EVOLUTION, MENTALITY, AND MORALITY:
CAN RELIGION BE RECONCILED WITH SCIENCE?

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EVOLUTION, MENTALITY, AND MORALITY: CAN RELIGION BE RECONCILED WITH SCIENCE?

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Eleanor Atwood Waterhouse
(1917-1952)

in memoriam

It is wrong always, everywhere, and for anyone,
to believe anything upon insufficient evidence.

—William K. Clifford (1879)

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PREFACE

Human beings have nurtured many conceits about the exalted place of humanity within the scheme of things entire, from the belief that the Earth is the center of the universe or, if not, then at least that the Sun orbits the Earth or, if not, then at least that humans are the rational animals or, if not, then at least that humans were created as the only animals with minds. The pilgrimage from Aristotle to Copernicus to Freud has been a revelation, where the cosmic insignificance of the human species has been further magnified by the relative unimportance of our solar system as a tiny feature of the Milky Way, which is merely one of billions of galaxies made up of billions of stars.

The progressive displacement of the species from its central position at the center of the universe, at the center of the solar system, or even as distinctively rational animals has been brought about by developments within science, especially advances in psychology as well as in physics and astronomy. Anyone today who proclaimed that the Earth is the center of the universe, that the Sun revolves around the Earth, or that humans are invariably rational would be widely regarded as displaying ignorance of the classic discoveries associated with the names of Kepler, of Newton, and of Freud. Yet a tendency remains to assume that humans are still the only animals with minds.

This book provides a systematic exploration of alternative theoretical hypotheses and recent empirical evidence with the objective of demonstrating that this conceit also should be relegated to the dustbin of intellectual history. The principal difficulties that have confronted investigations of animal mentality have revolved around the development of an adequate conception of mentality, on the one hand, and the emergence of a suitable methodology for investigating mental phenomena, on the other. Antiquated Cartesian conceptions of consciousness as the objective and introspection as the method have severely constrained scientific studies of animal mind.

The presuppositions that have affected inquiries within this domain have been distinctively philosophical, including, for example, that knowledge must be certain, while consciousness remains private—at least, for anyone other than oneself! The privacy of consciousness may preclude others from direct access to mental states, but it does not preclude indirect access: we typically draw inferences about others on the basis of observations of their speech and other behavior. And the absence of certain knowledge is compatible with the presence of uncertain knowledge: scientific knowledge is typically inductive and uncertain. Sciences of the mind are possible.

Indeed, a hardy band of students of animal behavior have made contributions to this enterprise that deserve candid acknowledgment and further exploration. These scholars include pioneers in the application of scientific approaches to the study of social behavior among human beings as well as other species, such as E. O. Wilson and Charles Lumsden, who first introduced (what is known as) "sociobiology" and its successor, "gene-culture co-evolutionary theory", but also those who are extending scientific techniques to the study of animal mind, Donald Griffin, Dian Fossey, Carolyn Ristau, Marian Stamp Dawkins, and Sue Savage-Rumbaugh, among others.

This book has the objective of discussing and advancing the scientific study of animal mind through the systematic elaboration of a philosophical framework that clarifies and unifies (what appears to be) a conception of the mind that applies to human beings, other animals, and even machines, if such a thing is possible. It is indispensable to such a conception that it should not "beg the question" by taking for granted that mentality is the exclusive property of a special group, even when that group is identified with humanity itself. The conception of minds as "semiotic systems" appears to possess precisely the properties that this framework requires.

The range of issues involved here has broad compass, including the character of evolution as a complex causal process, the alternatives posed by creationism and its variations, creation science and intelligent design, and the implications of evolution, properly understood, for religion and especially for morality. The arguments presented here demonstrate that tensions between religion and science arise as the result of specific attitudes toward religion, especially as manifest by fundamentalists and evangelical Christians, for whom the Bible is the literal word of God. Relative to an approach of that kind, conflicts between evolution and religion are inescapable. But broader visions, including those displayed by the Catholic Church, provide a more tolerant attitude within which non-literal interpretations are compatible with science.

This study thus elaborates upon the philosophical foundations of evolution, cognition, and morality, within the framework of an analysis of the relationship between science and religion. To appraise the theoretical potential of the conception of minds as semiotic systems, which is at the core of this approach, it is indispensable to undertake an examination of the empirical phenomena illuminated by its adoption. This includes research by students of animal behavior (as "ethology") who have been willing to embrace its cognitive dimensions (as "cognitive ethology"), such as Griffin's studies of animal awareness, Ristau's studies of the piping plover, Dawkin's studies of animal cognition, Fossey's studies of the great apes, and Savage-Rumbaugh's studies of the mentality of chimpanzees. Their work reflects the phenomena science must explain.

The obstacles to progress within this domain, alas, have emerged, not from the work of scientists, but from the efforts of philosophers, such as Noam Chomsky and his conception of innate syntax, Jerry Fodor and his hypothesis of a mental language, and Stephen Pinker and his defense of the language instinct. Their publications have exerted an influence that appears to be grossly disproportional to the theoretical and empirical merits of their positions. Indeed, if the conception of minds that receives elaboration here is right, then their work is wrong—not simply in its details, which would be unsurprising, but to its core. Their work is fundamentally misconceived.

Some of their arguments even appear to trade upon equivocations. During a recent exchange, for example, Chomsky has insisted that he does not acknowledge even the idea of "innate syntax" but advocates the notion of "universal grammar" instead (Chomsky 2007, Fetzer 2007b). Universal grammar, on this view, supplies the resources that underlie the syntax of each specific language, such as German, French, and so forth. If universal grammar were not common to every member of the species, however, it would not be "universal", and if it did not have structure, it would not qualify as a "grammar". Which means that it has to be "innate".

Indeed, specific languages, L1, L2, and so on, are commonly defined by means of the combination of a grammar G and a vocabulary V, where Ln = <Gn, Vn>, where language Ln is defined by the ordered couple, grammar Gn and vocabulary Vn. Which suggests that the term "grammar" is more appropriate to refer to the syntactical structure of specific languages and "syntax" more appropriate to refer to the underlying resource they are supposed to share in common, as an "innate syntax". When Chomsky denies the notion of innate syntax while embracing the notion of universal grammar, his contention appears to be either trivial or false.

Were the differences between Chomsky's views and the position elaborated here no deeper than this, however, there would be very little latitude for making an advance of the kind that the semiotic approach promises. Indeed, as Part II establishes, in understanding the nature of language, mentality, and cognition, pragmatical phenomena take precedence over semantical phenomena, just as semantical take precedence over syntactical. If, as Thomas Schoenemann and William Wong (Schoenemann and Wong 1992, Schoenemann 1999), have argued, syntax (or grammar) is an emergent property that arises as a pragmatic effect of semantic complexity—a position that this study confirms—the relative centrality of syntax to semantics and pragmatics requires reconsideration, where pragmatics takes precedence over semantics and semantics over syntax. Relative to the theory advocated here, the work of Chomsky, Fodor, and Pinker is fundamentally flawed.

Thus, if the arguments I have offered are well-founded, then they are part of the problem, not the solution. And their work is only the tip of the intellectual iceberg. The entire field of cognitive science, which they have strongly influenced, has become infatuated with the computational conception of the mind, according to which minds operate on the basis of the same (or similar) principles as digital machines. One of the most memorable characterizations of this conception would have us believe that thinking is reasoning, that reasoning is reckoning, that reckoning is computing, and that the boundaries of computation define the boundaries of thought. That is wrong.

Now and then, they show intriguing signs of discomfort with their own positions. When Fodor attacks Pinker for offering an exaggerated account of the extent to which language qualifies as "an instinct" and the force of what evolutionary psychology tell us about "how the mind works" (Fodor 2001), we are witnessing proof that a thinker's later thoughts can be more adequate than their earlier ones. But without embracing wholesale rejection of the computational conception of mind, Fodor cannot bring himself to accept the "better theory of mind" he anticipates to come. That theory, I submit, is elaborated and defended in detail in this book. A better theory is at hand.

Understanding the nature of mind requires understanding thought processes, not computational procedures. To understand the nature of animal mind, it is necessary to understand the nature of human minds. If the computational conception cannot be sustained, then its extension to animal mind—as Daniel Dennett, for example, has pursued it—cannot be sustained. But exposing the misconceptions that underlie so much of contemporary cognitive science—to the extent that at least one scholar has even <u>defined</u> the field as the study of computational models of the mind! —requires serious consideration of the elements implicit in that conception. If people are not computers and minds are not machines, then those contentions warrant refutation.

Thus, if minds are to bodies as programs are to machines, then the processes or procedures that relate minds to bodies must be similar to (or the same as) those that relate programs to machines. Programs turn out to be causal implementations of algorithms as "effective decision procedures", which are solutions to problems that are always applicable, always reliable, and always correct. They yield appropriate solutions to problems within a specific class that are always right and they do that within a finite number of steps. If the analogy is well-founded, then human thought must be governed by mental algorithms that serve the same (or a similar) function.

While the nature of computational systems has received considerable investigation, however, the nature of thinking things, even human beings, has not. It turns out that some of the most basic kinds of thought processes, including dreams and daydreams, perception, and memory—as well as ordinary thinking—do not satisfy the conditions for qualifying as "effective decision procedures". Even if there are modes of thought, such as the evaluation of proofs in logic, say, that do properly qualify as algorithmic, the computational conception no longer remains defensible. The analogy between human beings and digital machines has been misconceived.

This misconception has also been imported into the study of (what is known as) "evolutionary psychology" in the work of Leda Cosmides and John Tooby, among others. This has an ironic aspect, since digital machines are cultural artifacts that are subject to artificial selection rather than members of species that are subject to natural selection. Their appeals to "Darwinian algorithms" not only suffer from defects inherent in the computational conception, which they embrace, but also in mistakes in their arguments for their own position (Davies, Fetzer and Foster 1995).

This domain is better understood as devoted to the study of the influence of evolution upon psychology than as pursuing the study of the emergence of algorithms.

Indeed, although Cosmides and Tooby advance the notion of Darwinian algorithms as an improvement upon the counterpart conception of "epigenetic rules" that Lumsden and Wilson have proposed, there are excellent reasons to suppose that their earlier conception is also the more justifiable. It does not assume that mental processes are invariably algorithmic, which makes it a more encompassing conception. When "semiotic" epigenetic rules are distinguished within the general class of "epigenetic rules", it clarifies the nature of mentality. And it permits the evolution of mentality as a concomitant effect of the evolution of epigenetic rules.

Indeed, it may be worth accenting that the dominant paradigm underlying the efforts of Chomsky, Fodor, Pinker, Dennett, Cosmides and Tooby, including, of course, the computational conception of language and mentality, appear to be rooted in a form of absorption with formal systems. Without any doubt, the development of formal systems as a framework for the study of many diverse types of structures has made an enormous difference affecting the course of 20th Century studies of philosophy, linguistics, and cognition. That does not mean, however, that those studies have therefore been well-founded. If the approach pursued here is correct, then the 21st Century should benefit from a paradigm change contributing to the elaboration of more adequate conceptions.

One of the most important scientific hypotheses advanced in the pages of this book is the proposal that the general intelligence factor "g" discussed by Arthur Jensen, among others, should be identified with epigenetic rules that involve the use of signs. While Lumsden and Wilson introduced their notions of "selectivity" and "penetrance" as properties of predispositions to acquire and to utilize one or another disposition within a certain range, an additional measure of "ease of learnability" appears to be required. Semiotic epigenetic rules then have three dimensions: the range of dispositions organisms could acquire, under suitable conditions (selectivity); the ease with which those dispositions would be acquired (rapidity); and the strength of the acquired dispositions to manifest themselves (penetrance).

Ultimately, distinctions must be drawn between "intelligence" and "mentality", because, although "intelligence" can be envisioned as a special kind of mentality associated with cognitive versatility and behavioral plasticity, it can also be employed to describe inanimate machines that display behavioral plasticity, not because of their cognitive versatility, but because of their capacity to "learn" or to "acquire" a wide range of different forms of behavior, which are consequences of their susceptibility to programming. When properly understood, therefore, it is perfectly appropriate to describe systems of this kind as "intelligent machines".

No doubt, the most controversial dimension of the evolution of intelligence addressed here is the controversial contention—which, with important qualifications, I endorse—that cognitive abilities of human races have evolved in ways that differentiate them. In exploring this possibility, I have discussed work by Richard Herrnstein and Charles Murray as well as by J. Phillipe Rushton, who has summarized hundreds of studies that appear to support this conclusion. Though other scholars, such as Stephen Jay Gould, denounce their findings, so far as I am able to discern, they appear to have a firm foundation in these empirical studies.

While this aspect of my discussion may be discounted as politically incorrect, the subject is not political but scientific. Two questions demand differentiation, because the answer to one does not determine the answer to the other, namely:

(Q1) What cognitive differences, if any, may distinguish the races?; and,

(Q2) If such differences exist, what attitude should we adopt toward them?

The first is an empirical and scientific question, while the second is a moral and political question. Open and democratic societies should adopt public policies that benefit all of their citizens. But, absent such knowledge, which are those?

The range of alternatives extends from the pessimistic conception Herrnstein and Murray explore ("the custodial state") to the optimistic alternatives others have described (more enlightened options) that are discussed in Chapter 13 of this inquiry. There always remains the prospect that new hypotheses and new evidence may transform our understanding of the cognitive versatility not only of specific races but of the human species, as Richard Rothstein (2000) remarks. Indeed, recent research on the human genome has led some students of race to conclude that there is no genetic basis for distinctions between different races.

As Natalie Angier (2000) has reported, the demise of a genetic basis for race has been endorsed by J. Craig Venter, the head of Celera Genomics Corporation, who remarks, "Race is a social concept, not a scientific one", where those traits often used to distinguish the races—such as skin and eye color, or the width of the nose—appear to be controlled by a relatively small number of genes. In a similar vein, Harold P. Freeman of North General Hospital in Manhattan, asserts, "If you ask what percentage of your genes is reflected in your external appearance, the basis by which we talk about race, the answer seems to be in the range of .01 percent", which is a very small percentage of a person's genetic make-up.

But the existence of polygenic and of pleiotropic effects, where many genes interact to bring about specific traits, on the one hand, or where single genes are responsible for many traits, on the other, hints that obituaries for race as a scientific category are probably premature. Human beings and chimpanzees share approximately 98% of their chromosomes. That does not imply that significant differences between us do not exist. On the contrary, it indicates the importance that 2% genetic difference. Genetic differences between the races of .01% or less may prove to be as important as they are subtle and complex.

Moreover, other studies substantiate the "out of Africa" hypothesis of the origins of Homo sapiens. Additional investigations of mitochondiral DNA substantiate the thesis that our species originated in Africa and dispersed across the continent to Europe and to Asia perhaps as recently as 50,000 years ago (Donn 2000, Wade 2000). This work, based upon larger samples, reinforces earlier research that provided the foundation for concluding that the species had emerged from Africa less than 200,000 years ago, as this book explains. Traits that affect intelligence may be among those that were selected during the history of the species, even across an evolutionary past of 50,000 years.

The study of human differences is an important area of scientific inquiry, but we must be as tolerant of group differences as we are of individual differences. We cannot begin to understand the evolution of intelligence unless we possess a suitable conception of the nature of the mind and its origins in other species. While the computational conception has been shown to be mistaken, the conception of minds as semiotic systems appears to fare much better. Its broad scope and explanatory power are displayed relative to human beings and other animals as well as inanimate machines. And understanding the evolution of intelligence places us in a better position to appreciate where humans stand in the natural scheme of things and better able to promote our survival as a species.

It also provides an indispensable foundation for understanding the nature of rationality. Once we understand the nature of rationality, we begin to appreciate that, as a transient property humans can be without and still remain members of the species, its emergence tends to depend upon the presence of conditions that are fortuitous, such as having reasonable and open-minded parents, benefiting from a broad education that develops critical thinking, and acquiring the strength of mind necessary to preserve independence of thought in a world increasingly dominated by the manipulation of information for political purposes. One of the most important reasons for studying the evolution of intelligence thus turns out to be that it can contribute to the exercise of our own rationality by providing us with a better-grounded understanding of our place as humans in a troubled world.

The study of ethics, moreover, raises further important questions about relations between religion, evolution, and morality. The positions advanced in the pages of this book contend that religion alone cannot justify morality, but that morality transcends the boundaries of evolution as well. Neither religious-based morality nor evolutionary ethics are theoretically defensible conceptions, where the autonomy of morality offers a perspective from which the respective contributions of religion and of science may be more adequately understood and potentially reconciled. The study of science and its ramifications for public policies, however, suggests that commitments to theology that lie beyond any prospect of empirical testability should not be permitted to take precedence over scientific findings in relation to the determination of public policies.

Ultimately, however, relations between ideas must also be reconciled with behavior between people. As Bertrand Russell observed long ago, more human beings have been slaughtered in the name of religion than have died from all other deliberate causes. If we are to attain forms of organization that approximate something that might qualify as "the moral society", then we are going to have to practice forms of mutual respect and toleration for human diversity that have not been widely embraced in recent times. The moral society, which combines majority rule with minority rights, fulfills its destiny by embracing and defending freedom of religion and freedom of speech. Yet there is a very important—even crucial—difference between them that should not be misunderstood.

Authors as diverse as Richard Dawkins (2006) and Christopher Hitchens (2007) have raised important questions about the role of religion in society, on the one hand, and its relationship to science, on the other. And they have a point. The defense of freedom of religion can support and sustain religion as a veil for cruelty, irrationality, and ignorance, while the defense of freedom of speech should encourage recipients of religious communications to appraise them critically, to strip those veils away, and to remove religion as a barrier to understanding empirical evidence and scientific reasoning. Ultimately, the ethics of belief—which William K. Clifford proposed in 1879—has the potential to clarify where the line should be drawn between personal belief and public policy. The role of religion in society raises troubling and difficult questions, not only about science but about morality and politics as well. Disentangling them may not be easy, but the goal is worthy. Our potential for doing the right thing depends upon it.

James H. Fetzer

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My interest in these problems is one of long-standing. In my discussion of gene-culture co-evolutionary theory, I have drawn from "Science and Sociobiology", J. Fetzer, ed., Sociobiology and Epistemology (1985), pp. 217-246; of the nature of morality, I have drawn from "Ethics and Evolution", in James Hurd, ed., Investigating the Biological Foundations of Human Morality (Lewiston, NY: The Edwin Mellen Press, 1996), pp. 223-242; of the nature of society, I have drawn from "Group Selection and the Evolution of Culture", in Vincent Falger et al., eds., Sociobiology and Politics (Stamford, CT: JAI Press, 1998), pp. 3-15.

In my discussion of the nature of mentality, I have drawn from "People are Not Computers: (Most) Thought Processes are Not Computational Procedures", Journal of Experimental and Theoretical AI (October/December 1998), pp. 371-391. In my discussion of the nature of primate mind, I have also drawn upon Appendix E, "Gorilla Vocalization", in Dian Fossey, Gorillas in the Mist (Boston, MA: Houghton Mifflin, 1983), by permission of the Houghton Mifflin Company. Most importantly, I have integrated my previous research from The Evolution of Intelligence: Are Humans the Only Animals with Minds? (Chicago, IL: Open Court, 2005) and Render Unto Darwin: Philosophical Aspects of the Christian Right's Crusade against Science (Chicago, IL: Open Court, 2007) by permission.

J. H. F.

PROLOGUE

In the beginning God created the heaven and the earth.
— Genesis 1:1

If God created the heaven and the earth, then it might be a mistake to try to understand the world and its origin exclusively on the basis of science, because complete understanding would require knowledge of an act of creation by God. Among the first lessons of a scientific education, however, is that no one can subject an hypothesis to appropriate tests without understanding what it means—if not exactly in every detail, then at least vaguely and in general. The hypothesis that God created the heaven and the earth appears to be sufficiently intelligible in relation to the heavens above us and the earth beneath our feet, but what of God? What should we understand to be the meaning of the hypothesis that, in the beginning, God created the heaven and the earth? What does "God" mean?

As most of us are aware, there are many alternative conceptions, ranging from pantheism and deism to polytheism and monotheism. Pantheists, for example, identify God with the world, where God and the world are one and the same. This approach has the advantage over many others that evidence of the existence of the world counts as evidence of the existence of God, since there is no difference between them. Evidence for the existence of stars above and ground below, accordingly, qualifies as evidence for the existence of God. But pantheism also has the disadvantage that appealing to God to explain the existence of the world becomes pointless, because that "explains" the world's existence by positing the existence of the world, which is what we want to explain.

The prevalent conception among students of theology, no doubt, must be that of an omniscient, omnipotent, and completely benevolent divine being, whose existence presumably would warrant worship and reverence. Among the most serious difficulties confronting this appealing conception, however, is known as the problem of evil, which arises because of the presence of so many bad things in the world, such as disease, pestilence, and famine. Thus, if an omniscient God knows everything and an omnipotent God can do anything, then why should there be evil in the world? The apparent conclusion is that either God is not completely benevolent or else God is not both omniscient and omnipotent, which raises a critical problem for traditional accounts.

Some religions, such as Confucianism, emphasize moral principles and right conduct, while others, such as Taoism and Buddhism, place emphasis upon contemplation or focus upon the cessation of desire, respectively. Many religions, such as Mohammedanism and Hinduism, embrace combinations of monotheism and social practices, such as prayer, fasting, alms-giving and pilgrimages, in the first instance, and a rigid system of social castes, in the second. Mohammedanism promises Paradise for the faithful and Hell for infidels, while Hinduism accepts the existence of Brahma, the primal cause and pervading spirit of the universe. Judaism and Christianity embrace the existence of a divine being who created the world and sometimes intervenes in human affairs. So if, in the beginning, God created heaven and earth, then there are numerous candidates for the role.

1. Was there a Beginning?

Actually, there did not have to be a beginning. Some things have no beginning. Consider the series of negative integers that ends with the number zero:

. . . -4, -3, -2, -1, 0.

This is a sequence that has no first member and thus has no beginning. And some things have no end. Consider the series of positive integers that begins with the number zero in a sequence generated by adding one to each member:

0, 1, 2, 3, 4, ...

This is a sequence that has no last member and thus has no end. Indeed, some things have neither a beginning nor an end. Consider the series of positive and negative integers when they are joined by using zero as a point of intersection:

. . . -3, -2, -1, 0, 1, 2, 3, . . .

This sequence is a series of integers that has no first member and no last. But if some things have no beginning and no end, it must be possible for things to exist without having a beginning and even without having an end. So perhaps the world that consists of heaven and earth had no beginning and has no end.

The objection could be lodged that numbers and worlds are different kinds of things, like apples and oranges, which might be similar in some respects but nonetheless differ. Numbers, for example, are abstract things that are not even in space and time, unlike the numerals we use to name or describe them. This becomes obvious in the case of numbers such as pi and the square root of -1. Pi, for example, as the ratio of the circumference of a circle to its diameter, has an infinite (non-terminating and non-repeating) decimal numerical representation beginning with the sequence, 3.14159265....... Having no last digit, the complete decimal expansion for pi cannot even be written down in space and time.

Numbers can be named or described in many different systems of notation, Arabic (0, 1, 2, 3, . . .) and Roman (I, II, III, . . .) being only the most familiar. The number named by the Arabic numeral "2" and by the Roman numeral "II" is the same number, which—in other contexts—might likewise be indicated by raising two fingers of your right hand, as in the case of umpires calling strikes. Perhaps numerals, like fingers and hands, as physical things in space and time, had to have a beginning and have to have an end. Since they are things in the world, perhaps the world considered as a totality in space and time—as everything physical there is, was or will be (present, past or future)—is like them in this respect and therefore had to have a beginning and also has to have an end.

The matter matters to non-scientists and scientists alike, because if heaven and earth had no beginning and have no end, there might be no role for God to play in creating them and alternatively no "first moment" for science to explain. Just because certain abstract entities such as some sequences of numbers have no beginning and no end, after all, does not show that physical entities such as heaven and earth might have no beginning and no end. If such a conclusion is true, then it would have to follow on other grounds, if it follows at all. Indeed, scientists have diverged in their opinions about this matter, where among the best known theories of the origins of the universe in the past have been the "steady state" model proposed by Fred Hoyle (1950) and the "big bang" model advanced by George Gamow (1954). For the purpose of consideration within this context, only a few of their more general features require attention here.

2. Two Models of the Universe.

Thus, according to the big bang model, the world had a beginning in time initiated by a primordial explosion that occurred when all of its mass and all of its energy was condensed into a virtually infinitesimal point at enormously high temperature. The immense force of this explosion was sufficiently great to overcome the force of gravity that draws together everything having mass, while conditions that are sufficient for the formation of hydrogen, helium, and other elements were realized—even during the first three minutes! According to the steady state model, by comparison, the world had no beginning in time but persists today in a steady state of creation that depends on the continuous production of hydrogen and other elements condensing into stars and galaxies, which occurs at roughly the same rate that stars and galaxies are extinguished.

Upon initial consideration, therefore, it may appear as though a steady state model imposes no beginning in time upon the universe, while big bang models do. What actually had to have a beginning in time on the big bang model, however, may be better envisioned as single cycles in an endless sequence of cycles and recycles. The expansion of matter and energy precipitated by the big bang may, theoretically, at least, reach a point at which the weakest of the four forces —the strong and weak nuclear forces, the electromagnetic force, and gravitational attraction—becomes strong enough to reverse direction from one of expansion to one of contraction. The big bang might be followed by an expansion followed by a contraction and a big crunch, after which another sequence can begin again.

Indeed, John Wheeler (1977) has suggested that this "reprocessing model" of cosmology might be probabilistic rather than deterministic. If every law which governs physical processes happens to be <u>deterministic</u>, then if the complete set of initial conditions remains constant across every reconstitution of the universe from one cycle to another, then the sequence of successive states of the universe should remain exactly the same from one cycle to another. If even one law that governs these processes happens to be <u>probabilistic</u>, however, then the sequence of successive states of the universe need not remain exactly the same from one cycle to another, where the universe could attain one maximum volume and endure for one temporal interval during one cycle, but have another volume and duration in another cycle, and so forth—even under the same initial conditions!

