by means of concepts.

An adequate understanding of the evolution of language and mentality, moreover, heavily depends upon a firm grasp of the differences between genetic and cultural evolution. By adopting the common distinction between "genes" as units of genetic evolution and "memes" as units of cultural evolution, John BONNER (1980) already identified three important differences, because (1) genes can exist independently of memes, but not conversely (there are no disembodied thoughts); (2) genes are transmitted but once per organism, while memes can be acquired over and over; and, (3) that the rate of change for genes is constrained by gestation, whereas the rate of change for memes approximates the speed of information transmission. Thus,

Genetic Evolution	Cultural Evolution
(1) Genes can exist independently of memes	(1') Memes cannot exist independently of genes
(2) One time transmission of information (conception)	(2') Multiple opportunities for information transmission
(3) Changes very slow (bound by rate of reproduction)	(3') Changes very fast (bound by speed of light)

Figure 14. Genetic vs. cultural evolution (BONNER).

Other differences distinguish them as well, however, which in some contexts may be even more important. Thus, for example, the genetically heritable properties of organisms are ones that any organism with those genes could not be without (given fixed environmental factors) as permanent properties, while the memetic properties of organisms are often transient and acquired. The causal mechanisms underlying cultural evolution are rooted in the semiotic abilities of the species (FETZER, forthcoming).

Ultimately, distinctions must be drawn between species for which their mental abilities are innate, inborn, and species-specific, and those for which their mental abilities can be enhanced through conditioning, learning, and even critical thinking. Low-level species, such as bacteria, may satisfy the conception of evolution where complex biological sys-

tems arise by the gradual accumulation over generations of random genetic mutations that enhance reproductive success. But other species far transcend the limitations that those constraints would impose. The only permanent properties related to language that humans have to possess are predispositions for the acquisition of concepts as habits of thought and habits of action, including the use of icons, indices, and symbols. There is no need for a "language instinct" as an innate disposition to use language (FETZER 1991, SCHOENEMANN 1999, DUPRÉ 1999).

(4) affect permanent properties	(4') affect merely transient properties
(5) mechanisms of genetic change are Darwinian, including:	(5') mechanisms of memetic change are Lamarckian, including:
genetic mutation	classical conditioning
natural selection	operant conditioning
sexual reproduction	imitating others
...	...
artificial selection	logical reasoning
genetic engineering	rational criticism

Figure 15. Genetic vs. cultural evolution (FETZER).

Concluding Reflections

In a broader sense, thinkers like PINKER, FODOR, CHOMSKY, and MACPHAIL, who are preoccupied with language, have missed the boat by taking syntax to be more basic than semantics. When it comes to evolution, they have some general appreciation for the origin of species but little understanding of key differences between genetic and cultural evolution. They have developed their theories largely independently of the question, But ***where did language come from?,*** as though it could arrive on the scene full-blown as a language of thought rich enough to sustain every sentence in every language—past, present, or future—that did not have to be a product of evolution!

The considerations adduced here, however, provide a fertile point of departure for other studies that carry this approach into new domains. While the theory of minds as semiotic systems clarifies and illuminates the very idea of consciousness as an evolutionary phenomenon, the elaboration of that approach for unconscious and preconscious phenomena requires further exploration. At the very least, it makes clear that mental phenomena are semiotic phenomena involving the use of signs. When organisms are exposed to stimuli for which they lack corresponding concepts, for example, then they are unable to subsume them and remain merely "preconscious". When they subsumed by concepts for which those organisms have no signals, they are restricted to private use and might be said to be "unconscious".

This raises the possibility that the notions of "preconscious" and of "unconscious" may ultimately be envisioned as ***relative*** to kinds of consciousness. The study of Freud should contribute considerably within this context, since no one ever had a firmer grasp of the intricacies of the human mind with regard to its conscious, unconscious, and preconscious dimensions (SMITH 1999). Although the semiotic conception elaborated here supports appealing accounts of consciousness and of cognition, which have obvious evolutionary implications for the origin of species, its implications for the preconscious and unconscious invite future development.

The theory of minds as semiotic systems presents an attractive alternative to models of the mind inspired by computers and language. Their respective merits should be assessed on the basis of the criteria of comparative adequacy for scientific theories, which include (a) the clarity and precision of the language in which they are couched; (b) their respective scopes of application for explaining and predicting the phenomena to which they apply; (c) their respective degrees of confirmation on the basis of suitable observations, measurements, and experiments; and (d) the simplicity, economy, or elegance with which their scopes of application happen to be attained (FETZER 1981, 1993a). By this standard, the semiotic approach, which applies to humans, (other) animals, and even machines, if such a thing is possible, provides a far superior framework for understanding consciousness and cognition, including its ability to place "the hard problem" in proper evolutionary perspective.

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