More recent studies of the "big bang" model have been presented by Steven Weinberg (1977/88) and by Stephen Hawking (1988), who have also addressed themselves to the emergence of ultimate theories that would bring together the four forces within a single unified account (Ferguson 1991 and Weinberg 1992). Big bang models confront problems that continue to be explored today, such as whether there is enough mass in the universe to permit gravitational recycling (Wilford 1996a) and whether the universe might not peter out in a big whimper, after all (Wilford 1997). But even those who want to insist that the world had a beginning in time are apparently compelled to admit that—with qualifications of the kinds that I have acknowledged—the world might have had no beginning and might have no end seems to be not only an abstract but also a physical possibility.

3. Do Biology and Physics Conflict?

The steady state and the big bang models are far from the only theories that have been advanced to account for the origin of the universe from either historical (Munitz 1957) or contemporary perspective (Lerner 1992). Eric J. Lerner, for example, suggests that big bang advocates are embracing a medieval conception according to which the universe was created from nothing and attained its greatests degree of perfection at—or even prior to—the moment of creation. He maintains that there tends to be a striking correspondence between views dominant in cosmology and those dominant in society, where big bang models appear to be harmonious with doctrines of Christian theology. He even cites Pope Pius II, who relates the dissipation of energy during the history of the universe through increasing entropy to God's existence and a last judgment (Lerner 1992, p. 392).

While Lerner reports that some theologians view the existence of a finite universe—a universe with a definite beginning and a limited duration in time—as evidence of the subordination of the universe to God, our discussion of the big bang model indicates that the conclusion that the universe was created from nothing, ex nihilo, only arises if we reject the possibility that the universe may have had no beginning and no end. Indeed, if the history of the universe is one of eternal recycling, perhaps the universe is not subordinate to God, after all. If all the laws of the universe are deterministic and the initial conditions remain the same from one cycle to another, it might make more sense to view the end of every cycle as merely a stage in the eternal recurrence than as the occasion for final judgment.

The notion that the universe attained its greatest perfection at—or even prior to—the moment of creation appears to be motivated by considerations revolving about entropy, which derive from the second law of thermodynamics. As Paul Davies has observed, in its widest sense, this law maintains that the universe as a whole becomes increasingly disordered, because the distribution of matter and energy tends away from states of greater heterogeneity toward states of greater homogeneity (Davies 1983, p. 10). If the second law of thermodynamics were a deterministic law having no exceptions and if "perfection" were properly defined as a state of minimum entropy, then perhaps the universe does attain its greatest state of perfection prior to the moment of creation, understood as the moment at which the big bang occurred. But such a view would be rather difficult to defend.

The second law of thermodynamics has both a narrow and a broad interpretation. In its narrow sense, it applies exclusively to systems that are closed, which means that no interaction with other systems takes place. Even under this interpretation, however, constancy in entropy is permissible with reversible systems (Feynman 1963, p. 44-12). Steady state and big bang recycling models are both compatible with the second law. In its broad sense, it assumes the standing of a statistical generalization depicting the average behavior of collections of systems (Rogers 1960, p. 395). To the extent to which the creation of forms of life from non-life and new forms of life from old forms of life reflect decreasing entropy by systems that are open, biological evolution on a local scale is still compatible with entropy increases on a global scale. Evolution and entropy needn't conflict.

It would be a remarkable circumstance, of course, if the laws of biology could be true only if the laws of physics were false. Indeed, it does not even seem obvious that science and religion necessarily stand in conflict. As Michael Shermer has observed, conflicts with religion depend on rather specific beliefs, which are by no means universally shared (Shermer 2000, Chapter 6). Pope John Paul II, for example, has placed the authority of the Roman Catholic Church behind evolutionary theory with his decree that the Church supports the view that the human body may have been the product of a gradual process of evolution (Taliabue 1996, Applebome 1996). The human soul remains the province of God. Perhaps this should come as no surprise; after all, if God <u>is</u> omniscient and omnipotent, He could have utilized any method He preferred to create living things. Thus, if the the laws of physics are incompatible with the laws of biology or if religion must conflict with science, we need to discover why. The reasons are not yet evident.

CHAPTER 1: WHY NOT CREATIONISM?

Contemporary tension between science and religion has emerged in recent times in the form of an ongoing debate between evolution and creationism as presumably incompatible conceptions of the cosmos. This has emanated not from the Roman Catholic Church but from Christian fundamentalism instead. When "creationism" is understood as the view that God created the world and everything therein, it is not necessarily incompatible with science. God, after all, may have chosen to create a world governed by laws of nature, including evolutionary processes. When "creationism" is defined as the view that God created the world and every living thing therein in the form of species whose properties were thereby fixed and cannot change through time, however, then creationism and evolution are incompatible because they cannot both be true.

There are important differences between distinct species of creationism. In his book, The Creationists (Numbers 1992), ironically subtitled "The Evol-ution of Creationism", for example, Ronald L. Numbers distinguishes between three major movements: "age-day theory", which interprets the "seven days" described by the Biblical Book of Genesis as seven epochs of long duration; "the gap theory", which introduces a lengthy temporal separation between the cre-ation of the world and a much later, seven-day creation of human beings; and "creation science" as a more-or-less contemporary phenomenon, which insists that Earth is less than ten thousand years of age, that genetic variations are lim-ited and that Earth has undergone a world-wide flood (Numbers 1992, pp. x-xi).

Perhaps the most intriguing aspect of the creation science movement is that its advocates are promoting the view that creation science is science and there-fore ought to be taught along with evolution as part of the science curriculum in our public schools (Schmidt 1996). The conclusion that creationism as defined is incompatible with evolution, however, shows neither that creationism is not science nor that it should not be taught as part of the public-school curriculum. Possibly creation science and evolution are merely two scientific alternatives equally deserving of inclusion in the science curriculum. In order to establish that creationism is not science—if that, indeed, turns out to be the case—therefore, it is necessary not only to define "creationism" but also to define "science" and then demonstrate that science, thereby defined, excludes creation science.

If "creationism" or "science" were inadequately represented by the concepts employed for this purpose, of course, it would be appropriate to object that the conclusion that creation science is not science has not be shown to be the case. Moreover, even if creation science were thereby shown to be non-science, that would not show that creationism is non-sense nor would it show that evolution is science. That would require additional argument. The procedure that I shall adopt within this context, therefore, will be to begin with the nature of laws of nature, then consider three conceptions of science, and only then appraise the scientific standing of three classic creationist hypotheses. This should provide a suitable background for assessing evolution and creation science in Chapter 2. Along the way we'll discover the inherent uncertainty of scientific knowledge.

1. What are Natural Laws?

The proper relationship between the history of science and the philosophy of science comes to this: that the aim of science can only be ascertained by investigating the history of science, while the methods of science are properly established on the basis of philosophical reflections (Fetzer 1981, 1993). The difference thus displayed is one between "means" and "ends"; for although traditional ends of inquiry can be established historically, the most appropriate means for their attainment need not be the same as those we happen to employ. There are no built-in guarantees that the methods employed by many or by most or by all of those who call themselves members of the scientific community are necessarily the most effective, the most efficient or the most reliable to achieve a given goal —even when that goal happens to be the very purpose of scientific inquiry itself.

I shall thus assume that an investigation of the history of science—from classic sources such as van der Waerden's Science Awakening and Neugebauer's Exact Sciences in Antiquity on to Kuhn's Copernican Revolution and Holton's Thematic Origins of Scientific Thought—would establish that science does have its own distinctive objective, namely: the discovery of general principles by means of which the phenomena of experience may be subjected to explanation and to prediction, systematically, where these "general principles" in turn possess the form of scientific theories and of natural laws. Indeed, scientific theories are suitably viewed as sets of laws and definitions that apply to a common domain, thereby permitting the concise depiction of science as aiming at the discovery of natural laws.

Any other activity could be perfectly worthwhile, but it could not be science. Accepting the aim of science to be the discovery of natural laws does not determine which methods are most efficient, effective, or reliable for such a purpose, but it would be widely agreed that the application of those methods presupposes the availability of experiential findings in the form of a (perhaps quite large) set of singular sentences e describing the contents of experience in the form of observations, measurements, or experiments. Thus, given a specific set of alternative hypotheses or theories h1, h2, . . . , hn, the philosophical problem becomes that of identifying and justifying principles of inference that would establish which among the alternatives h1, h2, . . . , hn receives the strongest evidential support from the evidence e, whether or not that evidence would qualify as "conclusive".

Indeed, it would be generally conceded that scientific reasoning is characteristically "inconclusive", in the sense that the truth of the evidence e does not, as a rule, guarantee the truth of one or more alternative hypotheses h1 to hn. The reasons are many and varied, ranging from practical limitations that stem from the current availability of technical apparatus, such as electron microscopes and radio telescopes, qualified personnel and suitable funding to inherent limitations arising because the content of any conclusion reached, say, hi, characteristically goes beyond the content of the available evidence, e. This occurs whenever we draw conclusions about populations on the basis of samples, whenever we make inferences about the future on the basis of our experience in the past and whenever we derive conclusions about non-observables on the basis of observations.

The ultimate source of this tension, however, is the nature of laws of nature. Most theoreticians would agree that laws involve relations between properties, although some would hold out for classes instead. Classes differ from properties insofar as classes are said to be the same when their members are the same, a principle that does not hold true of properties. As W. V. O. Quine has observed,

> . . . classes are the same when their members are the same, whereas it is not universally conceded that properties are the same when possessed by the same objects........But classes may be thought of as properties if the latter notion is so qualified that properties become identical when their instances are identical. (Quine 1951, p. 120)

Since classes are the same when their members are the same, they are said to be "completely extensional" entities. It is essential to observe, moreover, that no specific conditions need to be satisfied by the members of a class other than that they be collected together or are jointly grouped as members of that class. Properties that come together in nature, by contrast, are called “natural kinds”.

An old comb, the square root of -1, and the current President of the United States, for example, could be taken to be the members of a class, even though they might share no—or virtually no—conditions, characteristics, or properties in common, apart from the trivial property of being grouped together as members of this specific class. Some of them do not even qualify as physical things. Quine's phrasing here is exceptionally important within the present context. He says that <u>two classes</u> are the same if they have the same members, but that <u>two properties</u> are the same when they have the same members <u>as long as</u> we take it to be the case that properties are the same when their instances are the same.

He is saying properties can be treated <u>as if</u> they were classes by assumption. Those who make this assumption are "nominalists", those who deny it "realists". Notice, for example, that, on nominalist principles, there can be no difference between properties—however counterintuitive it may appear—when they have the same instances. Thus, since there are no unicorns, vampires, or werewolves, the terms "unicorn", "vampire", and "werewolf" have the same extension, namely, nothing, or, as it is known in logical theory, the empty class (or the "null" class). It follows on nominalist principles that the properties of being a unicorn, of being a vampire, and of being a werewolf are one and the same property. This is quite an extraordinary result, because normally we would never have confused them.

Not only are unicorns, vampires, and werewolves the same kind of thing, on nominalist principles, given that properties with the same instances have to be identical, but they are also the same kind of thing as numbers that are both odd and even, circles with four sides, and other impossibilia. If the objection arises that circles with four sides and other impossibilia are abstract rather than physical entities, moreover, it invites the rebuttal that, if things can in fact be differentiated on the basis of their properties even when their instances are the same, after all, then surely we can differentiate between unicorns, vampires and werewolves—as we ordinarily do—even when they have the same class of instances!

This issue assumes considerable importance because nominalism supports a theory according to which natural laws merely describe correlations between instances of properties (classes) that happen to occur during the course of the world's history, which thus views sentences that describe them as extensional. Realism, by contrast, supports an alternative account according to which there is more to natural laws than mere correlations between instances of properties (classes) that happen to occur during the course of the world's history, which instead views sentences that describe them as intensional (Fetzer 1981, 1993). The problem that realists encounter that nominalists avoid, therefore, is to provide a defensible distinction between correlations that are and are not lawful, while nominalists are compelled to deny there is any distinction to be drawn.

The difference between them can be illustrated in relation to the following columns of property (or class) designators, which might have many instances:

R	A
red	round
wooden	cuckoo-clock
gold	melting point of 1064°C
^{218}polonium	half-life of 3.05 minutes

Table I. Some Properties and Attributes

No doubt, there is some relative frequency with which things-that-are-red are things-that-are-round, with which things-that-are-wooden are things-that-are-cuckoo-clocks, and so forth, as features of the history of the world. Equally clearly, no doubt, only some but not all of these true extensional correlations would ever be seriously supposed to be instances of natural laws.

From an extensional perspective, this circumstance poses a delicate predicament, since the separation of correlation descriptions that are true and laws from those that are true but not seems to presuppose some non-extensional principle of selection, which undermines the integrity of this approach. Some have thus imagined that this difference is either a "question of context" or a "matter of attitude". But their concrete proposals have not been especially reassuring, since attitudinal advocates incline toward the criterion that true extensional correlations are laws when they are regarded as being laws, as if that should explain why those claims are properly regarded as laws; while the contextual advocates recommend the standard that those are laws that can be derived from scientific theories, as if theories were not sets of laws themselves.

In order to preserve an extensional approach, in other words, serious thinkers have felt compelled to appeal to blatantly circular maneuvers or to overtly question-begging strategems. Within an intensional framework, by comparsion, things are not so desperate, for there appear to be ample resources for contending with these differences without resorting to ad hoc principles. Even if 1% of all things-that-are-wood are things-that-are-cuckoo-clocks or 99% of all things-that-are-cuckoo-clocks are things-that-are-wood, those extensional correlations, as true descriptions of the world's history, would not therefore qualify as laws of nature. For there are processes and procedures, such as the production of plastic cuckoo-clocks, of metal cuckoo-clocks, or the passage of legislation prohibiting the use of wood in their construction, by virtue of which, in principle, these correlations could be changed—even if such things never in fact happen!

In the case of gold and of polonium , by contrast, matters are quite different, for there appear to be no processes or procedures, natural or contrived, by means of which the melting point of 1064°C and the half-life of 3.05 minutes could be taken away from things of those kinds—were we ever disposed to try! The intensional conception of natural laws thus displays a sense in which laws of nature are correctly viewed as negative existential propositions, which deny the existence of certain possibilities, not as logical impossibilities but rather as physical impossibilites. For laws hold as intensional relations between a reference property R, let us say, and some attribute property A, where a lawful connection obtains beween those properties just in case there is no process or procedure, natural or contrived, by means of which something possessing R could lose A without also losing R, even though A is not a part of the definition of R, in language L. These are therefore permanent properties (Fetzer 1981, 1993).

Because the possession of A is not part of the definition of R, the possession of A by something that is R is said to be logically contingent. When A is a permanent property of R, therefore, then a corresponding subjunctive conditional (asserting what would be the case, if something were the case, whether or not it is) must be true. As a consequence, the logical form of lawlike sentences—of sentences that are laws if they are true—is that of logically contingent and unrestrictedly general subjunctive conditionals whose truth follows, necessarily, from the truth of these permanent property relations, whether they have any instances or not. Employing the symbol, ". . . ==> ___", as the subjunctive conditional, the logical form of (simple) lawlike sentences takes the following form:

(SL) (x)(t)(Rxt ==> Axt)

which asserts that, if something x were R at time t, then x would also be A at t.

It should be observed, therefore, that the attributes of (merely) extensional correlations are not properties that no members of their reference classes could be without: things-that-are-round might or might not be things-that-are-red, things-that-are-wood might or might not be things-that-are-cuckoo-clocks, and so on. As a result, these properties A are appropriately entertained as transient attributes of the members of their corresponding reference classes R. Moreover, natural laws invariably qualify as distributive rather than as collective generalizations in the sense that they attribute permanent properties A (having a melting point of 1064°C or a half-life of 3.05 minutes) to every thing possessing the reference property R instead of summarizing the relative frequency with which those attributes occur in those populations. Thus, if attribute A is not possessed by every thing that is R, then the corresponding generalization cannot be a law.

That attribute A occurs in constant conjunction with reference property R, of course, thus constitutes a necessary but not sufficient condition for a lawful connection to obtain between them, because A might happen to be a transient property possessed by every member of a reference class R in common (such as would be the case when every cuckoo-clock is made of wood). The distributive character of natural laws stands in sharp contrast with means and modes and medians as the following columns of predicates are meant to exemplify:

R	A
gifted children	130 median I.Q.
white Anglo-Saxons	usually Protestant
BMW's	average $35,000
New College students	mean 600 SATs

Table II. Means, Modes, and Medians.

Even if gifted children (identified by their verbal abilities) happen to have a median I.Q. of 130, that attribute could not possibly be a permanent property of the members of that reference class—unless every gifted child happened to have that same I.Q. in common; even if white Anglo-Saxons usually are Protestants, that attribute could not possibly be a permanent property of the members of that reference class—unless every white Anglo-Saxon happened to be a Protestant; and so on. For permanent properties are properties that no member of a reference class could be without and therefore allow of no exceptions.

The apparent tension between the aims of science and the global features of its methods alluded to above thus emerges clearly from this point of view. For science aims at the discovery of natural laws on the basis of experiential findings and the inferences they sustain, yet there are no obvious "principles of inference" relative to which any logically contingent, unrestrictedly general subjunctive conditionals h attributing permanent properties A to every member of suitably specified reference classes R could be established on the basis of (even quite large) finite sets of logically consistent singular sentences e. (If such a set were not logically consistent, then every conclusion would follow on the basis of elementary deduction; so these sets need to be logically consistent.)

The difficulties involved here are not (merely) those of warranting inferences from finite samples to infinite populations but those of warranting inferences from evidence describing (segments of) the world's actual history to hypotheses concerning the possible histories it could display, under differing initial conditions! For the logical force of natural laws as negative existential propositions not only entails that it is not the case that anything satisfies the corresponding description 'R & ~A' during the world's history (an "ordinary" inference) but also that it is not the case that anything could satisfy those descriptions during any such history, even though such an outcome remains logically possible in relation to the language _L_ (an "extraordinary" inference, indeed!).

Physical properties of objects in the world—from melting points to IQs—are tendencies to display certain outcome responses under suitable conditions, which are amenable to varying degrees of strength. Things that have a melting point of 1064°C, for example, would melt if their temperature were raised to that point, but otherwise would remain solid; things with a boiling point of 3080°C would boil if their temperature were raised up to that point, but otherwise would remain liquid; and so forth. And similarly for shapes, sizes, colors, and other properties, such as half-lifes and IQs. Formalizing these properties requires introducting causal conditionals that are stronger than subjunctives.

Employing the symbol ". . . =_u_=> ____" as a causal conditional of universal strength _u_ permits formal definitions of _A_ attributes by relating relevant test conditions _C1_, _C2_, . . . , _Cn_, and their outcome effects, _E1_, _E2_, . . . , _En_, as follows:

(DF) _Axt_ =df (_C1xt_ =_u_=> _E1xt_*) & . . . & (_Cnxt_ =_u_=> _Enxt_*);

for as many different test conditions and outcome responses as may occur, where _t_* is equal to or later than _t_ by some specific temporal interval delta. In the case of the melting point of 1064°C, therefore, it could be defined by instantiating this definitional scheme with appropriate tests and outcomes, where heating _x_ to a temperature _T_ greater than 1064°C at would invariably (with strength _u_) bring about its melting _M_ at _t_*, for each such manifestation.

Thus, when definitions of their attributes are conjoined with lawlike sentences of simple form, the result is _a set of lawlike sentences of causal forms_:

(CL-1) $(\underline{x})(t)[\underline{Rxt} \Longrightarrow (\underline{C1xt} =\underline{u}\Rightarrow \underline{E1xt}^*)]$; &

. . . . . . &

(CL-n) $(\underline{x})(\underline{t})[\underline{Rxt} \Longrightarrow (\underline{Cnxt} =\underline{u}\Rightarrow \underline{Enxt}^*)]$;

which means that every lawlike sentence of simple form is logically equivalent to a (possibly infinite) set of lawlike sentences of causal form. When being gold AU is the reference property and a melting point of 1064°C is the attribute, for example, then heating x to a temperature T greater than 1064°C at would invariably (with universal strength) u bring about x's melting M at t*, and so forth.

2. What is Science?

These considerations are important ontologically, first, because correlations that do not reflect laws occur when properties are statistically related but are not nomically connected, and, second, because some test conditions and outcome responses are related probabilistically rather than universally. In the case of merely accidental correlations, attributes occur with specific relative frequences in relation to reference properties, but these relations are not nomological. Formally, they reflect mere conjunctions of properties rather than subjunctive connections. And half-lives as properties of radioactive isotopes, for example, have test conditions (such as time trials) that are related to more than one outcome response (decay and non-decay, for example) by means of causal connections of merely probabilistic strength.

They are important epistemically, first, because testing a lawlike hypothesis relating an attribute A to a reference property R generally requires ascertaining when A is present or absent on the basis of its causal manifestations and, second, because attributes A1, A2, . . . that are nomically related to reference properties R1, R2, . . . cannot be separated from them. Conducting empirical tests of lawlike sentences of simple forms, in other words, can only be done on the basis of understanding their causal consequences, which represent (part or all of) their meaning. And establishing that a lawlike relation obtains between specific attributes and specific reference properties can only be done by attempting to violate them. If they are nomically related, it must be physically impossible for those reference properties to occur without those attributes, precisely because those attributes are permanent properties. Accounts of science that fail to incorporate Popper's conception of conjectures and attempted refutations are therefore very unlikely to succeed (Popper 1968).

In order to appreciate the inherent limitations with respect to the certainty of scientific knowledge thereby generated, let us consider three alternative conceptions of "principles of inference" that potentially might serve to "bridge the chasm" between evidence and hypothesis. According to these views, science is a process that proceeds in several stages more or less along the following lines:

INDUCTIVISM	DEDUCTIVISM	ABDUCTIVISM
Observation	Conjecture	Puzzlement
Classification	Derivation	Speculation
Generalization	Experimentation	Adaptation
Prediction	Elimination	Explanation

Table III. Alternative Conceptions of Scientific Procedure.

These are not the only possibilities, of course, since other views, including "The Bayesian Way" with its infinite contours, have vocal advocates, too (Fetzer 1981, 1993); but as non-exhaustive illustrations, perhaps these three will do. Indeed, Inductivism, Deductivism, and Abductivism have all been historically important and philosophically influential theoretical formulations that surely deserve serious consideration as significant alternative conceptions of scientific procedure.

Whether or not approaches of any of these kinds should or should not be taken seriously, furthermore, depends far less upon their specific details than on the sort of "principles of inference" they propose to attain the object of inquiry. From this point of view, therefore, the Inductivist conception of scientific procedure as a pattern of Observation, Classification, Generalization, and Prediction assumes importance only in relation to the basic principle of inference that establishes its foundation; thus, according to one such approach, the aim of science should be pursued by the method known as Enumerative Induction as follows:

(EI) From "m/n observed Rs are As", infer (inductively) "m/n Rs are As",

provided that a large number of Rs have been observed over a wide variety of conditions, where such inferences are subject to revision with the accumulation of additional evidence as the "total evidence" condition requires (Salmon 1967).

If natural laws are subjunctively conditional, while relative frequencies are extensional distributions, however, then methods of this kind afford no criteria for the differentiation of those descriptions that are true-and-laws from those that are true-but-not. Even a wide variety requirement does not help: a large number of cuckoo-clocks have been observed in many different locations and at many different times under quite diverse circumstances, yet the corresponding distribution establishes no law. The pattern of Observation, Classification, and Generalization by this method thus appears incapable of satisfying conditions required for discovering laws. Moreover, its basic principle applies only to properties that are observable, excluding non-observable properties entirely.

The Deductivist conception of scientific procedure promises to do better, albeit in a negative direction, for the pattern of Conjecture, Derivation, Experimentation, and Elimination at least provides for empirical tests of genuinely lawlike claims through the employment of the deductive rule Modus Tollens as follows:

(MT) From "hypothesis h entails e" and "not-e", infer (deductively) "not-h",

provided that rejection is not mistaken for disproof, since the evidence upon which such inferences are based may itself turn out have been at fault, as a function of background assumptions, auxiliary hypotheses, and other sources of potential error. Because natural laws as subjunctive generalizations entail corresponding extensional distributions in the form of constant conjunctions, the discovery of even one R that is not an A is sufficient to sustain the rejection of the corresponding lawlike hypothesis, which is a non-trivial benefit.

Yet so long as explanations are arguments with premises including laws, their assertion as adequate entails their acceptance as true: insofar as laws are necessary for adequate explanations, science cannot succeed without procedures for acceptance as well as principles of rejection. The Deductivist conception nevertheless signals an enormous improvement over the Inductivist counterpart, since it encourages attempts to arrange this world's history such that it should include sets of events of evidential relevance for testing alternative hypotheses and scientific theories. It thus becomes apparent that attaining the aim of science requires recognizing the difference between confirming extensional distributions and testing lawlike claims; for the evidence relevant to lawlike claims consists of repeated attempts to refute them (Popper 1963).

The Abductivist conception thus affords an appropriate complement to the Deductivist conception, at least so long as its stages of Puzzlement, Speculation, Adaptation, and Explanation are entertained within the framework of Inference to the Best Explanation, which may be represented by the following conditions:

(IBE) The alternative h that provides the best explanation for the available evidence e is the preferable hypothesis; and when the available evidence e is sufficient, the preferable hypothesis h is acceptable. Thus, under those conditions, infer (inductively) that h is true.

Thus, the implementation of this standard, which presumes a likelihood measure of evidential support, assumes the specification of a set of alternative hypotheses h1, h2, . . . , hn, and a set of evidence sentences e, where hypotheses that have a higher degree of evidential support in relation to e are preferable to those of a lesser degree of evidential support in relation to e, when e includes all of the available evidence. Then, when the available evidence happens to be sufficient in quantity and quality to support an inference, the hypothesis—or hypotheses—that are preferable are also acceptable, where the addition of new hypotheses or the discovery of new evidence may significantly change the inferential situation.

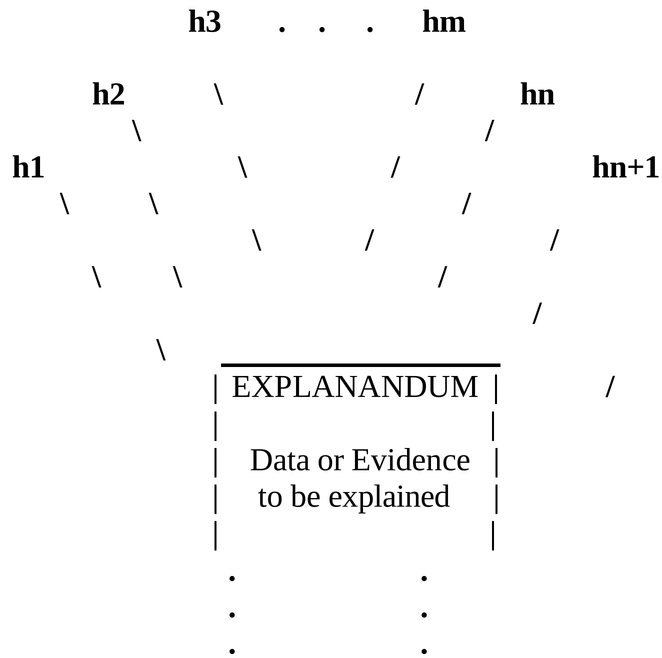

Figure 1. Inference to the Best Explanation.

Hypotheses may be false even when they are acceptable, but they are still the most rational among the set of alternatives (Fetzer and Almeder 1993, p. 1). The likelihood measure of evidential support implements the following concept:

(LM) From "the nomic expectability of *e*, given *h*, equals *r*", infer (deductively)

"the measure of evidential support for *h*, given *e*, equals *r*",

where the *nomic expectability* of evidence *e* equals the logical probability of *e*, given the truth of hypothesis *h*, which must include at least one law essential to establishing the value of *r* and—depending upon its specific application—initial conditions that were present, a matter we shall pursue. Such principles reflect likelihoods because the *likelihood* of hypothesis *h*, given evidence *e*, is equal to the probability of *e* on the asssumption that *h* is true (Fetzer 1981, 1993, 2002b).

The Abductivist conception, of course, is not without its own distinctive difficulties, insofar as every consistent theory entailing an hypothesis *h* satisfying the specified conditions receives a corresponding measure of evidential support from *e*, a problem partially offset by employing explanatory relevance and irrelevance relations as a foundation for determining evidential relevance and irrelevance relations, as we are about to discover. Not the least of the problems that have been left unmentioned, however, is the need for *nature's cooperation* in the pursuit of scientific knowledge of natural laws; for when there are no samples at all, or only small samples, or even large (but skewed) samples, the available evidence may warrant either a faulty inference or no inference at all (Fetzer 1983).

This difficulty becomes acute with respect to probabilistic properties, insofar as any relative frequency within an finite sequence is logically compatible with any probabilistic attribute, even though deviations from generating probabilities become increasingly improbable as the length of such a trial sequence increases without bound. Since an atom of polonium ^{218} has a half-life of 3.05 minutes, its probability of undergoing decay during any 3.05 minute interval equals 1/2; but it may indefinitely remain intact, nevertheless. And although approximately half of the members of a collection of atoms of this kind would be expected to experience decay during a similar temporal interval, that might or might not occur. Thus, even over infinite sequences, it remains not merely logically but physically possible that relative frequencies may deviate from their generating probabilities.

From an epistemic point of view, perhaps the most intriguing consequence consists of the result that a physical world whose composition includes at least some probabilistic properties might be historically indistinguishable from a world whose composition includes *no* probabilistic properties at all—either because there are no appropriate trials, or too few appropriate trials, or enough appropriate trials that, by chance, happen to yield unrepresentative frequencies. It should be emphasized, therefore, that even if a world were *indeterministic* in its character (by instantiating probabilistic as well as non-probabilistic properties), the history of that world might turn out to be indistinguishable from the history of a *deterministic* world insofar as they might both display exactly the same relative frequencies and constant conjunctions, where their differences were concealed "by chance"!

Thus, if some of the world's properties are probabilistic, not only may the same laws generate different world-histories, but the same world-histories may be generated by different laws—under identical initial conditions! Indeed, the most important implication attending these considerations deserves explicit recognition, since even if our available evidence could describe the world's entire history, fundamental aspects of its physical structure, including the deterministic or indeterministic character of its laws, might remain undiscovered, nevertheless. The tension between the aim of science and the global features of its methods is therefore inherent and cannot be overcome: the uncertainty of scientific knowledge is an unavoidable consequence of the nature of natural laws.

3. Is Creationism Science?

As we have found, the debate over whether creationism should be taught in the public-school science curriculum depends upon at least two crucial factors: the nature of creationism and the nature of science. The significance of our exploration of the nature of science may be evaluated by its application to three classic creationist hypotheses, which deserve consideration within this context. Each assumes that God is the creator of the universe and asserts, respectively:

(CH-1) God created the world and everything therein exactly as it is today;

(CH-2) God created the world and everything therein, including life in fixed and unchanging forms; and,

(CH-3) God created the world and everything therein, including all life forms by means of evolution.

Since these classic hypotheses do not exhaust creationist alternatives, especially its contemporary "creation-science" guise, we shall consider the issue further in Chapter 2. When we attempt to appraise their scientific standing on the basis of the three conceptions of science, however, they do not appear to yield the same results. This process therefore serves not only as a test of the scientific standing of these creationist hypotheses but also of the success of our analysis of science.

Consider, for example, the difference between the results of Inductivist and Deductivist appraisals of (CH-2). Inductivism, of course, adopts (EI) as the basic principle of scientific inference, according to which, if m/n observed Rs are As, infer (inductively) m/n Rs are As. The hypothesis that God created the world and everything therein, including life in fixed and unchanging forms, could presumably be inferred by means of this principle if it were possible (a) to observe n living things as instances of R and (b) to ascertain the proportion m/n of them that were created by God in forms that are fixed and unchanging as instances of A. (When every instance of R is an instance of A, of course, then m/n = 1.) The evident problem encountered here is not observing living things but observing which among them were created by God in forms that are fixed and unchanging.

The problem is less that of observing forms of life that are fixed and unchanging than that of observing that God created them. The conclusion that (CH-2) cannot qualify as a scientific hypothesis on Inductivist standards thus appears to be a consequence of the restriction of (EI) exclusively to observable properties. Deductivism, by contrast, adopts (MT) as the basic principle of scientific inference, according to which, from "hypothesis h entails e" and "not-e", infer (deductively) "not-h". If (CH-2) entails that (all) living things were created in forms that are fixed and unchanging, that implies in turn that (all) living things exist in forms that are fixed and unchanging, which would appear to be something that, under suitable conditions, could be subject to empirical test. The issue is not the truth of (CH-2), but whether, according to (MT) standards, (CH-2) qualifies as scientific.

Thus, if it were possible to discover even one species (such as bacteria, for example) that does not exist in forms that are fixed and unchanging, then hypothesis (CH-2) could be rejected as false—inconclusively, of course, since the discovery of new evidence, such as that old evidence was acquired on the basis of background assumptions or auxiliary hypotheses that turn out to have been in error or wrong, could undermine previous findings and require their revision. Thus, it should be apparent that the employment of deductive priciples within scientific contexts is a form of conclusive reasoning where conclusions that are derived on the basis of those priciples cannot be false—provided the premises upon which they are based are true! The crucial point with regard to (CH-2), however, is not that the application of (MT) in empirical contexts is fallible but that (CH-2) appears to be testable.

That Inductivist and Deductivist appraisals of creationist hypotheses, such as (CH-2), might support conflicting conclusions, no doubt, is a striking result. The conclusion that hypothesis (CH-2) is unscientific relative to (EI), however, might be altered by reducing (CH-2) strictly to the claim that the properties of species are fixed and do not change. The determination that the creationist hypothesis qualifies as "scientific" when the role of God is disregarded, however, would be a Pyrrhic victory for creationism, since the role of God is indispensable thereto. It is therefore all the more fascinating that, when the role of God is appropriately retained, Inductism and Deductivism yield conflicting evaluations, where (CH-2) apparently qualifies as "scientific" in relation to (MT) but not in relation to (EI).

It should be emphasized that the question is not reducible to one of truth or falsity. No doubt, the creationist hypothesis may turn out to be false insofar as it implies that the properties of species are fixed and do not change, because the available evidence might not support that conclusion. Nevertheless, that would not be enough to show that creationism is unscientific. Classical Newtonian mechanics, for example, has been superceded by Einsteinian relativity theory and is no longer held to be true, but that has not altered its standing as a scientific theory. Nevertheless, the standards imposed by Inductivism and Deductivism cannot qualify as definitive, since Abductivism appears to provide a far more adequate conception of the nature of science. The question thus becomes that of whether creationist hypotheses such as (CH-2) are scientific by its standards.

According to Abductivism, the basic priciple of inference is (IBE), according to which, from "the nomic expectability of e, given h, equals r", infer (deductively) "the measure of evidential support for h, given e, equals r". We have found that there are two aspects to the application of this principle, namely: that an hypothesis would be preferable to another when it provides a better explanation of the available evidence than does the other; and that the preferable hypothesis would be acceptable when enough evidence happens to be available. In criminal cases, this distinction corresponds to the difference between having a suspect in a crime and having enough evidence for an arrest. Someone can be the strongest suspect ("preferable") relative to the evidence available without the available evidence being sufficient to indict or to convict him ("acceptable").

What is most interesting about the application of (IBE) to creationism is that it properly applies to sets of alternative hypotheses, where each member of this set qualifies as an alternative explanation of the available evidence. In order to qualify as an "alternative explanation", however, an hypothesis has to advance a "possible explanation" for the available evidence, that is, it must qualify as an explanation that would be adequate if it were true. The question with which we are concerned, therefore, is not whether creationist hypotheses (CH-1) to (CH-3) are true, but whether each qualifies as a possible explanation for the evidence e, which includes the fossil record, geological strata, morphological similarities, etc.

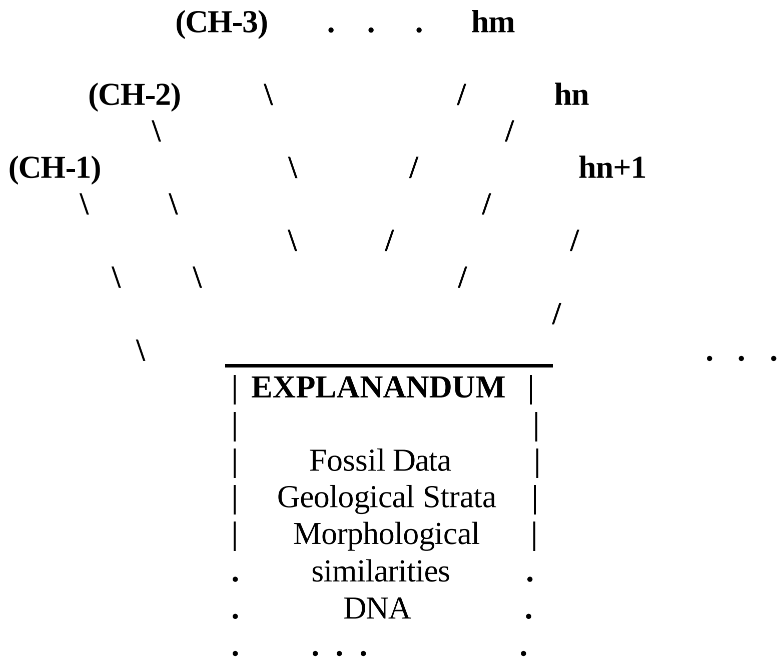

Figure 2. Are Creationist Hypotheses Scientific?

The conditions that must be satisfied for an hypothesis h to qualify as a possible explanation for evidence e are commonly specified by entertaining explanations as arguments, where the premises are known as the explanans and the conclusion as the explanandum. Strictly speaking, a distinction must be drawn between the "explanandum-phenomenon" as a feature of the physical world and the "explanandum-sentence" as a description of some particular aspect of the phenomenon for which an explanation is desired. The explanandum-phenomenon is then explained by subsuming that phenomenon within the scope of a "covering law", which might be deterministic or probabilistic, which may be accomplished linguistically by deriving—deductively or probabilistically—the explanandum as conclusion from the explanans as its premises.

Then the occurrence of the phenomenon described by an explanandum-sentence has an adequate scientific explanation in the form of its corresponding explanans when it satisfies the following four conditions of adequacy, namely:

(CA-1) the explanandum can be derived—deductively or probabilistically—as a (deductive or probabilisitic) consequence from its explanans;

(CA-2) the explanans contains at least one lawlike sentence (sentence that that would be a law if it were true)—of either universal or probabilistic form—that is required for the derivation specified by (CA-1);

(CA-3) the explanans must exclude irrelevant properties that make no difference to the occurrence of the explanandum, a condition that is now known as the requirement of strict maximal specificity; and,

(CA-4) the sentences that constitute the explanation—both the explanans and the explanandum—must be true. (Fetzer 1981, 1993, 2002b)

This conception supports the conclusion that there are at least two different kinds of explanation, one of which invokes a deterministic law and supports the deductive derivation of its explanandum, the other of which invokes a probabilistic law and supports the inductive derivation of its explanandum, which can be called "deterministic-deductive" and "probabilistic-inductive".

A simple example of a deterministic-deductive explanation could explain why a match made of a specific chemical composition lights when it is struck in a particular way, when the match is dry and oxygen is present, as follows:

Law:	Striking a match of kind K under condition Ci would cause it to light.	
Initial Conditions:	This is a match of kind K being struck under conditions Ci now.	EXPLANANS
Description of Event:	This match is lighting now.	EXPLANANDUM

Figure 3. A Deterministic-Deductive Explanation.

In order for its lawlike premise to be true, the antecedent of that sentence (its "if" clause) has to specify the presence or the absence of every property whose presence or absence makes a difference to the occurrence of its consequent (its "then" clause), a condition that is known as the requirement of maximal specificity. Suppose, for example, that the presence or absence of oxygen happened to omitted from consideration. Then that sentence would be false, because lighting would occur when oxygen was present, but otherwise not (Fetzer 1981, 1993).

As Carl G. Hempel (1965) forcefully emphasized, deterministic-deductive explanations are potentially predictive, in the sense that, had their premises been taken account of at a suitable prior time, it would have been possible to predict the occurrence of the explanandum phenomenon on the basis of those premises. Probabilistic-inductive explanations, however, do not display this property, since the occurrence of an outcome that occurs with a certain fixed probability may or may not occur with high probability, say, probability > .5. When an outcome, such as radioactive decay, occurs with a high probability, such as .9, then its alternative, such as non-decay, must occur with low probability, such as .1. Ordinarily, however, the occurrence of an event would not be predicted unless its probability were > .5. The premises that could explain outcomes of low probability, therefore, do not tend to support their prediction.

It is tempting to suppose that every inference from premises including laws must be explanatory, as, indeed, Hempel was inclined to think (Hempel 1965, pp. 173-174). However, it is not difficult to discover examples that show that to be a mistaken conception. Consider, for example, inferences involving premises that concern various conditions that are sufficient to bring about the death of those to whom they are subject, such as being run over by a steamroller (being stepped upon by an elephant, and so on). That you and I are still alive permits a retrodictive inference from the present to the past of the following kind:

Law:	Being run over by a steamroller would bring about your death.	PREMISES
Initial Conditions:	You are not dead.	
Description of Event:	You have not been run over by a steamroller.	CONCLUSION

Figure 4. A Retrodictive Inference.

It should be evident that this argument, which involves the deduction of a conclusion from premises including at least one law that is actually required for this derivation, is nevertheless non-explanatory; after all, while it permits the inference that you have not been run over by a steamroller, it does not explain why! The explanatory failure of cases of this kind appears to be rooted in their appeal to "initial conditions" that occur at times subsequent to the occurrence of the phenomena they are being used to retrodict (Fetzer 2002b).

Perhaps even more instructive within the present context, explanations suffer from another variety of inadequacy when their explanans-premises include properties whose presence or absence makes no difference to the occurrence of the explanandum-phenomenon. Consider the following "explanation":

Law:	Men who take birth control pills do not become pregnant.	EXPLANANS
Initial Conditions:	John Jones has been taking birth control pills.	
Description of Event:	John Jones has not become pregnant.	EXPLANANDUM

Figure 5. An Inadequate Explanation.

The striking feature of this "explanation", no doubt, is that the explanandum does indeed follow from its explanans, thereby satisfying adquacy condition (CA-1), where the derivation of the explanandum from its explanans does indeed require a lawlike premise, thereby satisfying adequacy condition (CA-2). The problem is that men do not become pregnant whether they take birth control pills or not, which means this argument violates adequacy condition (CA-3).

When (IBE) is being employed as a principle of inference, of course, we don't know which among the available alternatives satisfies condition (CA-4), which is the truth condition. (If we did, we would not need inference to the best explanation to find out!) The requirements that must be satisfied for an hypothesis to be a <u>possible explanation</u> and thereby qualify for inclusion within a set of <u>alternative hypotheses</u> <u>h1</u>, <u>h2</u>, . . . , <u>hn</u> that might be preferable or even acceptable, in relation to specified explananda or available evidence <u>e</u>, therefore, are (CA-1), derivability, (CA-2), lawlikeness, and (CA-3), the exclusion of irrelevant factors. Classic creationist hypotheses, such as (CH-1), (CH-2), and (CH-3), therefore, will qualify as scientific hypotheses if and only if they can satisfy these three conditions and thereby establish that they are possible scientific explanations for <u>e</u>.

From this perspective, the problems encountered by classic creationist hypotheses become obvious. (CH-1), for example, which asserts that God created the world and everything therein exactly as it is today, cannot satisfy (CA-1). The phrase, "exactly as it is today", after all, would describe the world no matter what its properties, including the presence or the absence of the fossil record, geological strata, morphological similarities, and the like. No descriptions of any evidence or explananda are derivable from (CH-1), which therefore cannot qualify as a possible explanation that might be adequate if it were true. As a consequence, (CH-1) cannot qualify as a scientific alternative, because it does not satisfy the condition of adequacy (CA-1) for a possible scientific explanation.

(CH-2), which asserts that God created the world and everything therein, including life in fixed and unchanging forms, by comparison, at least implies potential explananda, namely: that life exists in forms that are fixed and unchanging. To this extent, at least, therefore, (CH-2) appears to satisfy (CA-1). The problem is that the derivation of the potential explanandum—that life exists in forms that are fixed and unchanging—follows from (CH-2) without making any appeal to any laws. In parcular, there are no laws that relate antecedent conditions (concerning God's disposition to create worlds and life forms, for example) that could be invoked in support of such an inference. Even assuming that God had such a disposition, (CH-2) cannot satisfy (CA-2) and therefore does not qualify as a potential scientific explanation. As a consequence, (CH-2) also cannot qualify as a scientific hypothesis.

It could be argued that the claim that life exists in forms that are fixed and unchanging has a lawlike character, since it implies that, no matter what conditions might happen to be realized during the course of the world's history, those forms could not be changed. A similar argument could be made with respect to (CH-3), which asserts that God created the world and everything therein, including all life forms by means of evolution—at least, when the assumption is made that evolution provides a suitable set of causal mechanisms to account for the phenomena. In this case, (CH-3) satisfies not only (CA-1) but (CA-2) as well. The problem is, however, that if evolution provides a set of causal mechanisms that is suitable to account for the phenomena, an appeal to God is no longer necessary. This hypothesis fails to satisfy (CA-3) and thus also fails to qualify as a scientific alternative.

From the perspective of inference to the best explanation, therefore, none of these classic creationist hypotheses qualify as scientific alternatives, since none of them qualifies as a possible explanation for the phenomena. That this should be the case, moreover, becomes especially apparent when consideration is given to (LM), which asserts that, from "the nomic expectability of *e*, given *h*, equals r", infer (deductively) "the measure of evidential support for *h*, given *e*, equals r". The *nomic expectability* of evidence *e* equals the logical probability of its truth, given the truth of hypothesis *h*, where the value of *r* may be measured by the extent to which the explanandum phenomenon would be expected (or could be derived) from an explanans that includes at least one essential law. When the explanans contains no essential law, the nomic expectability of *e,* given *h,* is 0.

That the halflife of polonium^{218} is 3.05 minutes not only means that a single atom has a probability of 1/2 to decay during a 3.05 minute interval but also imples that the same atom has a probability of 1/2 to not undergo decay during that same interval. It also implies that, for large numbers of atoms of polonium^{218} given at a specific time, very close to one-half will still exist 3.05 minutes later, the remainder having disintegrated by decay (cf. Hempel 1966, p. 66). If the halflife of polonium^{218} were not know, repeated observations of decay on this order would support such an inference as the hypothesis that provides the best explanation for the frequency data. This would be the hypothesis with the highest likelihood, given the evidence.

Alternative hypotheses that might deserve consideration would include those that cluster around the observed relative frequency of decay in large samples, which would have values close to 3.05 minutes. Those hypotheses would have high likelihoods by virtue of making those outcomes highly probable, which indicates that more than one hypothesis can have high likelihood (Fetzer 1981, p. 276). When repeated sequences of trials are conducted under suitable test conditions and yield stable relative frequencies for decay, the hypothesis with the highest likelihood would deserve to be accepted. Indeed, the covergence of statistical data toward a normal distribution affords a measure that supports the presumption those trials were random and can be employed to determine when the available evidence is sufficent (Fetzer 1981, Chapter 9). The distribution of the data thus sustains inferences about its evidential value.

When the nomic expectability of e, given h, is 0, of course, the measure of evidential support for h, given e, is also 0. It should come as no surprise, therefore, that creationist hypotheses, such as (CH-1) and (CH-2), that confer no nomic expectability upon the explanandum, cannot have measures of evidential support greater than 0. Moreover, if (CH-2) and (CH-3) are defended on the ground that the existence of life in forms that are fixed and unchanging or the creation of life by means of evolution possess lawlike standing, it should be evident that their lawlike standing does not depend upon invoking God as the creator, which means that whatever explanatory potential they may possess does not depend upon God, which makes God irrelevant and thus defeats the creationist program. Even if classic creationist hypotheses are not scientific, however, that does not show that evolution is scientific or that other alternatives could not do better.

When (IBE) is used to draw inferences concerning the occurrence of specific phenomena, such as singular events e, alternative explanations, hi, may include both lawlike generalizations and initial conditions. When (IBE) is used to draw inferences concerning lawlike generalizations, e may include relative frequencies for specific outcomes in relation to initial conditions. Either way, evidence e supports hypothesis h1 better than hypothesis h2 when the likelihood of h1, given e, exceeds that of h2, or when the likelihood ratio of h1, given e, to h2, exceeds 1 (Hacking 1965). Notice, especially, that if h1 were an evolutionary hypothesis and h2 a creationist hypothesis, then even if the likelihood of h1 given e were very low—because the nomic expectability for evidence e, given h1, was very low—h1 nevertheless could be highly preferable to h2 given e—because the nomic expectability for e, given h2, was 0. So even if the nomic expectability for evidence e, given evolution, should turn out to be very low, it could still be not only a preferable alternative but even an acceptable one.

The purpose of this chapter has been to explain why the debate over whether creationism ought to be taught as part of the science curriculum in our pubic schools cannot be intelligently discussed, much less resolved, without justifiable conceptions of the nature of science, on the one hand, and of the nature of creationism, on the other. By exploring three of the most influential models of science—Inductivism, Deductivism, and Abductivism—a foundation has been laid for addressing these and related issues, including the scientific standing of evolutionary theory as well as of sociobiology and of gene-culture co-evolutionary theory. Those who persist in holding that classic creationist hypotheses are scientific, given the results that are reported here, thus incur an intellectual obligation to identify and justify the conception of science that would yield a more favorable outcome that its own merits may be considered.

CHAPTER 2: SCIENCE AND EVOLUTION

The conclusion that classic creationism does not qualify as science, no doubt, follows from other—more familiar and less complex—premises. Science can also be appropriately entertained as pursuing the study of causes and effects, which are related by means of causal laws. From this perspective, the universe (all of creation) can be viewed as an effect that has been brought about by some cause (or creator). That cause or creator, in turn, however, might be natural or supernatural in character, where "supernatural" causes exist or occur beyond the normal boundaries of human experience and cannot be explained by known forces or laws of nature (Webster 1988, p. 1344). To the extent to which "creationism" invokes or appeals to supernatural forces or causes, therefore, it cannot qualify as science, because the scope of science is confined to natural forces and causes.

CREATION AS AN EFFECT

NATURAL CAUSES (SUCH AS EVOLUTION)	SUPERNATURAL CAUSES (SUCH AS A CREATOR)
POSSIBLE SUBJECT OF SCIENTIFIC INQUIRY	IMPOSSIBLE SUBJECT OF SCIENTIFIC INQUIRY
SCIENCE	**NON-SCIENCE**

Figure 6. Science as the Study of Causes and Effects

That this is indeed the case may be illustrated in a variety of different ways. Consider, for example, that space and time (space/time in relativity) can be represented by a series of squares, each of which represents a location at a time:

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. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . __11111111111111111111111111 . . .
. . . 1111111111111111111111111111 . . .
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   -t < - - - - - - - - - - - - - - - - - - - - - | ------------------------------------------ > +t
                  PAST                  NOW                    FUTURE
```

Figure 7. An Isolated Region of (Local) Space and Time

where the vertical columns may be taken to represent different locations and the horizontal rows different times at those locations, in order to achieve the effect of representing various locations at various times. Then, in relation to "NOW", which stands for the present, events that occurred previously belong to the past, while those that will occur subsequently belong to the future—a distinction, of course, that is relative to the specific moment that is the NOW.

Causal connections thus obtain between space/time regions when the occurrence of an event at one such space/time region brings about an event at another space/time region, where the former stands to the latter as cause to effect. Ordinarily, these regions are assumed to be spatially and temporally contiguous in the absence of "action at a distance", which would involve the occurrence of an event at one region bringing about an event at another but non-contiguous region. Thus, if we were to imagine lower-case letter assignments to locations and numerical assignments to times, then the occurrence of an event such as the striking of a match at d3, for example, might bring about the occurrence of an event such as the lighting of a match at d4, but not at e7. "Action at a distance" can then be accounted for on the basis of causal chains.

There are accounts of causation according to which "causes" are nothing more than instances of properties that are regularly associated with instances of other properties in space and time. Thus, if every event of kind <u>striking of a match</u> in specific regions of space and time were to be followed by an event of kind <u>lighting of a match</u> at that same location immediately thereafter and if this pattern was displayed throughout space/time in the form of either a constant conjunction or (stable) relative frequency relating events of those kinds, then those regular associations would qualify as "natural laws". Constant conjunctions of events of appropriate kinds in space/time would therefore imply the existence of corresponding universal laws, whereas (stable) relative frequencies of events of such kinds would imply the existence of statistical laws.

Our discussion of the nature of laws in Chapter 1, however, has explained why mere extensional distributions such as these do not capture the character of natural laws or appropriately differentiate between permanent and transient properties. Indeed, when causation is a manifestation of lawful relations between reference properties and attributes whose effects are brought about under relevant test conditions, then it should be physically impossible to take those causal tendencies away from instances of those references properties, no matter whether they are of universal strength or of probabilistic strength. Conducting empirical tests of causal hypotheses, however, clearly depends on the ability to ascertain the presence or the absence of those ostensible causes <u>C</u> and their presumptive effects <u>E</u>, which implies that <u>C</u> and <u>E</u> must have some (direct or indirect) observable, experimental, or measurable manifestations.

Causal hypotheses can be subjected to empirical test by conducting suitable observations, experiments, and measurements to ascertain whether the extensional distributions that would be most probable if the hypotheses are true in fact occur, a relationship represented by a Causal Theory Square (Fetzer 1993):

Cause [C] is related by law to effect [E]

deductively or inductively		deductively or inductively

Empirical test for [C] is correlated with empirical test for [E]

Figure 8. A Causal Theory Square.

Thus, securing appropriate evidence to test causal hypotheses presupposes the possibility of detecting the presence or the absence of the occurrence of events of both kinds by observation, experimentation, or measurement. If the presence or absence of God as a possible cause (a "supernatural" square) of the universe as an effect (the "natural" squares) cannot be detected by (direct or indirect) empirical tests, God-the-Creator hypotheses are unscientific.

1. What is Evolution?

That the existence or non-existence of a God-as-the-Creator, when God is envisioned as a supernatural force that transcends the scope of human knowledge, cannot be established by reliance upon empirical procedures, of course, should come as no surprise. If God's presence or absence could be established on that basis, then discovering God's existence would be a subject for scientific research rather than a matter of religious faith. Perhaps even more striking, within the present context, is the realization that some effects—such as cancer as an effect of smoking—may take some time to become manifest, not in violation of the proscription against "action at a distance" but because the effects of these causes are cumulative rather than immediate. A long sequence of events of the kind smoking (one string of squares) can bring about another sequence of the kind cancer (another string of squares) if they are related by causal chains.

Establishing that a long-term effect of the kind cancer is brought about by a long-term cause of the kind smoking thus appears more difficult than establishing that an immediate effect of the kind lighting of a match is brought about by a short-term cause of the kind striking of a match. The former, after all, tends to require most if not all of the developmental history of a human being before its effects become evident, whereas the latter becomes evident virtually immediately. Indeed, cigarette companies have long insisted that the connection between smoking and cancer was only one of correlation and not one of causation, a pretense that was abandoned only recently when one of the nation's major cigarette manufacturers acknowledged that cigarettes cause cancer (Broder 1997). This admission was the culmination of a protracted battle lasting many decades.

Indeed, one reason this debate has been prolonged for so very long reflects the difficulties that are encountered in establishing causal connections that depend upon prolonged exposure to causes in order to bring about their effects. Discovering the existence of complex patterns of causation over lengthy intervals of time requires extensive historical records, sophisticated statistical analyses, and excluding alternative explanations. It cannot be properly understood apart from inference to the best explanation. Explanations for the occurrence of phenomena that involve causal chains that extend, not just over the history of development of individual organisms, but over histories of generation after generation of organisms through geological time, therefore, are going to be all the more difficult to discover. The pattern of inference, however, is the same.

The explanandum that alternative theories of evolution are intended to explain, therefore, include the fossil record, geological strata, morphological similarities, DNA relations and the like, including the existence of at least some 1.5 million species whose existence has been identified and classified, a relatively small proportion of all species, which may number between 10 and 100 times that number (Wilson 1992, p. 134). Indeed, it is fascinating to observe that, of the approximately 1 million animal species whose existence has been identified and classified, the vast majority are insects, which means that, even though by far the greatest number of individual organisms inhabit land, it turns out that by far the greatest number of <u>kinds</u> of organisms or <u>phyla</u>, the highest level of biological classification below <u>kingdom</u>, inhabit the sea (Wilson 1992, p. 136).

From the perspective of inference to the best explanation, therefore, the inferential situation—the evolutionary explanandum—assumes the following form:

Diagram from Foley

<u>Figure 9. The Evolutionary Explanandum.</u>

where most contemporary versions of evolutionary theory, which are meant to explain this explanandum, tend to adopt the following three assumptions:

(A1) <u>More are born alive into each species than survive to reproduce</u>.

(A2) <u>Many traits of organisms—whether plant or animal—are hereditary</u>.

(A3) <u>Many traits of successive generations depend on those who survive</u>.

The first of these, (A1), is usually attributed to Thomas Malthus (1766-1834), an English economist; the second, (A2), to Gregor Mendel (1822-84), an Austrian monk; the third, (A3), to Charles Darwin (1809-82), an English naturalist.

Although (A3) might seem to be an obvious consequence of (A1) and (A2) when presented as it has been here—where it could even be characterized as a theorem following from (A1) and (A2) as axioms and reformulated to say, Many traits of successive generations thus depend upon those who survive—Darwin was unaware of Mendel's findings, which lay the foundation for work in genetics. While he was aware of Malthus' research, therefore, Darwin was not in the position to derive (A3) from (A1) and (A2), but worked very hard to establish its truth on independent ground, especially through observations and measurements that he conducted during five years as a naturalist aboard H.M.S. Beagle throughout its 1831-36 voyage around the world (Browne 1995). Consequently, the merge of these three theses is called "the modern synthesis".

The most famous of Darwin's contributions concerns the role of competition between the members of a species ("conspecifics") for food, shelter, and other limited resources—including especially sexual mates, without whom sexual reproduction is impossible. (At least, until recently, when sperm banks and artificial insemination became possible, where this method of reproduction, unlike cloning, continues to require a genetic contribution from a member of each sex.) Thus, those who possess competitive advantages are more likely to reproduce. Since those who reproduce are among those who survive, Darwin's observation has come to be known as "the survival of the fittest", even though that may or may not be an accurate depiction, a matter to which we shall turn in Chapter 4.

Darwin referred to competition between conspecifics as "natural selection", suggesting that it was among the most, if not the most, important causal mechanisms that contribute to evolution. The special causal factors that determine which bodies and brains, known as "phenotypes", are perpetuated from generation to generation, moreover, are known as "genotypes" consisting of complete sets of genes for individual organisms. This notion may be distinguished from that of the "genome" as the complete set of genes for human beings, whether male or female, African or Oriental, and so forth (Schuler et al. 1996). Indeed, among biologists, evolution is measured by changes in gene pools across time.

Conclusions about the existence of genes and the traits they influence—individually or in combination—are derived here, as in other sciences, on the basis of inference to the best explanation. Consideration must be given to the available hypotheses and theories that might possibly explain the evidence or the phenomena. A simple example might consist of evidence that poodles beget poodles, that Chinese beget Chinese, and so on. The hypotheses might include that this is a chance phenomenon (that sometimes poodles beget Chinese and sometimes Chinese beget poodles, more or less on a random basis), that it is a probabilistic phenomenon (that there is a constant probability for poodles to beget poodles and to beget Chinese, a constant probability for Chinese to beget Chinese and to beget poodles), or that it is a deterministic phenomenon (where poodles only beget poodles, Chinese only beget Chinese, and so forth), where inference to the best explanation supports the deterministic alternative.

Although it has become common practice to refer to "evolution" and to "natural selection" as though they were synonymous, natural selection in the sense of Darwin is only one among at least eight different causal mechanisms, which contribute to evolution as it is measured by changes in gene pools across time, including genetic mutation, natural selection (in Darwin's sense), sexual reproduction, genetic drift, sexual selection, group selection, artificial selection, and genetic engineering. Four of these—genetic mutation, sexual reproduction, genetic drift, and genetic engineering—are sources of genetic variation within gene pools, while the other four—natural selection, sexual selection, group selection, and artificial selection—are mechanisms that determine which genes happen to be perpetuated from earlier gene pools to later gene pools (cf. Williams 1966).

The distinction between causal mechanisms that contribute to evolution and the means by which it is measured has sometimes been described as the difference between the levels of selection and the units of selection (cf. Sober 1984). The units of selection are supposed to be what is selected—that is, what is perpetuated—during evolution, which would appear to be individual genes as the transmissible entities that give rise to heritable traits. (Genotypes and phenotypes cannot be the units of selection, because—absent cloning—they are not perpetuated in subsequent gene pools.) The level of selection thus becomes the kinds of causal mechanisms that contribute to determining which genes are and which are not perpetuated in subsequent gene pools. While it may seem plausible to suppose that selection usually operates at the level of the phenotype, we shall discover reasons for doubting that this is generally true.

A few illustrations of some of these mechanisms may be appropriate here, though others will be exemplified elsewhere. Genetic mutation, for example, occurs when genes of one kind are transformed into genes of another kind, a phenomeon that can occur with no significant effects. Matt Ridley estimates that there are as many as 100 mutations per genotype in mammals: "That is, your children will have one hundred differences from you and your spouse in their genes as a result of random copying errors by your enzymes or as a result of mutations in your ovaries or testicles caused by cosmic rays" (Ridley 1993, p. 45). These represent a rather small percentage of (what are called) "point" mutations, where, with about 75 million points per genotype, 100 point mutations may occur, of which perhaps as much as 92% have no phenotypic effects.

The importance of genetic mutation, however, becomes quite apparent in view of the multiple differences that (relatively limited) genetic changes can make due to the influence of polygenic interactions and pleiotropic effects (cf. Lennox 1992). Polygenic interactions take place when more than one pair of genes interact to produce specific phenotypic traits, while pleiotropic effects occur when single pairs of genes produce multiple differences in phenotypes. An especially striking example of the importance of these causal mechanisms occurs in comparisons between human beings and chimpanzees, to whom we are closely related. Estimates suggest we share more than 98% of our chromosomes, yet our differences—including our behavior—are quite extensive, which emphasizes the importance of that 2% difference (Lumsden and Wilson 1983).

A striking and disturbing example of natural selection has been observed in relation to the evolution of bacteria that are resistant to antibiotics, which have been over-prescribed and improperly used by human subjects. There is a common tendency for patients to stop taking their medicine when they start to feel better, even though prescriptions specify completing the treatment by taking every dose prescribed. The result has been that weaker bacteria tend to be extinguished by penicillin, for example, but that the remaining bacteria, which are the most resistant to extinction, survive and reproduce, generating stronger, more penicillin-resistant, species (Garrett 1995). Recent outbreaks of food poisioning in Japan and around the world have been traced to E. coli bacteria that have acquired a gene for production of shiga toxin (Hilts 1996).

Another less-disturbing example of natural selection has emerged from recent studies of aquatic life in Lake Victoria, which is the largest lake found in Africa. The age of the lake, which used to be a dry, grassy plain, has now been measured by means of carbon-14 dating, and turns out be approximately 12,000 years, which is quite remarkable. For over three-hundred species of cichlid fish inhabit these waters, providing what appears to be conclusive evidence that rapid evolution of new species is not only possible but has actually happened in geologically-recent times (Johnson 1996). Indeed, the reaction of evolutionary theoreticians has been one of enormous surprise and great admiration over this dramatic example of evolution, which illustrates the ability of evolution to produce many species in a short time (Yoon 1996).

In later chapters, we are going to consider examples of genetic drift, group selection, and genetic engineering as well as additional illustrations of natural selection. The primary benefit of <u>sexual reproduction</u> seems to be an increase in genetic diversity that occurs when offspring possess half of their genes from each of their parents (Margulis and Sagan 1986). Precisely which conspecifics tend to mate and reproduce, however, is strongly affected by <u>sexual selection</u> on the basis of traits that members of the opposite sex tend to find attractive, which can take a fascinating variety of forms (Gould and Gould 1996). Sometimes nature is not allowed to have its way, however, due to the intrusion of <u>artificial selection</u> by parents on behalf of their children (arranged marriages) or by breeders on behalf of their profits (selective breeding), whose purpose is to leave as little to chance as possible in regard to reproduction (Michod 1995).

In its broad sense, therefore, the phrase, "natural selection", tends to be treated as encompassing every mode or mechanism that contributes to the evolution of species, including all the above. The theory of evolution as a set of causal mechanisms that might be invoked to explain the explanandum of the fossil record (geological strata, morphological similarities, and so forth) is less a single defined entity than it is a family of theories consisting of different combinations of causal mechanisms, where each theory consists of a set of laws that apply to a common domain. Consider the following alternatives:

(EH-1) Life has evolved by means of genetic mutation;

(EH-2) Life has evolved by that plus natural selection;

(EH-3) Life has evolved by that plus sexual reproduction:

(EH-4) Life has evolved by that plus genetic drift;

(EH-5) Life has evolved by that plus sexual selection;

(EH-6) Life has evolved by that plus group selection;

(EH-7) Life has evolved by that plus artificial selection;

(EH-8) Life has evolved by that plus genetic engineering.

Each of these is successively stronger in adding one more causal mechanism to the sets of causal mechanisms posited by previous alternatives. It should be apparent that "the theory of evolution" consists of families of theories that are not exhausted by these alternatives, since additional hypotheses such as the inheritance of acquired characteristics or other possible mechanisms are available, at least some of which have been taken seriously (Richards 1987).

From the perspective of inference to the best explanation, therefore, the question arises, not whether evolutionary hypotheses (EH-1) to (EH-8) are true, but whether they qualify as possible explanations for the evidence <u>e</u>:

```
                (EH-3)     .   .   .   (EH-6)

         (EH-2)       \                /        (EH-7)
                \                          /
  (EH-1)                \            /                (EH-8)
        \        \                        /
                         \        /                /
           \        \                    /
                                                 /
             \       ____________________                  .  .  .
                    | EXPLANANDUM |          /
                    |                    |
                    |     Fossil Data    |
                    | Geological Strata  |
                    |   Morphological    |
                    .     similarities   .
                    .        DNA         .
                    .        . . .       .
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Figure 10. Alternative Evolutionary Theories

where the best theory will confer the highest nomic expectability upon the explanandum and thereby achieve the highest degree of explanatory power while adopting the fewest explanatory principles to create an elegant theory.

Perhaps the most striking difference between the classic creationist hypotheses we have considered and these evolutionary hypotheses is that there appears to be scant room for doubt about the explanatory potential of these evolutionary hypotheses. There are few who would deny that each of these causal mechanisms—genetic mutation, natural selection, sexual reproduction, genetic drift, sexual selection, group selection, artificial selection, and genetic engineering—is implicitly lawful. Genetic mutation, for example, presupposes the existence of the potential for mutation as a permanent property of genes, whereby specific changes in their types are (invariably or probably) brought about as effects of specific causes, such as exposure to specific environments.

Similar considerations apply to natural selection, sexual reproduction, and every other member of this list, where the only debatable exception is group selection, which has been subject to intense criticism by those committed to individual selection (Williams 1966, 1992). The reasons for denying the existence of laws of biology thus appear to be bad ones, rooted in misunderstandings about the differences between properties and classes and the logical character of laws themselves, which need not have any instances at all, as Chapter 1 explains. Indeed, the criticisms that are directed toward evolutionary theory tend to differ categorically from the kind that confront creationist hypotheses.

The kinds of objections raised against evolutionary hypotheses have more to do with questions about initial conditions, such as whether or not theories of the origin of the universe and of the origin of Earth provide enough time for evolution thus understood to produce the number or diversity of species found today. Until recently, the tendency has been to assume Earth came into existence around 5 billion years ago, that animal life began about 600 million years ago, and that hominid life emerged around 5 million years ago (Asimov 1987). The prospect that intelligent life has evolved elsewhere in the universe, however, increases with each astronomical study (Wilford 1996b). And the latest reports suggest that the first micro-organisms—initially lacking even nucleae—may even have emerged as long as 3.5 to 4 billion years ago (Wilford 1996c).

Nevertheless, the most serious of objections that have recently been raised about the capacity of evolution to account for the evolution of species have concerned the very idea of species itself. Past practice has been to define (sexually reproducing) "species" employing biological criteria for reproductive behavior:

(DS) species =df a population whose members tend to interbreed freely under natural conditions (Wilson 1992, p. 38);

where the origin of species is simply the emergence of some difference—any difference at all—that inhibits the production of fertile hybrids between the members of populations under natural conditions (Wilson 1992, p. 56). Thus, the differences between species tend to originate as traits that adapt members to the environment rather than as devices for reproductive isolation (Wilson 1992, p. 59). The objection that has been raised to this conception has come both from biologists and philosophers, who have offered an alternative view.

2. Are Species Individuals?

The thesis advocated by the philosopher David Hull (1978) and the biologists Ernst Mayr (1988) and Michael Ghiselin (1997) is that species are not classes but individuals, a distinction that makes an enormous theoretical difference to major issues in evolutionary theory. This thesis threatens the account of evolution that I have presented to the extent to which it tends to undermine the plausibility of the conception of laws of biology and especially of evolution; for, if species are individuals, while laws concern entities of some other kind, then there are no laws of biology. It may seem ironic that philosophers of the science of biology should maintain that there are no laws of biology, which in turn implies that biology is not a science, but that is how things are. Yet their arguments seem to be predicated upon misconceptions.

To forestall misunderstanding, it should be observed that the term "individual" occurs in biological contexts with a variety of meanings. Sometimes it just means "organism", but sometimes it means "individual" in a more generic sense, where, for example, genes are individuals, hearts are individuals, and bee hives are individuals. When a biologist describes a gene as an individual, he certainly does not mean that this gene is an organism. The matter is about the nature of the entities that can occur as objects of quantification in lawlike sentences, that is, the entities over which the variable "x" ranges in sentences of the kinds discussed in Chapter 1. It should not be surprising, therefore, to discover that this issue may hinge on rather precise and technical distinctions.

Several distinctions must be introduced between intensions and extensions, classes and members, and classes and properties. Speaking generally, common nouns such as "marble", "chair", "unicorn" have both intensions and extensions. Their intensions are specified by the conditions that must be satisfied for something to be properly described by that word; their extensions consist of everything there is that satisfies those conditions. The term "marble", for example, might be defined as a little ball of stone, glass or clay used in games; or, alternatively, it can be defined as a hard, crystalline or granular, metamorphic limestone, white or variously colored and sometimes streaked or mottled, which can take a high polish and is much used in building and sculpture (Webster 1988).

Under the first such definition, the intension of the term "marble" is (being) a little ball of stone, glass or clay used in games, and the extension of the term is everything there is that satisfies those conditions, namely: every instance of those conditions—past, present, or future—or, in other words, the complete set of marbles. Under the second definition given, the intension of the term "marble" is (being) hard, crystalline or granular, metamorphic limestone, etc., while the extension of the term is everything there is that satisfies those conditions, namely: every instance of those conditions—past, present, or future—or every chunk, block, piece or chip or whatever that instantiates that kind of material.

These alternative definitions of "marble" exemplify two different kinds of common nouns, which Quine has referred to as "count nouns" and "mass nouns" (Quine 1960). Count nouns describe things that come (as it were) "prepackaged" and that can be counted; thus, a certain collection of marbles (in the first sense) might have five or ten marbles as its members, and other collections might have more or less, etc. Mass nouns, however, describe things that do not come "pre-packaged", which must therefore be measured quantitatively by other means. Things that are (made of) marble might be statues, buildings, blocks, chips, or whatever, where as statues of marble, as buildings of marble, as marble blocks or marble chips they might be counted (as number of instances of things of that marble kind), but where "how much" marble as such might require other units of measure: by weight (in tonnage), by volume (in cubic meters), or whatever.

In relation to the extension of "marble" in the first sense, there is a natural unit of measurement when it comes to quantitative considerations, how many? In relation to the extension of "marble" in the second sense, however, the natural unit of measurement is not, how many?, but rather, how much? This difference might be said to reflect the consideration that "marble" in the second sense is a kind of material out of which things of many different kinds might be made, while "marble" in the first sense is a kind of thing that can be made of many different kinds of material. Notice, too, that "marble" in the second sense is defined as "a hard, crystalline or granular, metamorphic limestone, white or variously colored", etc., as a kind—or one kind—of limestone, where there may also be various other kinds. As a kind of limestone, marble might also qualify as one of four or five kinds of limestone, where even (initially) mass nouns may describe countable phenomena at some level of description.

The instances of intensions of common nouns such as "marble", "chair", and "unicorn" are also known as "members" of their extensions, where these collections of members satisfying the same intensions are also known as "classes". Classes, however, are generally assumed to be entirely extensional entities, in the sense that two classes are the same, necessarily, if their members are the same, which is not assumed to be the case for intensions. To distinguish between the classes of things that satisfy specific conditions and the specific conditions they satisfy, therefore, a distinction is ordinarily drawn between classes and properties. As we discovered in Chapter 1, Quine (1951) has explained that classes can be treated as properties if the notion of property is qualified and properties become identical when their instances are identical.

Just because a position can be taken does not imply that it ought to be. We already know that this move, which separates nominalists from realists, has the consequence that being a unicorn, being a vampire, and being a werewolf are one and the same property. Indeed, they are now simply three words for naming the same property, because properties must be the same when their instances are the same. The same holds for classes that have members. In a world in which it happens that all and only oval lockets are made of gold, for example, the phrases (thing that is an) "oval locket" and (thing that is) "made of gold", where the first is a count noun and the second not, would apply to all and only the same things, yet we should not be tempted to suppose there is or would be no difference between those properties for that reason (Fetzer 1981).

These reflections suggest that nominalism is a peculiar and rather difficult doctrine to defend, notwithstanding the ingenuity some may display in its defense. But the same considerations suggest there exists a fundamental difference between classes (as extensional entities) and properties (as intensional entities) that strongly affects the plausibility of the species are individuals thesis. For it appears evident that these authors may have overlooked a third alternative, namely: that species are properties, at least insofar as the term "species" has both an intension and an extension, where that extension is not null but encompasses everything that satisfies its intension as members of the corresponding class. But this is a case where membership in the class is determined not by arbitrary congregation—as in the case of an old comb, the square root of -1, and the current President of the United States—but by some corresponding property.

In fact, there are numerous indications that Hull and others employ the term "class" in an ambiguous fashion and that what they really mean is synonymous with (or, at least, close to) the meaning of "property" as an intensional notion. Suppose we assume that their basic claim is correct, namely: that things that are individuals are not classes and that things that are classes are not individuals, as though that could be determined independently of some specific presupposed level of description. Then the problem becomes, what happens to the members of a species? Presumably they are individuals or they are classes, by hypothesis. But if they are individuals, then either they are members of another—higher order—individual or they are members of a class. And if they are members of another—higher order—individual, then what sense does it make to characterize that entity as an individual rather than as a class?

Species as natural kinds, species as properties, and species as classes are, at the very least, the kinds of things that can have members, but what sense does it make to adopt the theory that species as individuals nevertheless have members? There are cases in which it makes sense to say that something is composed of other things, where those other things are parts of that something and where that something qualifies as an individual. Organisms, for example, consist of (instances of) arrangements of cells, which are parts of arrangements of molecules, of organs (heart, kidney, liver, etc.) and of structures (muscular, skeletal, nervous, etc.). Those cells, organs and structures are all parts of an organism as components of a larger system. It could be said of them taken altogether (collectively) that they are members of a class. And it could be said of them that they are members of a class that consists of parts of an organism.

Perhaps it could also be said of them that they are members of a class consisting of the parts of a single—or individual—organism. But it would be wrong to say of those cells, those organs, or those structures that they were not themselves single—or individual—cells, organs or structures. So individual cells, individual organs and individual structures can be parts of individual organisms. We can even count them! Indeed, if we want a "rule of thumb" to tell whether we are dealing with individuals, then try counting them. If we are able to say how many there are, then we have succeeded in treating them as individuals.

If we were to take a single—individual—organism and ask, how many?, <u>in the absence of any specification of the kind of thing we were taking about</u>, the answer would be indeterminate: there might be one organism and one heart, but two kidneys, many organs, lots of bones, huge numbers of cells, etc. Without specifying the kinds of things we are talking about, there is no determinate answer to the question, how many? The question has a determinate answer only on the assumption that we have specified or presupposed <u>the kinds of things</u> we have in mind relative to which there will be so many <u>things that are of that kind</u> in a given case. With respect to mass nouns, such as "blood", moreover, we must specify the unit of measurement in liters, milliliters, etc.

Unfortunately, this result is perfectly general, which means that whether something is or is not an individual is relative to a certain level of description. Traditional biological classifications reflect a (roughly, hierarchical) sequence of successive more and more general properties distinguishing between different kinds of things. These properties represent abstractions in relation to those below them, where the sequence from species to genus to family to order to class to phylum to kingdom reflects a progression from larger and more detailed arrangements of properties to successive smaller and less detailed arrangements of properties. Even at the highest level, however, there are individuals—in this case, individual kingdoms, which can be enumerated and counted: viral, bacterial, fungal, plant and animal, respectively—just as there are individual phyla, classes, orders, families, genera and species. Viewed intensionally as classes that are defined by intensional membership properties, each of these categories contributes whatever it contributes to systematic understanding of the nature of biological organisms; but there are individuals at each level described.

Indeed, from a logical point of view, the matter is elementary. The notion of a sentential function is defined by a (monadic, dyadic, etc.) predicate that can be turned into a sentence that may be true or false four different ways, namely:

____is (an) F

may be turned into a sentence by (a) filling in the blank by a proper name, (b) filling in the blank by an ambiguous name, (c) replacing the blank by a variable and binding that variable with a corresponding existential quantifier, or (d) replacing the blank by a variable and binding that variable with a corresponding universal quantifier. Then the list of proper names and ambiguous names that are possible values of the quantifiers thereby become the singular entities—or "individuals"—within that system of notation (cf. Gustafson and Ulrich, 1973).

The property under consideration, therefore, could be that something ___is made of gold or ___is an atom of polonium^{218}, which might be represented by G__ or by P^{218}__, respectively, where instead of "__"s, logicians make use of "x". Thus, "Gx" and "P^{218}x" are examples of sentential functions that maintain "x is G" and "x is P^{218}", respectively, which are the forms of possible sentences that are neither true nor false but which can be turned into sentences in four different ways. Replacing "x" with a proper name, such as "c" for Bill Clinton, "Gx" becomes "Gc", which asserts, "Bill Clinton is (made of) gold". Alternatively, replacing "x" with an ambiguous name, such as "d" for John Doe, "Gx" becomes "Gd", which asserts "John Doe is (made of) gold". The use of the so-called existential quantifier, "(Ex)", can be prefixed to "Gx" to become, "(Ex)Gx", which asserts "Something is (made of) gold", while the universal quantifier, "x", can be prefixed to "Gx" to become "(x)Gx", which asserts, "Everything is (made of) gold".

If the system includes names of kingdoms, for example, and 'F' is replaced by a description of properties that kingdoms might possess—such as being populated by many phyla or by few phyla, then it could produce sentences such as, "The viral kingdom has many phyla", "Some kingdoms have few phyla", or "Every kingdom has at least one phylum", and such, where the values of those variables are the individuals of that system. (Indeed, proper names are also known as "individual constants" for this reason.) Thus, as I asserted above, something qualifies as an individual relative to a certain level of description, where things, such as species, could be individuals in relation to some levels of description relative to sentence functions that correspond to the range of predicates that describe properties that such a species may or may not have (ranging over every question that might be asked about them) but not others.

If organisms are the only kind of entity that is said to develop, for example, while species are said to evolve, then questions about the development of species or about the evolution of organisms are, strictly speaking, not well-formed and commit what is commonly referred to as a "category mistake". It would be logically improper, for example, to ask if David Hull, Michael Ghiselin, and Ernst Mayr had "evolved"—which can be represented formally by employing corresponding sentence functions having names for them as individual constants—

claims that would be regarded by convention as either false or meaningless. As it happens, this thesis appears to apply to everything, which means that, from a logical point of view, it is turns out to be mistaken and misleading to take species as individuals, even though the reasons are subtle and complex.

Now there is a legitimate question of whether it is more illuminating or not to consider the history of evolution that brings a species into existence as a defining property of that species, where the members of no other group—no matter how similar in their structure and function they may be: even if they are genetically, phenotypically and behaviorally identical—should be classified as members of the same species. That is an interesting problem about the nature of biological classification and its theoretical objectives. But it does not require the drastic and unjustifiable conception of species as individuals for its solution. Indeed, it depends upon the construction of species as properties, intensionally understood, where one of those properties concerns the evolutionary origin or lineage of those who currently instantiate these properties. If this is the real issue, as I suspect, then perhaps this discussion may contribute to the debate.

The thesis that species are individuals appears to have been motivated, at least in part, by the belief that generalizations must have many instances and otherwise cannot qualify as laws. This is false, as Chapter 1 explains, because laws concern relations between properties, including causal mechanisms, that might or might not be instantiated during the world's history. Laws characterize permanent properties and their causal manifestations, where every causal mechanism, including those considered above, has implicitly lawful standing with respect to the conditions of its application and the effects it brings about. The reason most laws that have been discovered have many instances is that it can be difficult to discover laws when they have few or no actual instances.

Moreover, laws apply to things as instances of those reference properties and not as those individual things. A person of 200 lbs. weight, for example, is an instance of things having a certain mass in a fixed-strength gravitational field, of course, but also has other properties because he is an instance of the species Homo sapiens, including specific reproductive capacities, learning tendencies, and other properties as specific lawful manifestations of phenotypes developed of specific genotypes. These laws apply to instances of such reference properties regardless of whether they have been instantiated in the past .

Thus, those who hold there are laws for classes but not for individuals are wrong on both counts, because there are laws for individuals as instantiations of reference properties, but there are no laws for any extensional classes. The permanent property relationship, like the maximal specificity requirement, is so strong that it logically guarantees that the truth of any singular subjunctive conditional of the form, "Rxt ==> Axt", deductively implies the truth of the corresponding generalization, "(x)(t)(Rxt ==> Axt)", no matter whether it happens to be instantiated by an individual constant c, an ambiguous name d, or actually has no instances during the history of the world (Fetzer 1981, pp. 53-54).

The objections that Hull, Ghiselin, and Mayr raise to essentialism, a doctrine that takes species to have "essences" that are immutable and can never change, which emerge intermittently with great force, are at least partly rooted in their belief that essentialists would oppose their historical-evolutionary relativization of the species concept, which is no doubt correct. There are many reasons to object to essentialism, which Karl R. Popper (1968), especially has raised, including, for example, that scientists have no way of discovering if essences do or do not exist. Essentialism thus creates a barrier to productive theorizing. The strongest possible motive for making this kind of relativization would arise, however, if it were to yield reference properties that have the effect of maximizing nomically-related attributes. Conduct a search for the least reference properties that yield the largest classes of related attributes. Whether this would occur when species are defined by means of lineages remains to be seen. That would clearly justify a relativization of this kind, but it might also be justifiable on the basis of conceptual economy, theoretical elegance, heuristic fertility or other demonstrable benefits.

3. Is Creation Science Science?

These considerations suggest that the thesis that species are individuals cannot be correct and therefore does not undermine the traditional biological conception of (sexually reproducing) species as populations whose members tend to interbreed freely under natural conditions (Wilson 1992). Clearly, this is both a genetic and a behavioral definition, which might perhaps be improved upon by some heretofore overlooked alternative definition. The crucial consideration remains that science attempts to maximize the empirical content of its theories by whenever possible displacing "analytical truths" relating properties (which are true by definition) by "empirical truths" relating properties (which are not true by definition) through the adoption of reference properties in relation to which their instances have the maximal class of permanent properties (Fetzer 1981).

As Numbers (1992) has observed, creation science has now emerged as a recent version of creationism, one that claims to have the status of a science that therefore should be taught in the science curriculum of the public schools. The version we shall consider, which has been formulated by the creation scientist, Walter Brown (1996, p. 172), offers three theses about the history of the world:

(CS-1) Everything in the universe, including the stars, the solar system, the earth, life, and man, came into existence suddenly and recently, in essentially the complexity that we see today;

(CS-2) Genetic variations are limited; and,

(CS-3) The earth has experienced a worldwide flood.

There is an ordinary sense of the term "theory" in which something qualifies as a theory when it consists of any mere speculation, conjecture or guess. No doubt, creation science qualifies as a "theory" in this sense, simply because it advances at least three speculations, conjectures, or guesses about the history of the world. The interesting question is not whether it qualifies as a "theory" in this (ordinary) sense but whether it qualifies as a theory in the (scientific) sense, where a "theory" must be a potentially explanatory lawlike hypothesis.

Activities that are called "science", such as Library Science, Military Science, and Mortuary Science are not <u>therefore</u> sciences, because—in this case—they do not aim at the discovery of natural laws. Moreover, activities that are sciences are not always called by that name: physics, chemistry, and biology, for example, are sciences, even when they are not being called "sciences". The question that arises with respect to creation science, therefore, is not the trivial question of whether it is called "science"—obviously, it is—but the non-trivial question of whether or not it actually is one. Sciences, as we have discovered, are distinguished by their aims and their methods, where physics aims at the discovery of laws of physics, chemistry of laws of chemistry, and so forth, by employing such methods as observation, experimentation, and inference to the best explanation.

In order to provide a framework that differs from those we have employed in previous discussions, let us assume that scientific knowledge assumes forms that are <u>conditional</u>, <u>testable</u>, and <u>tentative</u>. The conditionality of scientific hypotheses and theories arises from characterizing what properties or events will occur in the world as permanent properties or causal effects of the presence of other properties or the occurrence of other events. Such knowledge has to be testable, where it must be possible to detect the presence or absence of reference properties or events-as-causes and to detect the presence or absence of attribute properties or events-as-effects in order to subject those hypotheses and theories to empirical test. Moreover, scientific knowledge is tentative insofar as it is always subject to revision due to technological innovations, the acquisition of additional evidence, or the discovery of alternative hypotheses.

These conditions—of conditionality, testability, and tentativeness—supply a third approach to evaluating the scientific status of hypotheses and theories. The first, of course, involving inference to the best explanation, which we considered in Chapter 1, demonstrated conclusively that classic creationist hypotheses are not scientific, because they cannot satisfy conditions of adequacy that are required to qualify as possible explanations for the explanandum phenomenon. The second, which we considered in early pages of Chapter 2, explained why appeals to supernatural causes cannot qualify as scientific, when scientific inquiries are confined to natural causes. The third, which we are now considering, bears strong affinities to the second, and, like the second, seems to be simpler and easier to apply than are appeals to inference to the best explanation.

If Creation Science is science, then it should satisfy the aim of science—the search for laws of nature—and the methodological desiderata characteristic of sciences—conditionality, testability, and tentativeness. Let us therefore apply this standard to the three creation science hypotheses, beginning with (CS-1). Thus, the first problem with hypothesis (CS-1) is that it appears to be unconditional: it does not specify the conditions under which events of the kinds that it describes would be expected to take place. These events were either caused or they were uncaused. If they were uncaused, then they are beyond scientific investigation. If they were caused, then their causes must be supernatural or natural. If they are supernatural, however, then they are beyond scientific investigation. If natural, those causes have to be specified to qualify as scientific.

Hypothesis (CS-1) also appears to be untestable. Neither the time of creation nor the degree of complexity to be found in the world "today" is specified. It is therefore compatible with any time of creation or with any degree of complexity. Some classic philosophical examples of hypotheses of this kind include that the world was created five minutes ago/ten minutes ago/an hour ago/. . . but with exactly the properties we find present in the world today, including records of fossils, geological strata, and so on, even including our present memories with exactly the contents that they possess today. Another is the thesis of solipsism, namely: you think you exist in the world, but actually you are merely living a dream, because the world is nothing but a fabrication constructed by your mind. These are hypotheses that seem to be completely inaccessible to empirical test.

Hypothesis (CS-1) also seems to be arbitrary. It does not tell us, for example, whether the stars, the solar system, the earth, life, and man were the products of one act of creation or of many acts of creation. Indeed, it does not even tell us whether the one-or-more acts of creation were performed by one-or-more creators. It may sound odd because our Judeo-Christian culture has conditioned us to presuppose the existence of a single (omniscient and omnipotent) God. But surely there could be many gods, who specialize in various kinds of creative acts, some for viruses, some for bacteria, some for fungi, and so on. There appear to be no possible scientific answers to questions such as these. Everything that occurs, no matter what, could be claimed to be of supernatural origin.

This may be part of the humor found in the comedy routines of Flip Wilson, who—whenever he was caught doing something he should not have been doing, which was often—would proclaim, "The Devil made me do it!" Events whose occurrence is supposed to contravene or violate natural laws, of course, are supposed to be "miracles". It should come as no surprise, therefore, that scientists tend to take a dim view of allegations of miraculous occurrences. Indeed, one of the most famous arguments against miracles was advanced by the Scottish philosopher, David Hume (1711-76), who observed that the evidence supporting the existence of laws of nature counts against the occurrence of miracles: in order to accept the accounts of those who claim that they have occurred, it has to be more improbable that those who claim to have witnessed miracles are mistaken than it is improbable that the laws of nature have been violated.

Moreover, this arbitrary, unconditional and untestable hypothesis seems to be held, not tentatively, but absolutely, come what may. If those who advance (CS-1) want to defend their acceptance as <u>tentative</u>, then they ought to explain under what circumstances they would be willing to surrender it as no longer tenable. A typical indication that a thesis is being held as an article of faith rather than as a rational belief derives from its apparent compatibility with the evidence, no matter what. We have already seen that what would count as "evidence" for or against such an hypothesis is not at all apparent. And even if there were circumstances under which someone who holds this hypothesis might be willing to give it up, those could not be scientific circumstances. An abritrary, unconditional, and untestable hypothesis is unscientific.

Hypotheis (CS-2), which holds that genetic variations are limited, suffers from other deficiencies. The extent to which genetic variation is supposed to be limited is not specified. Thus, so long as genetic variation is not unlimited (or infinite), this hypothesis is true. But there is an ambiguity. Under INTERPRETATION 1, genetic variations are limited insofar as future genetic variations are strictly limited to genes in existing gene pools. This interpretation, however, is incompatible with the occurrence of genetic mutations, for example, and therefore appears to be false. According to INTERPRETATION 2, by contrast, genetic variations are limited insofar as present genetic variations are strictly limited to genes in existing gene pools, which is true but trivial.

There is yet another alternative, INTERPRETATION 3, according to which genetic variations are strictly limited to evolution within species (let us call this "microevolution") and does not extend to evolution between species (let us call this "macroevolution"). Thus, creation scientists such as Brown (1996, p. 3) consider microevolution to be permissible but macroevolution not to be:

(DE-1) **microevolution** =df a [naturally occurring] change that produces only minor chemical alterations or changes in size, shape or color that do not involve increasing complexity. (Sometimes called "horizontal".)

(DE-2) **macroevolution** =df a naturally occurring, beneficial change that produces increasing and heritable complexity, which would be shown if the offspring of one form of life had a different and improved set of vital organs. (Sometimes called "vertical".)

Brown asserts that microevolution plus time will not produce macroevolution, while acknowledging that, "Both creationists and evolutionists agree that microevolution occurs" (Brown 1996, p. 3). Since evolution is measured in terms of changes in gene pools across time and mircoevolution involves changes in gene pools across time, microevolution is a form of evolution. Moreover, affirming the occurrence of microevolution while denying the occurrence of macroevolution is no more than begging the question by taking for granted what is at issue, namely: whether or not macroevolution as a natural phenomenon occurs.

Brown is right when he claims that such a distinction is drawn not only by creation scientists but by evolutionary biologists. Ricki Lewis, for example, in her biology text, Life, has defined these terms as follows (Lewis 1995, p. 398):

(DE-3) **microevolution** =df small-scale evolutionary events, including changes in individual allele (gene variant) frequencies within a population; and,

(DE-4) **macroevolution** =df large-scale evolutionary events, including the appearance of new species (speciation) and the disappearance of species (extinction).

Anyone who engages in public debate with creation scientists, as I have done, therefore, soon discovers that the debate is not between "evolution" and "creationism" but between "evolution" and "creation-plus-microevolution". Yet, depending upon the explanatory potential of its causal mechanisms, it may turn out that something like micro (with mutation, say) + time accounts for macro. The boundaries of evolution cannot possibly be resolved merely by stipulation!

Hypothesis (CS-3), which holds that the earth has experienced a world-wide flood, of course, appears to have obvious religious significance relative to Biblical accounts of a worldwide flood. Prominent creation scientist, Henry Morris, has emphasized that belief in a worldwide flood is essential to maintaining a literal interpretation of the Bible as the inspired word of God (Morris 1974, pp. 250-252). Others have been more circumspect. In the "Special Edition" of his work, In the Beginning, which is intended to present the scientific evidence for creation and to exclude religious sources (Brown 1996), Walter Brown supports the occurrence of a worldwide flood to explain the fossil record and geological strata. Apart from its merits with respect to these phenomena, it also appears to raise more questions than it answers regarding organic evolution specifically.

Consider the problem of repopulating the earth. If every form of life (save those that thrive in oceans) was extinguished during the flood except for those who were saved by Noah and his family aboard the Ark, then if something on the order of 1 million land-borne species exist today—which is a conservative estimate, as E. O. Wilson observes (Wilson 1992)—then these species must be descendants of species aboard the Ark, if the flood chronology is true. According to the calculations of an Anglican Bishop, James Ussher (1581-1665), who assigned dates to Biblical events, the worldwide flood took place in 2349 B.C. There are signs of a huge flood in the Tirgis-Euphrates valley that took place about 2800 B.C., but it was a local rather than a global flood (Asimov 1987).

According to Genesis, Noah built an Ark according to God's specifications, the length of which was 300 cubits, the breadth 50 cubits, and the height 30 cubits, where a "cubit" measured the length of the arm from the end of the middle finger to the elbow (or approximately 18-22 inches). Again, following God's instructions, Noah populated the Ark with his family and a pair of each kind of living thing. God then caused it to rain upon the earth for forty days and forty nights, creating a worldwide flood of more than 10 months in duration, which brought about the extinction of every single species not represented aboard the Ark—except, presumably, those that inhabited the seas. All life on Earth was then repopulated from species that survived on the Ark.

During a public lecture on the subject that I attended, Walter Brown said that Noah had taken 20,000 animals aboard the Ark, which was created with suitable accommodations, including, for example, an exercise room for the animals. (In a fascinating slip that occurs in the "Special Edition" of his work, he maintains that dinosaur eggs "would be quite easy to handle" aboard the Ark (Brown 1996, p. 166). Whether dinosaurs would have been as easy to handle is not discussed.) When the figure of 20,000 is divided by 2 to reflect the number of pairs of sexually reproducing species, then the maximum number of species that were aboard the Ark must have been 10,000. If the flood occurred in 2349 B.C., while the number of species that exist today is conservatively estimated at 1 million, then more than 990,000 species have evolved in the interim.

The temporal interval from 2349 B.C. to 2000 A.D., of course, is approximately 4400 years. That means that an average of 225 species had to have evolved during each year, a figure that appears to be considerably more rapid than that of the cichlid fish of Lake Victoria, where 300 species evolved in 12,000 years, a rate of approximately 1 species every 40 years. Even apart from numerous other difficulties that flood chronology generates—such as the blatantly incestuous character of the repopulation of the human species by Noah's family, the problems of feeding and caring for 10,000 species (including viruses and bacteria along with animals and plants, many of which have very brief life spans and consume one another in the wild)—even elementary calculations establish that flood chronology implies the existence of an abundance of <u>macroevolution</u>.

It does not take a rocket scientist to realize that the three theses that define "creation science" in its contemporary guise—(CH-1), (CH-2), and (CH-3)—do not qualify as scientific hypotheses. Alternatively, if (CH-3), for example, is taken to be a scientific hypothesis because it can be subjected to empirical test on the basis of calculations such as those that have just been performed, then it may, at best, be said that, to the extent to which creation science qualifies as science, it does not support creation; and to the extent to which creation science supports creation, it does not qualify as science. Even without addressing a host of other problems that creation science raises, the distinction between microevolution and macroevolution upon which its tenability depends cannot be sustained, especially in light of the proliferation of speciation implied by flood chronology itself.

Thus, neither contemporary evaluations of creationist hypotheses based upon the principles of inference to the best explanation nor classic evaluations based upon principles of conditionality, testabililty, and tentativeness (which reflects the attitude of believers toward the objects of their beliefs) support the conception of creationist hypotheses as scientific hypotheses. This does not imply that a scientist, for example, could not believe in God, but it would require that she differentiate between beliefs that she holds on scientific grounds (such as that all life forms were brought about by means of evolution) and those she holds on religious grounds (such as that God created the world and everything therein). For, if the question is raised, "Creation or Evolution?", the answer—at this point, the only available scientific answer, at least—seems to be "Creation by Evolution".

CHAPTER 3: WHAT ABOUT INTELLIGENT DESIGN?

We have discovered that creation science encounters a dilemma with regard to its capacity to satisfy the standards of science, even using the less formal criteria that scientific hypotheses are conditional, testable, and tentative. The thesis of a young Earth, for example, (CS-1), can be formulated to accommodate the present state of the world, no matter what, in which case it cannot qualify as scientific because it is not empirically testable. Alternatively, however, when formulated on the basis of some specification of the age of the Earth, such as 10,000 years, it turns out to be testable on multiple grounds, where the combined results of astronomy, cosmology, geology, and paleontology falsify that claim in support of an age of approximately 4.5 billion years. For Earth to be around 10,000 years of age, therefore, would require rejecting the conclusions of natural science, which are based upon natural laws, including age dating using radioactive carbon. If the science is right, then a young Earth is wrong.

While the thesis of micro-evolution but not macro-evolution, (CS-2), appears to have the status of a stipulation that cannot be false, a conflict arises between this contention and thesis (CS-3) of a world-wide flood around 5,000 years ago. Based upon a conservative estimate of 1,000,000 as the number of animal species known to exist today (Wilson 1992, p. 136), if there were 20,000 animals aboard the Ark just 5,000 years ago—or 10,000 sexually-reproducing species—then for 1,000,000 species to exist today, around 990,000 new species must have evolved over the past 5,000 years. And that, in turn, represents a rate of speciation of about 200 new species a year! (The numbers depend on the precise dating of the flood and the exact number of sexually-reproducing species, but these figures are appropriate approximations.)

Thus, either there are not at least one million known living animal species today or evolution has been taking place at the rate of about 200 new species a year since the flood! Which, in turn, implies that, if there was a world-wide flood and the story of the Ark is true, then macro-evolution as well as micro-evolution has to have been taking place at the rate of approximately 200 new species a year. Which means that, even if the thesis of a young Earth (CS-1) is left to one side, the thesis of a world-wide flood (CS-3) contradicts the thesis of micro-evolution but not macro-evolution (CS-2), which in turn implies that creation science cannot possibly be true. Unless (CS-1) is associated with a specific age estimate, it is empirically untestable and therefore does not qualify as science. When it is associate with a specific age estimate, it turns out to empirically testable but false. Even more consequential, the truth of (CS-3) turns out to contradict the truth of (CS-2), rendering creation science an indefensible doctrine.

That a doctrine happens to be indefensible, of course, does not imply that no one is going to continue to believe it, since degrees of credulity (or "credulousness") differ from person to person and from time to time. We are all more easily persuaded of some claims than we are of others as functions of our cognitive predispositions. The indefensibility of creation science should have an impact on those whose degrees of credibility tend to converge with degrees of rationality (or "reasonableness") relative to justifiable standards of logic and the available relevant evidence. The difference is that credulousness, like gullibility, is a subjective property of each person, which can change across time, for example, with the acquisition of education and training. Our reasonableness, like thoughtfulness, is defined on the basis of objective standards of logic that do not vary from person to person or from time to time. Persons tend to be rational to the extent to which their degrees of credulity satisfy objective standards.

Those who qualify as "true believers", no doubt, will have no difficulty rejecting the conclusion that creation science cannot possibly be sustained merely because the tenet of a world-wide flood 5,000 years ago contradicts the tenet that mirco- but not macro-evolution occurs, based upon very simple calculations of the number of species that were aboard the Ark and the number of species that exist today. The division of

1,000,000 species by 5,000 years yields 200 new species per year. But if you want to believe—sincerely want to believe!—that creation science is correct, nonetheless, then you can preserve your consistency by rejecting either the premise that there are now at least 1,000,000 known living species or the premise that the world-wide flood took place about 5,000 years ago! The second option is unlikely to yield the outcome that a true believe desires, however, since any number of known living species in excess of 10,000 would appear to produce the same dilemma—unless, of course, that figure of 1,000,000 known living species represents micro-evolutionary variations upon the original 10,000, in which case it might be possible to preserve consistency once again!

The discovery of previously unknown species, which continues unabated, would appear to undermine that alternative, no matter how appealing it may initially seem. A google search turns up report after report of the discovery of one new species after another: new species of fish, new species of shark, new species of honeyeater birds, new species of insects, news species of assassin spiders, new species of primate giant apes, new species of rorqual whales, new species of lemurs, new species of window bugs, new species of crab, even new species of carnivorous fairy shrimp! They range from new species of microorganisms, like chlamydiae, C. pneumoniae and C. pecorum, to vast numbers of new species of animals and plants in "Lost Worlds" of New Guinea and Indonesia up to even more curious species that represent kinds of cross-species.

Among the most important finds, no doubt, are the new species of giant ape with characteristics of both gorillas and chimpanzees that has been sighted in the jungles north of the Democratic Republic of Congo Reports. These new giant apes grow up to six feet, five inches in height and weight as much as 187 to 224 pounds. They have large, black faces (like gorillas), consume a diet rich in fruit (like chimpanzees), and their males make nests on the ground (like gorillas) ("'New' giant ape found in DR Congo", BBC NEWS, 10 October 2004). Another fascinating find is a new species of tiny humans, which may have lived as recently as 13,000 years ago, that has been found on an Indonesian island. The species stood about three-feet in height with a brain the size of a grapefruit ("Tiny species of human unearthed", NewScientist.com, 27 October 2004). The species has been designated Homo floresiensis and, from the artifacts that were found in caves near the discovery, used stone tools and ate bats, rats, and fish, which they cooked. According to the report, the caves also contained the bones and teeth of several dwarf stegondons, precursors of the modern elephant. But debate over its status as a “new species” continues to this day (Wilford 2007).

The very idea that there are only a fixed number of species dating from the Ark thus becomes increasingly difficult to maintain with the discovery of more and more new species, which steadily increase in their number across time. Thomas S. Kuhn (1962) has described the characteristics of conceptual schemes or "paradigms" that are progressive when they lead to the integration of new hypotheses and evidence within a domain but that become degenerate when they are besieged by mounting "anomalies" they cannot accommodate. Those who want to preserve the paradigm in the face of potential falsifiers treat the inconsistent evidence as though it were a puzzle to be solved instead of a theory deserving rejection. Even Kuhn, who focuses upon the psychology of scientists as opposed to the logic of science, regards such an attitude as rational only so long as no better theory with more encompassing scope remains unavailable. Evolution appears to provide that more encompassing theory.

Creation science thus appears to be a degenerating paradigm. While some may want to preserve it in the face of contradictory evidence, its tenability diminishes as a function of the accumulation of anomalies that it cannot explain. The multiple causal mechanisms of evolutionary theory combined with descriptions of conditions that obtained at the time can provide historical explanations of their emergence that makes appeals to distinctions between "micro" and "macro" evolution unsustainable.

Indeed, classic creation science texts, such as Walter Brown, In the Beginning (1995), depict micro-evolution as a horizontal process of variations within a species, whereas macro-evolution is a vertical process of new species emerging from earlier ones. As his own illustration, new species of lizards, for example, may emerge as the products of micro-evolution from earlier species of lizards, but species of birds do not emerge as the products of macro-evolution from earlier species of lizard (Brown 1995, p. 6).

The discovery of a new species of dinosaur that was a feathered cousin of T. Rex may well qualify as the symbolic dagger in the heart of creation science as a theory. The discovery of this tiny dinosaur, which inhabited the lakeside forests of Liaoning Province in Northern China around 130 million years ago, confirmed predictions by paleontologists that a new species of this very kind would eventually be discovered ("New Dinosaur Discovered: T. Rex Cousin Had Feathers", National Geographic News 6 October 2004). The new species, which has been named Dilong paradoxus (for its "paradoxical" feathers), a five-foot long carnivore, had been predicted by Thomas Holtz, a vertebrate paleontologist from the University of Maryland. I suppose that, if a dedicated creation scientists wanted to insist that dinosaurs are not lizards and that Brown's illustration has therefore not been refuted, then it would make sense to observe that the evolution of birds from dinosaurs is an equally good refutation.

Indeed, it turns out there have been earlier discoveries of links between birds and dinosaurs. Another species, Sinovenator changii, which was also discovered in the Liaoning Province of China, also fills gaps in the evolutionary record. "This new dinosaur, which was probably feathered, is closely related to and almost the same age as the oldest known bird, Archaeopteryx," said Peter Makovicky, the assistant curator of The Field Museum. "It demonstrates that major structural modifications toward birds occurred much earlier in the evolutionary process than was previously thought" ("New Species Clarifies Bird-Dinosaur Link", ScienceDaily.com,14 February

2002). In another article on this discovery, Makovicky observes, "These findings help counter, once and for all, the position of paleontologists who argue that birds did not evolve from dinosaurs" ("New species clarifies bird-dinosaur link: Field Museum paleontologist helps analyze fossil", The Field Museum Information: Press Room, 2005). And it also helps counter, once and for all, the position of creation scientists who argue that only micro-evolution but not macro-evolution is possible.

1. Why Intelligent Design Won't Do.

That creation science qualifies as a degenerating paradigm within the Kuhnian scheme of things has not dissuaded Christian fundamentalists from their desire to bring religion into the classroom. Perhaps Freud could explain the determination with which this group has sought to force Biblical beliefs into the public schools, which bears the classic signs of an obsession: repeated, persistent, enduring and compulsive efforts using social, political, and legal avenues of approach, with the single-minded objective of introducing theistic alternatives to evolutionary theory into the science curriculum. And that, of course, is the rub. There may be a place for teaching religion and its multiple manifestations in the public schools, but there would appear to be virtually insuperable objections to teaching theology as science.

From the perspective of this investigation, the "intelligent design" movement appears to abandon creation science and even classic creationism for a return to more traditional conceptions of the relationship between a creator and the world. But this approach is more abstract and less detailed than traditional conceptions. Indeed, even the language of "creator" as a synonymy for "God" is abandoned on this approach in favor of the phrase "intelligent design" and the conception of an "intelligent designer". The movement tends to emphasize that there are organs and organisms in the world that display forms of complexity that lie beyond the capacity of evolution to explain. Some of these exhibit what the proponents of intelligent design call "irreducible complexity", where the displacement of any single part would cause the organ to cease to function, which is thus supposed to require an intelligent designer, since it could not have emerged by evolution.

That, at least, is the underlying claim. The foremost representative of this approach is Michael J. Behe, an associate professor of biochemistry at Lehigh. In his book, Darwin's Black Box (1996), Behe lays down the challenge to offer an account of bacterial flagella, for example, which are motor-like properties that enable bacteria to propel themselves by means of their rapid rotation. Another example—the favorite among those who favor this approach—is the human eye, a structure that seemingly defies explanation on the basis of the causal mechanisms of evolution. As a non-biological example of irreducible complexity, Behe offers a household mousetrap, with its unique arrangement of a platform, a hammer, a spring and a catch, with a holding bar. When the catch is moved, the holding bar releases the spring and the trap snaps shut.

From a logical point of view, the intelligent design movement depends on an argument by analogy for its plausibility. The intelligent designer is to the world as an artisan is to his artifacts. Or, at least, the intelligent designer is to the irreducibly complex elements of the world as an artisan is to his artifacts. The intelligent designer differs from the artisan insofar as an artisan, such as a woodworker, inhabits space and time and uses tools, such as planes, saws, and hammers, which have known and predictable causes and effects. People can apprentice to become woodworkers and learn to use tools such as planes, saws, and hammers. But what about the intelligent designer? Does he inhabit space and time? And what tools does he use? What are his "planes, saws, and hammers"? Could anyone apprentice to become an intelligent designer? How?

That some of these questions sound at least faintly ridiculous suggests that the intelligent design movement may be based upon a faulty analogy. That, of course, would not be especially surprising, since comparisons between natural and supernatural phenomena tend to be problematic. Arguments by analogy compare one thing or kind of thing with another, contending that, since the first has properties A, B, C, and D, and the second has A, B, and C, for example, so the second should also have D. They are faulty when (a) there are more differences than similarities, (b) there are few but crucial differences, or (c) the argument is taken to be conclusive. That two things share certain traits in common, after all, provides inductive support that they may share another but not deductive proof.

From an historical point of view, "intelligent design" is old wine in new bottles as the latest incarnation of what is classically known as the argument from design. It was subjected to a devastating critique by David Hume in the 18th century. A perfect and complete Earth suggests a perfect and complete creator, while a finite and flawed Earth suggests a finite and flawed creator. Does anyone want to claim we have a perfect and complete Earth under any remotely plausible interpretation of that phrase? That suggests a finite and flawed creator. Who knows how many prototypes of Earth might have gone before and been discarded? Woodworkers frequently discard their flawed attempts at creating artifacts. Perhaps the world we inhabit might be among them. Who knows how many gods or goddesses may have been involved? Who knows how any of this could possibly have been done?

Comparisons between supernatural entities and natural entities are bound to involve more differences than similarities, not matter what we call them. If we cannot know whether god is one or many, how many gods there might be or even whether god is male or female, then calling God "the intelligent designer" is not likely to enhance our understanding. We are as ignorant about any presumptive "intelligent designer" as we are of any "God"—with the possible difference that, as long as we take our analogy seriously, we are impaled by the properties of human artistans as evidence of the properties of an intelligent designer. Since we know the tools and practices that woodworkers employ to make their artifacts, isn't it a crucial dissimilarity that we don't know the tools and practices intelligent designers use to produce their artifacts? Indeed, we don't even know how many there may be!

The mousetrap as an example of irreducible complexity, moreover, suggests that the comparison between products of cultural evolution and the products of genetic evolution require further contemplation. Thoughtful humans think things through, they reason and experiment, create prototypes and analyze them. The intelligent designer might well be expected to perform all of these tasks, on the assumption, of course, that he, she, or it has the capacity to think things through, to reason and experiment, create prototypes and analyze them. The point is that we really have no idea how any of these things could possibly be done by an entity beyond space and time of which we appear to have no knowledge. Not to make a subtle point, but human thought processes take place within human brains. Are we to assume, on the basis of another analogy, that the intelligent designer also has a mind and, if so, that it takes place within the designer's brain? And where is that located?

The idea of "building a better mousetrap" suggests the possibility of trial and error learning and of learning from experience. Is that a trait that we would be inclined to attribute to an intelligent designer? After all, humans are intelligent, but their degrees of intelligence vary widely. Just how intelligent is this designer supposed to be? Is there any way we could tell, or is this just a belief that many of us want to adopt because it makes us feel more secure in a world that is full of threats and promises, where threats tend to predominate? And if there is more than one "intelligent designer", could it be the case that the world is the product of a committee? And if we reason from what we know about committees in our own true life experience, is there any reason to have confidence that the product of "intelligent design" is going to be intelligent on any reasonable interpretation of its meaning? Just how seriously are we supposed to take the implied analogy?

Reasoning by analogy is frequently flawed and does not invariably qualify as scientific. In the absence of objective standards, what qualifies as an adequate answer to a question tends to vary from person to person and from time to time. Subjective certitude is not the same as scientific adequacy. The aim of science, as we know, is the discovery of laws of nature, including the laws of physics, the laws of chemistry and the laws of biology. These laws are the foundation of scientific explanations, predictions, and retrodictions. If it is a law that water freezes at 32 degrees Fahrenheit, then together with suitable information about initial conditions, it provides a premise for predicting that, when water reaches that temperature, it will freeze, and when it does freeze, together with information that the temperature hit 32 degrees, can explain why. But their conditions of adequacy are specifiable.

Those conditions include requirements of derivability, lawlikeness, and exclusion of irrelevant factors. Unless we know the means by which one or more intelligent designers brings about their effects, how could we possibly subject them to suitable empirical tests? And if we can't subject them to suitable empirical tests, how can any hypothesis of this general kind qualify as scientific? And if it cannot qualify as scientific, then what is the basis for its inclusion in the science curriculum of a public school? These are ideas that can be taught and discussed in churches and in synagogues, in temples and in mosques, where the scientific standing of ideas simply does not matter. Why, then, should so much insistence be places upon the inclusion of hypotheses like intelligent design in a public school science curriculum when they do not qualify as scientific? What is the rationale for including them?

Even Behe admits that there are earlier versions of mousetraps, which suggests in turn that there may be earlier versions of human eyes. The complexity of the human eye invites explanation on the basis of the laws of biology together with information about the specific conditions that have occurred during the course of natural history. These laws include a set of at least eight causal mechanisms--not only genetic mutation and natural selection, as some creation scientists have said, but genetic drift, sexual reproduction, sexual selection, group selection, artificial selection, and genetic engineering. As we have already discovered, four enhance genetic diversity and four determine which genes are perpetuated through time. It is impossible to explain the evolution of the human eye by invoking them?

Suppose, for example, that a kind of black algae had acquired land motility and a single light-sensitive cell. If that sensitivity to light was remotely advantageous in adapting to the environment by promoting sensitivity to locations that happen to be even slightly more nutrient-rich than alternative locations, for example, it is rather easy to imagine that mutations of additional light-sensitive cells in various formations could rapidly evolve as an effect of natural selection. Over millions of years, the result might look like the product of intelligent design, but it would be the outcome of purely causal processes. Indeed, the point of evolutionary theory is to explain the origin of species without having to make any appeal to intelligence or to divine design. That was Darwin's purpose: to provide a natural explanation for phenomena that give the appearance of being the result of intelligent design!

It is not as though evolutionary biologists have been unaware of the problem of accounting for the evolution of complexity. Behe's book including references to William Jennings Bryan, for example, but not to John Tyler Bonner. Yet it is Bonner, not Bryan, who has devoted himself to the study of this problem. One of the most important, if not the most important, studies within this domain is his The Evolution of Complexity by Means of Natural Selection (1988). I find it rather puzzling that someone like Behe, who professes profound interest in the evolution of complexity, does not focus on the work of the leading scholar who deals with the evolution of complexity! Indeed, he does not even acknowledge the existence of his work. Behe cites many other theoreticians of evolution, such as Richard Dawkins and Elliott Sober, which is to the good, but excluding crucial research on his own problem raises doubts about the seriousness of his purpose.

When it comes to the scientific explanation of phenotypes and genotypes, the causal mechanisms of evolution have no real competition. We know that different theories of evolution appeal to different combinations of these mechanisms, where accounting for the evolution of species appears to require invoking them all. That the human species has evolved from earlier species has become apparent from the discovery of our many ancestors, including Australopithecus, Java Man, Peking Man, Neanderthal Man, and Cro-Magnon Man. None of them was as well adapted to their environment as, up to this point in time, has Homo sapiens proven to be. And only evolution has the capacity to account for them. Appeals to God or to an "intelligent designer" explain nothing. How many acts of special creation would all of this have required? More importantly, exactly how is any of this supposed to have been done?

We also know that we share more than 98% of our genes with chimpanzees. This may not guarantee that we are genetically related, but it is powerful evidence that points in that direction. Small differences in genes can make considerable differences in their manifestations, especially in view of the influence of pleiotropic and polygenic effects, where single genes affect multiple traits or combinations of genes affect single traits. Once the role of pleiotropic and polygenic effects is properly understood, it is very difficult to not recognize that there do not have to be "missing links" that fill every gap between different species. Nature can experiment and discover which combinations work and which do not on the basis of very small differences in genes that can have very great differences in phenotypes. Some "links" are not "missing".

One might well ask, how do DNA and skeletal similarities between species, for example, figure in the grand design? An "intelligent designer" could have created new arrangements for different species, yet there are underlying similarities in the skeletal structures of lizards, dinosaurs, birds and human beings. Doesn't all of this suggest the operation of the causal mechanisms of evolution of long duration rather than repeated acts of special creation? Morphological similarities, DNA comparisons, the fossil record and geological evidence support the general conception of an Earth that is about 4.5 billion years old, where life emerged around 600 million years ago and humanoid life around 5 million years ago. Appeals to an unknowable source using unspecified means does nothing to fill the gaps in our knowledge. It merely substitutes pretense for what we do not know, ignorance that in the past has proven to be temporary. Intelligent design has nothing to contribute to scientific knowledge.

2. <u>Bad Arguments for Intelligent Design</u>.

For the hypothesis of intelligent design to be taken seriously as a scientific theory rather than merely a guess or conjecture, it would have to possess predictive as well as explanatory significance. Without knowledge of the causal mechanisms used by the intelligent designer, it is not a testable theory, because it cannot pass conditions of derivability and of lawlikeness. What are the laws that were used in designing the world and its specific features? With knowledge of those causal mechanisms, however, there is no need to invoke the designer itself. The situation parallels that of classic creationist hypothesis (CC-3). Either way, there is no place in science for the intelligent designer hypothesis. It cannot satisfy conditions of adequacy (CA-1) and (CA-2), on the one hand, and even if it could, it would be unable to satisfy the condition for the exclusion of explanatorily irrelevant factors, (CA-3), on the other.

This does not mean that bad arguments for intelligent design are not multiplying rapidly. A recent column in a local paper by Jeff Marino (*Duluth News Tribune*, 19 March 2005) offers a nice example. Jeff defines "science" as restricted to what can be observed and subject to experiment by means of repeatable units within a three-dimensional world. If God (or "the intelligent designer") is unobservable or outside of our three-dimensional world, then the God hypothesis cannot qualify as scientific. But God is both. So his own definition disqualifies his own hypothesis as science. It may be unusual to discover that an argument has the qualify of being self-refuting, but this appears to be of that kind. Even if Jeff were right, he would still be wrong.

Science is not restricted to observables, but it must be possible to derive some consequences from hypotheses that are capable of being tested, under appropriate conditions, by means of observation, measurement, or experiment. The basic flaw, in fact, is not that God is unobservable but that God hypotheses have no observable, measurable, or experimental consequences for us to test. Marino also insists that evolution violates natural laws, which would be a fascinating and even devastating result, if it were true. The several examples he offers, which are either mistaken or wrong, are nonetheless instructive in reviewing attempts to defend the indefensible.

Marino's first example he calls "the law of cause and effect", namely: that every effect must have a cause. Calling this a law does not make it one, however, and this is simply a definitional truth. An event only qualifies as "an effect" because it has "a cause". In this context, he then asks, "Where did the original matter and energy come from?" Notice this is a question about cosmology, not evolution. It might be taken as asking, "Why is there something rather than nothing?", which I am willing to grant is a question for which there appears to be no scientific answer. However, if he means, as in the case of "First Cause" and "Prime Mover" arguments for the existence of God, that there had to be a first cause or a prime mover to initiate the world's history, it appears rooted in the religious belief that the world had to have a beginning in time.

No doubt, most of us tend to take for granted that the origin of the universe had to be unique and irrepeatable. The presumption that the world had to have a beginning in time, however, as the Preface explains, turns out to be indefensible on logical and on physical grounds The sequence of positive and negative integers from zero up and zero down illustrates a numerical sequence that has no beginning and no end. So the idea of a sequence having no beginning and no end is at least logically possible. And, indeed, on both "steady state" and "big bang" models, it also seems physically possible. On "steady state" models, the universe has always existed and always will exist with a globally uniform, locally varied distribution of matter and energy. It has no beginning.

On "big bang" models, the universe began with an explosion creating photons and neutrinos from electrons and protons, but cooled sufficiently for electrons to join nuclei and form atoms of hydrogen and helium, which condensed to form galaxies and stars and eventually Earth. If the universe continues to expand until there is a completely homogenous distribution of matter and energy, it ends with "a whimper". Depending upon its exact mass, however, it may reach a point at which the influence of gravity takes over, contracting matter and energy back together in a "big crunch". Given that scenario, we could be in one cycle of endless cycles of big bang/expansion/contraction/ big crunch, where there is no first and no last historical world. In this case, too, there is no need for God as a "first cause" because there is no beginning and there is no end.

Each specific initiation of a cycle in an endlessly recycling series of "big bangs", of course, could not qualify as science if its manifestations were incapable of observation, measurement, or experimentation. Even though each of those initiations is unique and irrepeatable as a singular event, it remains testable as an event of a specific kind. The detectable effects of "big bangs" thus include the recession of distant galaxies and weak radio static that fills the universe, which have been found by astronomical observation. An analysis of the early stages of the big bang are the subject of a very accessible book by Stephen Weinberg, *The First Three Minutes* (1977), whose author would be awarded the Nobel Prize in 1979. While we do not have direct access to big bangs, including our own, their occurrence, nevertheless, can still be tested based on their empirical effects.

Marino calls his second example "the law of biogenesis", which states that life only comes from life. But this is no more a natural law than the first. Indeed, it exemplifies the classic fallacy known as "begging the question", in which you assume as a premise what must be established on independent grounds. Deriving a conclusion from itself as an assumed premise, after all, is deductively valid. But that does not make such claims true! Scientists are actively investigating the conditions that are specific to the origin of life on Earth as it cooled, including water vapor and carbonic gases. Retroviruses may hold the key. The mystery is unresolved, but science is making progress. And it ought to be apparent that, however satisfying it may be subjectively, appealing to God (or to an "intelligent designer") to plug this gap makes no contribution to scientific knowledge.

Anyone with an elementary familiarity with the history of science knows it proceeds by a process of successive approximation, where hypotheses and theories that account for and explain the available evidence at one time may require revision or rejection as more evidence becomes available subsequently. There will always be gaps in what we know about the world around us. The critical consideration, here and elsewhere, is that filling gaps by appeals to an unknowable source using unspecified means is merely the substitution of one kind of ignorance for another. A sense of psychological certainly is a poor substitute for an objective explanation. It cannot satisfy any of the conditions of derivability, lawlikeness, or exclusion of irrelevant factors. It is not remotely scientific.

Marino's third example is the second law of thermodynamics, which, he says, dictates that matter and energy go from states of higher order and complexity to states of lower. This example is a bona fide law, but he overlooks that it has two formulations, either as a law for closed systems or as a law for open ones, as the Prologue explained. Systems that are reversible, such as recycling "big bang" sequences, go both ways. Viewed as a statistical law describing the behavior of systems on the average, those that tend toward the dissipation of energy globally are consistent with the emergence of greater complexity locally, which reconciles biology with physics, as we have already discovered. Thus, when it is properly understood, even the second law of thermodynamics poses no obstacles to reconciling physics with biology. Neither creation science nor intelligent design are able to derive support from the laws of physics, which are compatible with biology.

While Marino also offers quotes from famous biologists who admit our knowledge is incomplete, those do not qualify as endorsements of intelligent design. Those who understand the role of polygenic and pleiotropic effects, where many genes influence the development of single traits and single genes influence the development of many traits, recognize that transitions between organisms and species need not be smooth or continuous, but can exhibit striking differences and discontinuities, which could result from the alteration of as few as a single gene. No matter how many new fossils or so-called "missing links" science may discover, creationists can always claim that there should be more. But that would be justifiable only if evolution has to be gradual and continuous, when it can be intermittent and gappy. Some gaps are the way things are!

The most irresponsible ingredient of Marino's position, however, is his claim that evolution asserts upward progression "by chance". He acknowledges none of the eight causal mechanisms of evolution, including genetic mutation, natural selection, sexual reproduction, genetic drift, sexual selection, group selection, artificial selection, and genetic engineering. These mechanisms are the lawful basis for evolutionary science that make its hypotheses both explanatory and testable and, in relation to particular historical conditions, predictive as well. This is roughly on a par with Walter Brown's claim that evolution is a theory without a mechanism, which he contradicted when he further asserted that its only mechanisms are genetic mutations and natural selection.

Intriguingly, the foundation for Marino's position about "chance" may be found in arguments presented by other proponents of intelligent design. An interesting paper by Reverend Bill McGinnis entitled, "Intelligent Design Can Be Tested Scientifically", (LoveAllPeople.com), correctly remarks that intelligent design is a concept of religion or of philosophy rather than of science, which is consistent with the outcome of our investigations. He offers the fascinating suggestion that, insofar as the world is the product of Intelligent Design, it is the obligation of Science to understand its results:

> Science is only a means to understanding that which was created by Intelligent Design, . . . , where it is not the responsibility of Intelligent Design to follow the methods of Science, but the responsibility of Science to understand and explain that which was created by Intelligent Design.

No doubt, that McGinnis obviously "begs the question" does not require comment; but an argument he presents based upon statistical probabilities deserves analysis.

According to McGinnis, if we ascribe statistical probabilities—which he does not otherwise define—to "the earth itself, with its perfect atmosphere to sustain life; perfect temperature for life; perfect cycle of night and day; perfect cycle of seasons; perfect soil for growing crops; fish to eat in the rivers and oceans; animals to eat on earth; perfect amount of water for drinking, . . . ", and so forth, then we will discover that, for all of these properties to have come together at the same time by chance is "about one in a million zillion", drawing the conclusion, "So even if we do not consider the staggering complexity of biological life, it is statistically impossible that our earth simply happened by chance, or by any imagined combination of pre-existing natural processes". And this, he claims, proves that it must be a product of Intelligent Design!

The argument, alas!, suffers from serious flaws. First, his conclusion tacitly shifts from overwhelming improbability ("about one in a million zillion") to what he calls "statistical impossibility", which obviously does not follow. Events that are extremely improbable are not therefore impossible, where his use of "statistical impossibility" is sufficiently ambiguous to take in the unwary. Second, like Marino, McGinnis ignores the eight causal mechanisms of evolution, including genetic mutation, natural selection, sexual reproduction, genetic drift, sexual selection, group selection, artificial selection, and genetic engineering, which produce outcomes that are not the products of chance; at least, they are not the products of chance as coincidental or accidental happenings. Third, he appears unable to appreciate that the actual must be possible, where, since we have evolved on Earth, that must have been possible, no matter how improbable. Unless the conditions for life and evolution had been favorable, we would not be here.

A striking feature of this argument is that it ignores calculations that are intended to supply estimates of the possible existence of other species throughout the universe. What is called "the Drake equation", for example, adopts educated guesses about the average rate of star formation, R, which is assigned the value 10; the fraction of stars that could contain planetary systems, fp, which is assigned the value of .1; the number of planets per star that are Earth-like, ne, which is assigned the value of 1; the fraction of Earth-like planets upon which life could develop, fl, which is also assigned the value of 1. Since our galaxy, the Milky Way, contains around a hundred billion stars, there would appear to be ample opportunities for life to have developed elsewhere in the universe (White 1999, Chapter 2), which completely undermines this line of argument.

An influential variation has been advanced by William A. Dembski, who has been a research professor in the conceptual foundations of science at Baylor University. As H. Allen Orr ("Devolution: Why intelligent design isn't", The New Yorker 30 May 2005), has observed, Dembski suggests that complex objects must be the result of intelligence if they are the products neither of chance nor of necessity. So Dembski broadens the alternatives from "chance versus intelligence" (McGinnis) to "chance versus necessity versus intelligence" (Dembski). The kind of necessity he has in mind, presumably, is physical necessity, which occurs when effects are brought about by initial conditions and natural laws. But there is a hidden ambiguity here as well, since laws of nature can be deterministic or indeterministic, as we discovered in earlier chapters of this book. Deterministic laws are those for which same cause/same effect always obtains, while indeterministic laws are those where same cause/same probable effects obtain.

It should immediately be apparent that, since evolution in accordance with laws of either kind would govern outcomes that occur by necessity, as long as its effects are brought about by initial conditions and natural laws, there is nothing involved here that dictates a role for intelligence. We have already found it is a mistake to regard the effects of the eight causal mechanisms of evolution as matters of chance in the sense that matters here—even as indeterministic causal processes—because their outcomes are not merely the results of coincidence or accident, as Chapter 4 explains. We are left with an apparent choice between necessity and intelligence. But what occurs by law happens by necessity in the appropriate sense. So nothing about the origin of species dictates intelligence must play a role. Demski only makes a case for intelligence by treating chance as coincidence and necessity as determinism. Absent those question begging assumptions, his conclusion does not follow. And this means that the theory of intelligent design remains in search of an intelligent defense.

3. Intelligent Design before the Court of Law.

The intellectual shortcomings of the theory of intelligent design has not inhibited Christian fundamentalists from advancing it as a candidate for inclusion in public school systems in many parts of the country. For reasons that I shall consider in what follows, they have insisted that it be taught as part of the science curriculum, which raises serious questions about its standing the proponents of that doctrine do not appear to understand. As this chapter has explained, intelligent design is not a scientific hypothesis and therefore does not belong in the science curriculum. But philosophical analysis and political actions are disparate activities, where one does not often constrain the other. Some school boards have moved to have it included in their public school science curriculum, which, when challenged, has moved the controversy from the domain of intellectual inquiry into the public courts of law.

The case that captivated the nation involved the decision by the Dover Area School District of Pennsylvania, which, in October 2004, declared that, beginning in January 2005, intelligent design would be included in the ninth grade biology curriculum. A group of parents affected by the decision filed a suit alleging that this decision was an effort to establish religion in violation of the first amendment of the Constitution, which guarantees not only freedom of speech and of the press but freedom of religion. The case was decided in December 2005 by Judge John Jones, who handed down a 139-page decision exploring both legal and intellectual dimensions of the case (Jones 2005). A summary overview has been published by Jason Rosenhouse (Rosenhouse 2006), but here I want to examine the foundation for the decision to exclude intelligent design from the biology curriculum in Dover for the purpose of evaluating whether it appears to have been properly decided.

In his decision, the judge observes that Christian fundamentalism arose in the nineteenth century as a response to social changes, new religious thinking, and the advent of Darwinism as a naturalistic explanation of the origin of species on the basis of natural selection. Motivated by religious concerns, various groups attempted to influence their state legislatures to restrict instruction in evolution as part of the public school curriculum, culminating in the criminal prosecution in 1927 of a public school teacher named John T. Scopes in Tennessee, where the judge excluded expert scientific testimony from the defense. Pitting two of the nation's greatest orators, Clarence Darrow for the defense and William Jennings Bryan for the prosecution, the case created a sensation. While Scopes was found guilty of teaching evolution in violation of a Tennessee law and assessed a $100 fine, the state was widely ridiculed for having "monkey laws" (Berra 1990, Ch. 5).

The next major decision occurred in 1968, when the Supreme Court ruled that an Arkansas law prohibiting the teaching of evolution was unconstitutional. The proponents of Biblical views then promoted "balanced treatment" legislation that granted equal-time to religious and to non-religious viewpoints, but that approach was found to be in violation of federal law in 1975. This outcome eventually lead those who wanted to promote a return to "fundamentals" and their instruction in the classroom to adopt another tactic by offering scientific-sounding language for thinly-disguised Biblical accounts of the origin of life in the form of what is called "creation science", including the doctrines of a young-Earth, of a world-wide flood, and of the non-emergence of new species from previously existing species. The rationale, no doubt, was in the spirit of the adage, "If you can't lick 'em, join 'em"!

In an important decision in 1987, however, the Supreme Court ruled that the Establishment Clause against the establishment of government-sponsored religion was violated by teaching creation science, which turned the Appeals Court ruling of 1975 into national policy. According to that clause, "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof", an injunction extended to the states by the Fourteenth Amendment. The appropriate standard for determining whether the Dover policy is Constitutional, as both sides agreed, was set forth in a 1971 decision known as "the Lemon test", according to which a policy or practice is unconstitutional if the defendant's primary purpose was to advance religion or the adoption of the School Board's new policy had the primary effect of advancing religion. The Court found that it failed this standard.

An important part of the evidence on which the Court rendered its verdict was testimony that the members of the School Board had not only acknowledged that they wanted to put religion back into the schools but that they had manipulated the science curriculum by threatening to withhold funding for a biology textbook unless another book entitled Of Pandas and People (Davis and Kenyon 1989/1995) was also made available to students. There was ample testimony that the members of the Board had more or less consciously, through their deliberations, decided to substitute the words "intelligent design" for the word "creationism". Not only was there legal proof that the Board's motivation was primarily religious but the judge found that its members repeatedly lied about their purpose in embracing Pandas and in adopting policies that had the effect of the endorsement of a specific faith.

The history of the Board's decisions leaves scant room for doubt on the purpose for its actions. On 18 October 2004, by 6-3, it adopted the following resolution:

> Students will be made aware of gaps/problems in Darwin's theory and of other theories of evolution including, but not limited to, intelligent design. Note: Origins of Life is not taught.

In fact, the subtitle of Pandas is “The Central Question of Biological Origins”. Presumably, what is meant by this brief passage is that students will be made aware of gaps/problems in Darwin's theory and made aware of other theories of evolution including, but not limited to, intelligent design. It does not state that the students will be made aware of gaps/problems with these alternative "theories of evolution", including intelligent design, perhaps the most important of which is whether intelligent design properly qualifies as a scientific theory.

The Board mandated that, commencing in January 2005, ninth grade biology teachers would be required to read a four-paragraph statement singling out evolution as a subject in which instruction and standardized tests are required by the state. It included three more paragraphs, the first of which is as follows:

> Because Darwin's Theory is a theory, it continues to be tested as new evidence is discovered. The Theory is not a fact. Gaps in the theory exist for which there is no evidence. A theory is defined as a well-tested explanation that unifies a broad range of observations.

This was not the original wording proposed by the teachers, acting under duress, who had suggested that Darwin's theory ought to be described as "the dominant scientific theory", which the Board edited out. The teachers also had included the word "yet", where the third sentence would have read, "Gaps in the theory exist for which there is yet no evidence." The observation that there is "a significant amount of evidence" supporting the theory was also proposed but not included.

From a philosophical point of view, the first paragraph appears more or less innocuous. The term "fact" can be construed either as having the same meaning as "true"—in which case, the sentence, "The Theory is not a fact", presumably, is intended to assert that it is not true—or as having the same meaning as "proven true"—in which case, the sentence, "The Theory is not a fact", presumable, asserts that it has not been proven to be true. Since the last sentence defines "a theory" as "a well-tested explanation that unifies a broad range of observations", putting the first sentence together with the last yields the claim that Darwin's theory is a well-tested explanation that unifies a broad range of observations, albeit one that, on the more charitable interpretation of the text, has not been proven to be true.

Although the teachers' recommendations would have made this paragraph a bit stronger and more accurate, there is not a lot to fault here, notwithstanding the suspicion that the Board would have liked to have used a weaker definition, according to which a theory is merely a speculation, conjecture, or guess. There is yet another sense that defines a theory as an empirically-testable, explanatory hypothesis, whether or not it has ever actually been tested. Since a theory cannot have been "well-tested" without being "testable", however, apart from ambiguity about the meaning of "fact", this first paragraph does not raise serious problems for scientific theories. It does, however, raise potentially serious problems for an alternative that is not well-tested or does not unify a broad range of observations. The Board may not have recognized that its own standard could defeat its purpose.

The second paragraph, by comparison, offers a description of intelligent design that raises more serious questions. The full text of that paragraph reads as follows:

> Intelligent Design is an explanation of the origin of life that differs from Darwin's view. The reference book, Of Pandas and People, is available for students who might be interested in gaining an understanding of what Intelligent Design actually involves.

The use of the term "explanation" absent the qualification "scientific" equivocates between the weak sense of a subjectively satisfying account and the far stronger sense of an adequate scientific explanation. The former, after all, might or might not be able to fulfill conditions of derivability, lawlikeness, and the exclusion of irrelevant factors imposed by the latter. Insofar as our previous discussion has found that the tenets of creation science are either empirically untestable or seem to be false, it runs the risk of being unable to qualify as "a well-tested explanation that unifies a broad range of observations" and therefore not qualify as "science".

The third paragraph may not initially appear to be important, since it suggests that biology students should "keep an open mind". Here is the language it used:

> With respect to any theory, students are encouraged to keep an open mind. The school leaves the discussion of the Origins of Life to individual students and their families. As a Standards-driven district, class instruction focuses upon preparing students to achieve proficiency on Standards-based assessments.

The Court would hear evidence that, while ostensibly encouraging their students to "keep an open mind", the only alternative offered to evolution is not scientific but religious in the form of intelligent design; that by encouraging their students to discuss this with their parents, students can reasonable infer that the District's attitude is religious; and that this admonition thereby protects the alternative to evolution from critical scrutiny, which was perceived as threatening by the Board.

Serious problems developed during the trial about the scientific accuracy of the Board's preferred text. The only expert on paleontology, for example, testified that Pandas systematically distorted and misrepresented important tenets of evolution, including cladistics (the classification scheme for biological species), homology (the comparison of parts between organisms of various species), and exaptation (where a structure that served one function could change across time). Exaptation is very important in evolutionary theory, because, as in the case of the fins of fish evolving into fingers and bones and legs and toes for land-mobile animals, is a mechanism for the emergence of new species from old reflecting macro-evolution as a kind of micro-evolution across time. Other testimony similarly established that Pandas

> distorts or misrepresents evidence in the fossil record about pre-Cambrian-ear fossils, the evolution of fish to amphibians, the evolution of small carnivorous dinosaurs into birds, the evolution of the mammalian middle ear, and the evolution of whales from land animals.

Even the most important witness for intelligent design, Michael Behe, admitted that Pandas misinforms its readers about basic features of standard evolutionary theory.

Expert testimony during the trial supported the conclusions that the purported arguments for intelligent design do not satisfy the conception of scientific theories as testable hypotheses based upon natural explanations. As the opinion remarks,

> ID is reliant upon forces acting outside of the natural world, forces that we cannot see, replicate, control or test, which have produced changes in this world. While we [the Court] take no position on whether such forces exist, they are simply not testable by scientific means and therefore cannot qualify as part of the scientific process or as a scientific theory.

Indeed, three witnesses for the defense, including Behe, testified that, in order for intelligent design to satisfy the conditions that are requirements to qualify as science, it would be necessary to "change the ground rules" or otherwise "broaden the definition" to allow consideration of supernatural forces to qualify as science.

Even Behe's definition of "irreducible complexity" turns out to suffer from what appears to be a fatal defect. Expert witnesses not only testified that his concept depends upon overlooking or ignoring established mechanisms of evolution but that his conception, according to which a system is "irreducibly complex" when a precursor "missing a part" is by definition nonfunctional, what he should mean is that a precursor "missing a part" would function differently than it would when the part is present. This could even be said of the bacterial flagella, which might not function as a rotary motor when parts are missing but might instead serve another function, such as that of a secretory system, which, given the phenomena of exaptation, means Behe's approach no longer has force in criticizing evolution.

Indeed, another expert testified that the evolution of the mammalian middle ear from a jaw bone as an example of exaptation was a transition in functions of parts across time that would be impossible, by definition, on Behe's conception. This resonates with the contention by creation scientists that micro-evolution, but not macro-evolution, is possible, as though it were a matter that could be settled by stipulation. In both cases, the evidence of evolution contradicts the prohibition against exaptation (by Behe) and the constraint on macro-evolution (by creation scientists). Questions about the origin of life and the evolution of species are empirical questions and cannot be answered simply by stipulation!

Although the Defendants persistently asserted that instruction on intelligent design was instituted in order to improve science education and encourage the exercise of critical thinking, the Court was not impressed. It found that none of the actions to be expected, if that was the Board's purpose, were pursued, such as consulting scientific publications, contacting scientific organizations, or even soliciting the advice of the District's own science teachers. On the contrary, the Board acted on the basis of legal advice from two organizations with dedicated religious, cultural, and legal commitments. Indeed, most of the members of the Board admitted that they had no clear understanding of intelligent design as an hypothesis or theory, which undermined the credibility of the defense position. The Court concluded the professed secular purposes were insincere and a sham.

Among the indicators the Court cited as evidence that intelligent design is not a scientific theory were that studies of intelligent design have not been published in peer-reviewed journals, it has failed to generate a research program devoted to developing and testing the theory it represents, and it has not gained adherents in the scientific community. Thus, the application of the Endorsement and the Lemon tests to the actions by the Dover School Board demonstrated to the Court that the Board's policy on intelligent design violates the Establishment clause and does not qualify as constitutional. "Our conclusion today is that it is unconstitutional to teach ID as an alternative to evolution in a public school science classroom", it so ruled.

One of the most fascinating aspects of the case emerged in the form of what the Court described as a "contrived dualism" advanced by creation scientists and by Christian fundamentalists that "one must either accept the literal interpretation of Genesis or else believe in the godless systems of evolution". On this approach, any problems with evolution count as evidence for creationism. This might better be described as a "specious bifurcation", which divides an issue along lines that are not theoretically justifiable and treats them as definitive. The Roman Catholic Church, for example, reconciles science and religion by adopting the position that God created the world and various forms of life using evolution. God could have used any means he wanted to create the world and forms of life, but those that he chose were the mechanisms of evolution. This combines evolution with theism.

The Court's decision was exceptionally clear and direct on this point. According to the judge, a common misconception underlies much support for their position:

> Both Defendants and many of the leading proponents of ID make a bedrock assumption which is utterly false. Their presupposition is that evolutionary theory is antithetical to a belief in the existence of a supreme being and to religion in general. Repeatedly in this trial, Plaintiffs' scientific experts testified that the theory of evolution represents good science, is overwhelmingly accepted by the scientific community, and that it in no way conflicts with, nor does it deny, the existence of a divine creator.

It may be this false presupposition that drives think tanks, such as The Discovery Institute, to advocate the "defeat of scientific materialism and its destructive moral, cultural, and political legacies" and attempt to "replace materialistic explanations with the theistic understanding that nature and human beings are created by God." While some forms of materialism may be antithetical to belief in supreme beings, there is nothing about evolution as such that implies those forms of materialism.

Thus, if the eight causal mechanisms of evolution are adequate to explain and to predict the course of evolution relative to information about particular events during the world's history, then those laws belong in the science curriculum. But not the appeal to God, an hypothesis that does not qualify as scientific. It would not be inappropriate, however, to include the intelligent-design hypothesis along with multiple other views about the origin of life in courses dealing with religious beliefs. A great deal of provincialism, bigotry, and intolerance are associated with fundamentalism in America. Courses in cultural anthropology and in comparative religions would have an enlightening effect and provide our students with a far broader education. But we should not substitute ideology for evolution. Render unto God that which is God's but also render unto Darwin that which is Darwin's.

CHAPTER 4: IS EVOLUTION PROGRESSIVE?

The species of creationism that we have considered, including classic creationism and creation science, are not exhaustive of the genus. Henry Morris, for example, offers an alternative version in his Scientific Creationism (1974, p. 12). Morris distinguishes the "evolution model" from the "creation model":

EVOLUTION MODEL	CREATION MODEL
Continuing naturalistic origin	Completed supernatural origin
Net present increase in complexity	Net present decrease in complexity

Table IV. Morris's Evolution and Creation Models.

At least two aspects of these "models" should be immediately apparent: first, that the distinction between "naturalistic" and "supernaturalistic" origins, causes, or creators implies that the evolution model may be scientific, but the creation model cannot be; and, second, that there appears to be heavy reliance upon consideration related to the second law of thermodynamics, except that now increases in entropy are identified with decreases in complexity and vice versa.

We discovered already in the Prologue that global increases in entropy were consistent with local decreases in entropy. It should come as no surprise that the same must hold true for complexity, when complexity is identified with entropy. Thus, local increases in complexity are compatible with global decreases in complexity. A closely related idea is that any cause must be greater than its effects. When we think of the (natural) world as a totality, this principle seems to imply that it must have a greater (supernatural) cause or creator. Many examples—including the zygote that develops into a human being, the acorn that develops into a mighty oak, and such—suggest that this principle does not hold for open systems. But even were this principle to hold for closed systems, what follows is not that creationism is science but that science cannot study creation.

The evolution of complexity arises again and again in creationist literature, ranging in forms from gross falsehood to subtle distortion. Walter Brown (19-96, p. 15), for example, maintains that evolution "is a theory without a mechanism [to bring about more complex from less complex forms of life]". Those who have read Chapter 2, no doubt, will recognize how gross a falsehood this really is. Elsewhere (Brown 1996, p. 172), however, he offers the following diagram:

Figure 11. Comparison of Creation and Evolution.

which purports to be a comparison of creation and evolution on the complexity scale. What may be most striking about this "comparison", however, is its scale. The top-line represents a time-line of about 10,000 years for creationism, while the bottom-line represents a time-line of about 5 billion years for the age of Earth. If the bottom-line were drawn to the same "scale" as is the top line, then the bottom-line would turn out to be more than 15 miles long!

The difference, of course, is that the slope that represents increasing complexity for evolution would be very slight, not at all as it is represented here. More interesting than this sleight-of-hand, however, is that creation models quite generally assume that the moment of creation was the moment of greatest complexity or of greatest perfection; consequently, whatever comes thereafter must reflect a loss of complexity or a diminution of prefection through a process of deterioration. It implies that primitive humans were more advanced than modern humans, that earlier forms of life were more developed than later forms of life, and so on. This may sound highly counterintuitive, but science cannot be constrained by intuition. If evolution promotes progress, then we would expect the opposite to be the case, where modern humans would be more advanced than primitive humans and later forms of life more developed than earlier forms of life. If evolution always brings about optimal solutions to problems of adaptation, then evolution must be progressive. But whether that is the case remains to be seen. Perhaps evolutionary progress is a myth.

1. The Tautology Problem.

An extremely interesting collection of papers on evolution and optimality has focused attention on the nature of the evolutionary process. In The Latest on the Best, some who believe that evolution should be viewed as an optimizing process join issues with others who do not. As the editor observes,

> A number of the contributors from the earlier parts of the anthology . . . argue forcefully for the difficulties with any general assumption that evolution generates optimal adaptation. On the other hand, a number of the contributors involved in applications of optimality analysis are extremely enthusiastic about the potential benefits of this approach. (Dupre 1987, p. 22).

Indeed, as he also observes, even within biology itself there appears to be more enthusiasm for applications of optimality theory than there is for the conclusion that evolution itself is an optimizing process (Dupre 1987, p. 22).

In this section, we will investigate this issue by exploring the differences between optimizing and satisficing approaches toward understanding evolution. In the process, we shall have to deal with the claim that satisficing has no clear meaning in evolutionary theory. By focusing upon the probabilistic character of fitness, however, it ought to be possible to shed light upon these difficult problems, since neither of the two most adequate accounts of probability as a physical property—the frequency interpretation and the propensity interpretation—support the conception of evolution as an optimizing process. The general conception that emerges from these reflections is that selection takes place relative to adaptations that are "good enough" to sustain survival and reproduction. While optimizing theory can play a valuable heuristic function in suggesting hypotheses about the design of organisms, satisficing theory affords a more adequate framework for understanding the broadest and deepest features of evolution as a process.

The issues encountered within this domain are closely related, if not identical, to those that revolve about the suitability of the phrase, "survival of the fittest", as a general depiction of the evolutionary process. As Ernst Mayr observes, Charles Darwin borrowed the phrase from Herbert Spencer (Mayr 1982, secs. 386 and 519, for example). After all, if those who survive are the fittest, then the process of natural selection must invariably produce increasingly fit organisms across time, where there can be no basis for doubting whether the latest must be the best. If biological evolution is a process that invariably induces the survival of the best, then it must be impossible for the latest not to be the best.

Although Mayr is concerned that the phrase, "survival of the fittest", may be merely tautological as a claim that cannot be false by virtue of its meaning, when properly understood, it not only appears to be no tautology but may even be empirically false. The problem is to separate the meaning of "fitness" from the meaning of "those who survive", which may be accomplished by viewing "fitness" as a probabilistic tendency to survive and reproduce. (A closely related view is proposed by Sober 1984, Ch. 2.) When the exact character of this probabilistic tendency is rendered more precise, however, it then becomes evident that "high fitness" may or may not be associated with increased frequency for survival and reproduction.

Although we shall pursue more exact characterizations in the following, it may be worthwhile to provide a general sketch of the differences which tend to distinguish "optimizing" from "satisficing". These notions are derived from decision theory, where optimizing models characterize systems that always select solutions to problems that are at least as "good" as any other solution; satisficing models, by comparison, characterize systems that select solutions to problems that are "good enough" but which may have alternatives that are even better. Judgments of goodness (good, better, and best), of course, are relative to some presupposed set of values or utilities. (Michalos 1973 provides an illuminating introduction to the alternatives.)

When these ideas are applied within the context of evolutionary theory, however, an important distinction must be drawn. Decision theory is normative and prescribes how people should act, whereas evolutionary theory is explanatory and describes how nature works. While normative theories do not have to be abandoned or be repaired when they do not describe the way things are, explanatory theories in science must be abandoned or be repaired when they do not describe the way things are. If nature does not operate in conformity with optimizing models, therefore, then that counts against their standing as scientific theories, although optimizing models for decision making are not thereby disqualified, even if no one acts in conformity with them.

The values or utilities that are commonly assumed to possess evolutionary significance, no doubt, are those of survival and reproduction, especially offspring production equal to or greater than replacement level. Relative to this measure of utility, organism x may be supposed to have "higher fitness" than organism y, with respect to a specific environment, for example, when x has greater probability of offspring production than y, with respect to that environment. As Elliott Sober has observed, there are good reasons to resist the temptation of identifying "fitness" in this sense with actual reproductive success, since this property seems to be best envisioned as a disposition toward reproduction in lieu of its actual obtainment (Sober 1984, pp. 43-44).

Since nature cannot be expected to select solutions to problems that are unavailable, whether or not evolution should be viewed as an optimizing or as a satisficing process must be relative to the available gene pool and the available environment rather than relative to every possible gene pool and every possible environment. If these stronger conceptions are taken to describe kinds of "global optimality", then only weaker conceptions of "local optimality" deserve consideration here. Evolution would appear to qualify as an optimizing process in the appropriate sense, therefore, so long as selection produces organisms with fitness values that are equal to or greater than those of parent generations across time, relative to these constraints.

To ascertain whether or not evolution ought to be viewed as an optimizing or as a satisficing process, therefore, it is essential to secure the right kind of non-tautological connection between "fitness" and "those who survive" and then to determine if the resulting process is optimizing, satisficing, or something else instead. If the less fit sometimes survive and reproduce while the more fit do not, for example, then surely that is something that evolutionary theory ought to be able to explain. Ultimately, it seems, evolution needs to be understood by means of the repetitive operation of "single case" tendencies for particular traits to be selected under specific (possibly unique) conditions utilizing the idea of single-case propensities.

This conception, however, should not be confused with the notion of single-step selection in the sense that Richard Dawkins has introduced, where entities or organisms are sorted once and for all (Dawkins 1986, pp. 45-46). Single-case propensities as properties of specific events are thus compatible with cumulative selection operating across time, while single-step selection is not. Indeed, as Dawkins himself has observed,

> There is a big difference . . . between cumulative selection (in which each improvement, however slight, is used as a basis for future building), and single-step selection (in which each new "try" is a fresh one). If evolution had to rely on single-step selection, it would never have got anywhere. (Dawkins 1986, p. 49)

The application of the single-case propensity interpretation to the problem at hand, therefore, should not be rejected on the ground that evolution is a cumulative rather than a single-step process. That would be unjustifiable.

In their valuable paper on optimality theory in evolutionary biology, G. A. Parker and J. Maynard Smith, both noted for their contributions to this domain, consider the question, "Can natural selection optimize?" In their view, optimization by natural selection requires special conditions, because the potential for optimization by means of natural selection depends on gene expression (the phenotypic manifestations of underlying genes) and on mechanisms for genetic change in populations, such as the rate at which natural selection has the capacity to alter genetic structure, the amount of additive genetic variance present at the start of selection, gene flow (for example, that arising from immigration), the rate at which conditions change, and random effects such as genetic drift. Moreover,

> Most optimality models assume that strategies reproduce asexually, or if the model is mendelian, that the optimal prototype can breed true. Pleiotropy (genes affecting multiple traits) is assumed not to operate and strategies are allowed to replicate independently of each other. Obviously selection cannot produce an optimum if there is no way of achieving it genetically, but for some models, it is clear that selection will get as close to the optimum as the genetic mechanism will allow. (Parker and Maynard Smith 1990, pp. 30-31)

When natural selection occurs in asexually reproducing or true breeding populations within stable environments that endure unchanged for periods of time which are sufficient for optimal traits to emerge, optimizing models of evolution may be appropriate in the absence of pleiotropic effects. In situations of the kind that characterize most natural as opposed to artificial environments, however, conditions like these are not realized.

Indeed, even Parker and Maynard Smith themselves observe that the emergence of optimal traits is not easily arranged: "infinite time and infinite populations would be needed to achieve the [evolutionary] peak itself" (Parker and Maynard Smith 1990, p. 31). But this means that optimality theory provides an idealized conception of what might happen in the limit as a special case rather than a descriptive explanatory framework for understanding evolution under normal conditions. A satisficing model, by comparison, provides a foundation for viewing the emergence of optimal adaptations as a possible "long run" product of what has to be understood as a "short run" process that applies to finite populations and finite times.

The tendency in evolutionary theory to fixate on the long run rather than on the short run or on the single case has a parallel in the theory of probability itself, where long-run frequency conceptions have prevailed until recently. The emergence of the single-case propensity conception within this context thus promises to shed light on natural selection. Indeed, from the perspective afforded by the single-case propensity conception, appeals to the ultimate outcome of long-run processes appear to have the general character of teleological causation, whereas appeals to the proximate outcomes of single-case processes appear to have the general character of mechanistic causation instead (cf. Fetzer 1988a).

If optimal adaptations only emerge as a special limiting case under quite idealized conditions, moreover, it should be evident that the products of evolution that emerge during any merely finite segment of the world's history are never optimal, unless allowance is made for their production as a consequence of fortuitous conditions (or by chance). But if this is indeed the case, then satisficing appears to be the strongest theory that generally applies. While Parker and Maynard Smith consider "the comparative method" and "quantitative genetics", they do not consider satisficing approaches at all. Once the properties of satisficing models are properly understood, however, their appeal should become obvious.

Evolution appears to be an inherently probabilistic process, at least to the extent to which sexual selection, sexual reproduction, genetic drift and the like involve probabilistic elements. Two interpretations of probability might apply here, the long-run <u>frequency</u> interpretation, which identifies probabilities with limiting frequencies in infinite sequences, and the single-case <u>propensity</u> conception, which identifies them with the strengths of causal tendencies to bring about particular outcomes on individual trials. While we have already discovered that optimal adaptations as a result of natural selection only occur (other than by chance) over the long run, perhaps evolution can still be viewed as a probabilistically optimizing process.

Suppose we define "fitness" in terms of probability of survival and reproduction at a level equal to or greater than replacement level *R* within the specific environment *E*. Thus, if the probability for survival and reproduction *R* within environment *E* is *greater* for individual *x* than it is for individual *y*, then there are properties of *x* (which here are not specified) in relation to the properties of *y* (also unspecified) such that x is *more fit* than *y* with respect to R within *E*. Then it might be plausible to hold that less fit traits will decrease in frequency across time or that less fit traits will eventually no longer be "good enough" to sustain survival and reproduction. But when such claims are subjected to close scrutiny in relation to the frequency and the propensity alternatives, it becomes clear that they cannot be sustained. Even when claims about *what will probably occur* displace claims about *what will occur*, these probabilistic alternatives do not support the idea of evolution as an optimizing process.

On the frequency interpretation of probability, for example, the probability for *B* in relation to *A* equals *n*—that is, *P*(*B*/*A*) = *n*—if and only if the limiting frequency for *B* in an infinite sequence of *A* trials equals *p*. The relative frequency for *B* in finite segments of *A* trials can arbitrarily vary from *n*. Whenever *P*(*B*/*A*) = *n*, of course, *P*(~*B*/*A*) = 1 - *n*. Even if *n* is high and 1 - *n* is low, therefore, outcomes with low probability can occur, even with high relative frequency, across any finite segment of the world's history. While the frequency interpretation guarantees convergence between probabilities and frequencies over the long run, it does not guarantee convergence of probabilities and frequencies in the short run.

If we identify outcomes of kind B with offspring production at equal to or greater than replacement level relative to environments of kind A, then it should be apparent that, even when that outcome has high probability, the result of offspring production at less than replacement level may still occur, over the short run, in relation to the frequency approach. Moroever, if we identify outcomes of kind B instead with the production of offspring whose own fitness values are equal to or greater than those of their parents, then it should still be apparent that, even when that outcome has high probability, the result of the production of offspring whose own fitness values are less than those of their parents may likewise occur.

On the propensity interpretation of probability, matters are even worse, since, as a property of each single trial of those conditions, even infinitely many repetitions of those conditions cannot guarantee that an outcome will occur with a limiting frequency that equals its generating propensity. This interpretation maintains that the probability for B in relation to A equals n if and only if there is a causal tendency of strength n for conditions A to produce (or "bring about") an outcome of kind B on any single trial of that kind which might be represented formally employing the (probabilistic) causal conditional, ". . . =n=> ___", where "(x)(t)(Axt =n=> Bxt*)" means the strength of the tendency for a single trial of kind A at t to bring about outcome B at t* is n. The conditions that specify a trial of kind A can be broadly construed to include conceptions and gestations that endure over intervals of time so long as every property that is relevant to the outcome is considered (Boyd 1997).

The ontological difference between the frequency and the propensity interpretations is that one makes probabilities properties of infinite sequences while the other makes them properties of singular trials. The advantage of the propensity approach, from this point of view, is that, if the world's history is merely finite, the existence of probabilities as propensities remains secure, while the existence of probabilities as frequencies is problematical. The logical connection that obtains between probabilities and frequencies on the frequency approach, however, is completely severed by the propensity approach, since, even over infinite sequences of trials, the limiting frequency for outcome B might deviate arbitrarily from the propensity for B.

2. Does Evolution Optimize?

Three possible foundations for the conception of evolution as an optimizing process have been considered, none of which provides suitable support. The first came from Parker and Maynard Smith's discussion of the conditions that are required for natural selection to produce optimal adaptations. When natural selection occurs in asexually reproducing or true breeding populations within stable environments that endure unchanged for periods of time that are sufficient for optimal traits to emerge, optimizing models of evolution can be applied in the absence of pleiotropic effects. Most natural situations do not satisfy the conditions, however, and optimal adaptations require infinite populations and time.

This means that optimality theory provides an idealized conception of what might happen in the limit as a special case rather than a descriptive explanatory framework for understanding evolution under normal conditions. Moreover, appealing to probabilistic properties does not appear to salvage the situation. Under the frequency interpretation, higher fitness yields higher frequencies of survival and reproduction (or higher fitness in offspring generations) only by assuming infinite sequences of trials. Under the propensity interpretation, higher fitness affords no guarantee of higher frequencies of survival and reproduction (or higher fitness in offspring generations) even if infinite sequences are assumed.

Probabilistic factors are an extremely important source of difficulty for the conception of evolution as an optimizing process, especially in relation to the mechanism of natural selection, but they are not the only source of difficulties. Others include different ways in which various environments can be subject to change, which shall be referred to here (somewhat arbitrarily) as "random happenings" and as "accidental occurrences" as follows:

(i) Random happenings (such as stray bullets, terrorist bombs, and the AIDS virus) are micro properties which vary within macro environments. None of us has greater fitness in coping with them as a rule, but only some of us actually encounter them. Organisms with high fitness within macro environments may not survive and reproduce due to their influence, while organisms with low fitness within those macro environments may do so.

(ii) Accidental occurrences (including large asteroids hitting the Earth) are events that bring about major alterations in the macro environment, which we otherwise tend to treat as a "closed system". Once again, organisms with high fitness within macro environments may not survive to reproduce due to their influence, as may have happened with the dinosaurs. Other organisms of lower fitness, however, might nonetheless survive, etc.

The point of introducing these concepts is not to suggest that evolutionary theoreticians have been oblivious to the role of random factors or of accidental occurrences as they have been defined above (which Arnold and Fristrup 1982, among others, have acknowledged), but rather that they indicate historical difficulties in securing the conditions that must obtain for optimizing models to apply. If the conditions under which natural selection operates are constantly changing due to the influence of random factors and of accidental occurrences, then reliance upon models that presuppose infinite populations across infinite times relative to unchanging environments cannot possibly provide an adequate foundation for describing or explaining the actual course of the evolutionary process.

Perhaps the most important difference between optimizing and satisficing theory, from this perspective, is that optimizing theory implies that, over the long run, if not the short, organisms become increasingly more and more fit as a result of an inevitable "winnowing process" that takes place within constant environments. Satisficing theory, however, carries no such implication, accepting instead that sometimes higher fitness may not increase in relative frequency across time, while lower fitness does. The satisficing approach, nevertheless, provides a foundation for viewing the emergence of optimal adaptations as a possible "long run" product of what has to be understood as a "short run" process that applies to finite populations and finite times, under certain highly fortuitous conditions.

Other authors have proposed that the propensity interpretation of probability might provide an appropriate foundation for understanding the nature of fitness, especially Susan Mills and John Beatty (Mills and Beatty 1979). Their conception, however, does not properly represent either the context-dependence of propensities or their character as single-case causal tendencies. Consequently, they encounter difficulty in developing an adequate account of fitness as a propensity, which leads them to reconsider the adequacy of this approach (Beatty and Feinsen 1989). The difficulties they consider, however, appear to be problems with the notion of fitness rather than problems with the notion of propensities, when that conception is properly understood (cf. Fetzer 1988).

Some of the most important reservations that have been raised concerning propensities, moreover, concern their formal properties. Beatty and Feinsen (1989), for example, assume that propensities are properly formalized as conditional probabilities and that there must be a positive correlation between high fitness and reproductive success. These assumptions, which others, such as Alexander Rosenberg and Robert Brandon, have endorsed, provide a misleading characterization of the propensity interpretation and generate problems that are more apparent than real (cf. Fetzer 1981 and Niiniluoto 1988). Other objections are also defeated by the failure to appreciate that any probability measures constructed on the basis of the propensity interpretation qualify as propensity concepts.

While the foregoing arguments may already provide forceful evidence that evolution is not an optmizing process, I want to advance at least one additional argument that is meant to make it very obvious that there are evolutionary phenomena that cannot be appropriately understood on the basis of an optimizing model but which make good sense from the point of view of a satisficing model. This case has been offered by David S. Wilson (1980), who suggests that there is nothing about evolutionary theory that precludes the possibility that selection might "routinely" occur under conditions whereby an organism x decreases its own fitness but nevertheless is selected because it has decreased the fitness of competing conspecifics y even more (Wilson 1980 as reprinted in Brandon and Burian 1984, p. 275).

An appropriate illustration would appear to be American political campaigns, where negative advertising is normally judged successful as long as it enhances relative differences. There is an instructive lesson for evolutionary theory here, moreover, since cases of this kind emphasize that selection tends to be a matter of <u>relative</u> rather than of <u>absolute</u> fitness, insofar as those traits that confer a competitive advantage with respect to survival and reproduction can be "good enough" even if better solutions are available. If organisms can benefit from diminishing their fitness in order to increase their relative advantage over others, then it is difficult to see how the idea of evolution as an optimizing process can be justified.

It could be maintained that, even if natural selection (or evolution, which is not confined to the mechanisms of natural selection) is not an optimizing process, optimality theory remains a useful heuristic device for generating hypotheses about phenotypic design, even if "not about the process of evolution that produced that design" (Smith 1991b). In suggesting this alternative, Eric Smith admits that there may be significant philosophical questions that can be raised about using optimality theory to study something, such as phenotypic design, that is the result of a non-optimizing process, but he cites the publication of thousands of research articles in which optimality theory fulfills precisely such a role.

In advancing this position, Smith would seem to echo the findings of John Dupre, when he reports that within biology itself there appears to be more enthusiasm for applications of optimality theory than exists for the conclusion that evolution itself is an optimizing process (Dupre 1987, p. 22). And, indeed, the potential for optimality theory to fulfill a role in generating hypotheses about degrees of adaptiveness of phenotypes relative to specific environments does not contradict or undermine the view that fitness should be properly understood as a single-case dispositional property, where a clear distinction is drawn between fitness values and reproductive success. Optimality theory can be useful in a heuristic role.

The question of whether evolution is an optimizing process, therefore, has to be distinguished from the question of whether optimality analysis can be useful in generating fitness hypotheses. Treating nature "as if" it were an optimizing process may be beneficial as a heuristic technique, but that does not mean that evolution itself is an optimizing process. The issue here is closely related to the distinction between realism and instrumentalism as it arises in theorizing generally. Instrumentalism views theories as instruments of prediction that are not meant to describe entities or properties in the world, while realism views theories as descriptions of the world. It seems evident that optimality theory can be useful instrumentalistically.

Thousands of published handbooks of navigation begin with a sentence which says, "For present purposes, we will assume that the Earth is a small stationary sphere whose center coincides with that of a much larger rotating stellar sphere", as Thomas Kuhn has observed (Kuhn 1957). The widespread utility of adopting a certain model for a special purpose, however, in no way alters the limitations of that model for understanding the world itself. If evolution is not an optimizing process, then it makes no difference that, for certain special purposes, we can treat it "as if" it were. As long as our purpose is to understand the nature of evolution, therefore, optimizing theory is not enough. Its value appears to be exclusively heuristic in kind.

To avoid any misunderstanding of the nature of my argument, bear in mind that evolution has several distinct dimensions. It can be viewed as a causal process involving interaction between organisms with different degrees of fitness and their environments. Since more fit organisms, by hypothesis, have higher probabilities of survival and reproduction, given a probabilistic conception of fitness, it would be mistaken to suppose that I am denying something that cannot be false. More fit organisms clearly do have higher probabilities of survival and reproduction, even if, as we have found, there is no guarantee that the traits of organisms with higher fitness will invariably increase in their relative frequencies across time.

What I am asserting instead is that the actual course of evolution that emerges across time depends upon an interaction between organisms and their environment, where the environment is almost constantly changing across time. Indeed, there are at least three reasons why environmental variations tend to defeat the emergence of optimal adaptations. Because actual environments only remain constant over finite intervals, not for infinite durations; because random happenings and accidental occurrences are exerting their influence on the course of evolution; and because those who survive and reproduce may be merely the lucky rather than the fit, the process of evolution across time appears to be but a gamble with life where players shift from game to game without any advanced warning.

The strongest arguments supporting the conception of evolution as an optimizing process thus appear to be indefensible. The classic model advanced by Parker and Maynard Smith depends on special conditions that are seldom, if ever, satisfied during the history of world, including, for example, infinite populations and infinite times. Two probabilistic models are available on the basis of the frequency and the propensity interpretations. The frequency-based model, however, can only guarantee that higher fitness will produce higher reproductive success over the infinite long run. And the propensity-based model cannot guarantee the convergence of fitness and success even over infinite long runs.

These considerations suggest that evolution should not be viewed as an optmizing process. Sometimes higher fitness occurs with higher frequency across time, but sometimes not. The role of random factors and accidental happenings reinforces the variability of environments, which by itself undermines the applicability of optimality models. Nevertheless, optimality theory does appear to be applicable in the heuristic role of suggesting hypotheses about the adaptiveness of phenotypic designs in generating fitness hypotheses. Taken altogether, therefore, the question of whether evolution should be viewed as an optimizing process seems to have a definite answer. Evolution is really nature gambling with life.

As Robert Richardson (1998), has observed, satisficing substitutes "a stopping rule" for one maximizing the outcome of interest, where searching stops when a solution at a certain threshold is attained. If optimizing models characterize systems or processes that always select solutions to problems that are at least as "good" as any other solution, while satisficing models characterize systems or processes that select solutions to problems that are "good enough" but can still have alternatives that are even better, then evolution is clearly not an optimizing process. Nature thus appears to operate by finding solutions that are good enough rather than the best.

Survival requires finding solutions to problems. If those who survive are not necessarily the fittest, the process of natural selection may or may not produce increasingly fit organisms across time. Since biological evolution is not a process that invariably induces the survival of the best, it remains entirely possible that the latest are not the best. And insofar as natural selection and biological evolution do occur even in the absence of optimal strategies and optimal adaptations, it appears as though nature is content with genetic combinations and selection processes that are simply "good enough". Selection and evolution operate relative to available genes and available environments that satisfy their own non-optimal conditions.

3. Is Evolution Algorithmic?

The history of science reflects crucial shifts from the teleological world-view associated with Aristotle to the mechanistic worldview associated with Newton, on the one hand, and from the deterministic worldview associated with classical mechanics to the indeterministic worldview associated with quantum mechanics, on the other. Both deterministic and indeterministic worldviews, however, are mechanistic in their general character, whereas determinism presumes that laws of nature invariably bring about the same outcomes under the same conditions, while indeterminism affirms that some laws probabilistically produce one or another outcome in the same class of outcomes under the same conditions. Those familiar with the history of science, therefore, may find it somewhat surprising to discover that, within several domains of current inquiry, assumptions are being adopted that not only contravene indeterministic principles but are stronger than deterministic ones in the novel guise of the contention that evolution is "an algorithmic process".

The first of these is the philosophy of biology. In Darwin's Dangerous Idea (Dennett 1995), for example, Daniel Dennett maintains that the theory of evolution by natural selection qualifies as "a dangerous idea", precisely because it provides a framework for understanding evolution as an algorithmic procedure. The second is within cognitive science, where the dominating paradigm, known as the computational conception, takes for granted that minds either are computers or, at some suitable level, operate by means of the same algorithmic principles that govern computing machines—even as a matter of definition (von Eckhardt 1993). And a third arises within what is called evolutionary psychology, where Leda Cosmides and John Tooby, especially, maintain that human reasoning is under the control of Darwinian algorithms as mental procedures that have evolved by natural selection (Cosmides 1985, 1989; Cosmides and Tooby 1987).

Their apparent convergence upon the centrality of algorithms within these domains, however, does not guarantee that cognitive science, the philosophy of of biology, and evolutionary psychology therefore rest upon a firm foundation. Indeed, for reasons that I have elsewhere explained, neither cognitive science nor evolutionary psychology seem to be theoretically well-grounded. The computational conception, for example, appears to represent a striking over-generalization of one rather special kind of thinking that does not seem to be characteristic of human thought processes generally (Fetzer 1994a, 1997, and 1998). As a theory of reasoning specifically rather than of thinking, evolutionary psychology inherits only some of these problems, but it also confronts difficulties of its own (Davies, Fetzer and Foster 1995, Fetzer 2005). My purpose here is to explore the extent to which evolutionary biology itself fits within an algorithmic framework.

The classic conception of algorithms characterizes them as effective decision procedures, which are methods or techniques that can be applied to problems of appropriate kinds to yield definite solutions within a finite sequence of steps (Kleene 1967, Ch. V). Because algorithms have these properties, they are definite (you always get an answer), reliable (you always get a correct answer) and completable (you always get a correct answer in a finite interval of time). According to the computational conception, therefore, thought processes are governed by mental algorithms. Dreams and daydreams, however, appear to be instances of ordinary thought processes that have neither definite beginnings nor definite endings and that do not provide reliable solutions to problems, if they provide "solutions" to "problems" at all. They are among several kinds of non-algorithmic thought processes that appear to undermine the computational conception.

Indeed, the wide variety of phenomena that tend to disconfirm or to even refute the dominating paradigm include (a) that thinking does not require the execution of mental algorithms, because imagination and conjecture (including dreams and daydreams) involve thought but do not require the execution of mental algorithms, (b) that some kinds of reasoning (involving the use of heuristic procedures or asymmetrical decision methods) are kinds of reasoning that do not require the execution of any algorithm, (c) that ordinary thinking displays probabilistic associations of thoughts that do not qualify as algorithmic or even as partially-algorithmic, and (d) that even the availability of marks as subject to systematic syntactical manipulation appears to presuppose the existence of interpretations, interpreters or minds, which takes for granted what computational conceptions are intended to explain. It cannot be sustained (Fetzer 2001).

The problems with evolutionary psychology, it should be emphasized, do not arise from the general appeal to evolutionary influences as causal determinants of mental abilities but rather from the specific form that these mental abilities are supposed to assume as Darwinian algorithms. If mental processes are properly viewed as causal but non-algorithmic, where some kinds of reasoning, but not thinking generally, may have an algorithmic character, after all, then those who take for granted that thought processes are algorithmic—even apart from their adaptive character—have committed a blunder. Thus, the research program advocated by Cosmides and Tooby can be improved even further by embracing the conception of epigenetic rules as genetically programmed, species-specific developmental tendencies that may or may not be algorithmic in lieu of their position (Alexander 1990, Davies, Fetzer and Foster 1995, Fetzer 1991/96).

Dennett invites us to view evolution by natural selection as an algorithmic process, where (in his words) "an algorithm is a certain sort of formal process that can be counted on—logically—to yield a certain sort of result whenever it is 'run' or instantiated" (Dennett 1995, p. 50). The key features of algorithms are said to be substrate neutrality (they can be implemented by many different kinds of systems), underlying mindlessness (they can be applied mechanically without thought or judgment), and guaranteed results (they always provide reliable solutions to the problems to which they apply). Their characterization as "formal processes" thus reflects their substrate neutrality. Darwin's dangerous idea is then paraphrased by Dennett in the following fashion: "Life on Earth has been generated over billions of years in a single branching tree—the Tree of Life—by one algorithmic process or another" (Dennett 1995, p. 51).

It should be observed, however, that "the Tree of Life" as a branching tree structure that reflects the history of species across time must be understood as the product of causal mechanisms of various kinds applied to the specific conditions that obtained during specific intervals through the history of life on Earth. These causal mechanisms appear to include genetic mutation, sexual reproduction, genetic drift, and genetic engineering (as sources of genetic variation) and natural selection, sexual selection, group selection and artificial selection (as related mechanisms of selection). Thus, "natural selection" has both a broad and a narrow sense, where in its broad sense, "natural selection" includes all these less artificial selection and genetic engineering, perhaps, but in its narrow sense, "natural selection" applies to competition between con-specifics as individuals.

Strictly speaking, for evolution by natural selection (in its broad sense) to be algorithmic, it would have to be the case that each of the causal mechanisms for variation and for selection that have been mentioned qualify as "algorithmic" in the appropriate sense. Specifically, it would have to be the case that, for each instance of operation of each of these causal mechanisms during the course of life on Earth, they satisfy the requirements for being effective decision procedures—or Dennett's counterpart conditions of substrate neutrality, underlying mindlessness and guaranteed results. If genetic mutation, sexual reproduction and sexual selection, for example, do not qualify as effective decision procedures that bring about guaranteed results, then natural selection (in its broad sense) cannot properly qualify as "algorithmic" and Dennett will have misdescribed natural selection.

That algorithmic processes have a definite beginning ("input") and a definite ending ("output") follows from their character as effective decision procedures. While Dennett asserts that "Every computer program is an algorithm" (Dennett 1995, p. 51), he also acknowledges that, in his sense, "an algorithm" need not terminate (Dennett 1995, p. 52, note 8). It would be better, however, to preserve the distinction between "programs" and "algorithms" where "programs" incorporate algorithms in causal forms suitable for execution by organisms or by machines. In this case, algorithms could retain their character as effective decision procedures (abstractly specified), while programs would be causal incorporations that might suffer from failures due inadequate implementations. Algorithms then specify procedures, while programs incorporate processes.

The inconsistency in maintaining that natural selection is an "algorithmic" process guaranteed to yield successful results, on the one hand, and that some "algorithms" are properly so-called even though they never terminate, on the other, displays itself in the realization that non-termination does not ordinarily yield what would be viewed as a successful outcome. Perhaps some "problems" are better left "unsolved", but for the remainder, non-termination does not qualify as "a solution to a problem"! It should be obvious, moreover, that at least some of the causal mechanisms that are subsumed by natural selection (in its broad sense)—including genetic mutation and sexual reproduction, for example—are typically regarded as probabilistic (or "indeterministic") causal processes where their operation can produce one or another outcome—such as mutation/non-mutation or genotype1/genotype2—under the same conditions.

This is a striking result on several counts. In the first place, it is not clear why one or another of these outcomes would be viewed as "successful" and the other as "unsuccessful". Without such a standard, however, it is impossible to tell whether or not a process yields a "successful" result. If 98% of all species have become extinct, for example, is extinction then a "success"? In the second place, the very possibility of more than one possible outcome ("output") under the same conditions ("input") places the very idea of "algorithmic process" into doubt. Algorithmic procedures, after all, have to be implemented by means of deterministic processes, since otherwise they cannot be guaranteed to produce "solutions", such as, say, survival and reproduction. There appear to be ample grounds to conclude not only that natural selection (in either sense) is not an algorithmic procedure but that it is also not a deterministic process. Dennett's formulations, however, obscure the importance of this fundamental distinction.

In particular, Dennett contends that, while some algorithms are "guaranteed to do whatever they do", others are "guaranteed to tend (with probability n) to do something" (Dennett 1995, p. 57). He appears to be (implicitly) appealing to a single-case propensity conception. Yet once beyond the pale of determinism, no process can properly qualify as "algorithmic". Algorithms are technically defined as functions understood as classes of ordered pairs, which map values in some domain of values x onto those of some range of values y (Boas 1960, p. 65). Thus, an output y is a function of an input x if, when x is given, the value of y is uniquely determined. Non-deterministic processes, however, do not satisfy this conception, because they provide either no value or more than one value for the output y for at least some values of input x. Processes that fail to provide solutions for problems that are uniquely determined for each value of input x thus cannot qualify as "algorithmic" (Fetzer 1994a, pp. 2-5 and 10-13).

Dennett's attenuated sense of this term does not even correspond to that of a partial function understood as a partial mapping from a domain x to a range y which is unique for each value of x when a corresponding value of y happens to exist. In this sense, partial functions are incomplete classes of ordered pairs, but they retain the uniqueness condition that, for any specific value of x, there exists at most one corresponding value of y. Processes that tend (with probability n) to bring about their outcomes where more than one outcome is possible, therefore, are simply non-algorithmic. Moreover, while Dennett wants to maintain that the algorithmic procedures that govern evolution are causal processes that tend to produce organisms that are increasingly adapted to their environments across time, even natural selection itself does not appear to be capable of guaranteed optimal solutions to problems of adaptation—even probabilistically!

To the question, "Is evolution progressive?", therefore, the only appropriate response appears to be, "Sometimes it is, sometimes it isn't!", which means that the answer is, "Not necessarily!" While it is physically possible for later species be more fit than earlier species, the influence of random factors and of accidential occurrences combine with the probabilistic character of evolutionary causal mechanisms to preclude any guarantees. Sexual reproduction, sexual selection, and genetic drift, for example, contribute to create conditions under which the operation of evolution can be appropriately described as "a gamble with life". Although appeals to algorithms are currently surfacing in various domains, the causal mechanisms encompassed thereby are not always definite, reliable, and completable. The evolution of species—including speciation and extinction—is no more governed by algorithmic processes than it is governed by optimizing ones.

It does not follow, of course, that evolution precludes the possibility of progress, when measured on the basis of appropriate biological criteria. The causal mechanisms of evolution, especially natural selection, tend to promote fitness in organisms, but there are no built-in guarantees. Just as short term increases in complexity are physically compatible with long term increases in entropy, short term increases in adaptiveness are physically compatible with long term—even abrupt—extinction, which the vast majority of species are destined to endure. It would therefore be a mistake to maintain that "Darwinism denies progress", as Michael Ruse has recently proclaimed (Ruse 1998, p. 93). It would be better to observe that Darwinism cannot guarantee progress than that it denies progress.

Thus, that evolution cannot guarantee progress does not mean that it denies progress, which Ruse, perhaps the leading authority on the concept of progress in evolutionary theory in the world today, no doubt, understands perfectly well. That evolution guarantees progress and that evolution denies progress are contraries, which can both be false, rather than contradictories, of which one or the other must be true. In <u>Monad to Man</u> (1996), Ruse suggests that progressivism continues to exert a subtle but powerful influence upon professional biologists, where comparisons between popular writings and scientific publications tend to support the conclusion that the idea of progress has been promoted primarily as a social construction advanced by cultural forces, including religious and political.

And he is absolutely right to maintain—as he does here and elsewhere—that the discovery that human beings are the product of a natural process qualifies as the most important self-discovery of our history. Darwin's conception was "a dangerous idea", not because it was algorithmic, but because it did not appeal to God.

Those who want to maintain that God had a role in bringing about the human species, of course, could still hold out for the “special creation” of mentality as a distinctively human possession. To ascertain the prospects for an evolutionary theory of the emergence of mind, however, we must first explore the relationship between minds and bodies, thoughts and actions, knowledge and rationality. This exploration will afford a framework for considering how mind could have emerged in lower forms of life, including animals, and evolved from animal mind to primate mind and on to human mind. Absent a viable theory of the evolution of mentality, room remains for invoking appeals to God as the only possible “explanation” for the existence of this property. The place to begin, therefore, is the study of the relationship between biology and behavior.

CHAPTER 5: BIOLOGY AND BEHAVIOR

The most important considerations that underlie the emergence of mentality and intelligence concern the adaptive benefits that accrue from the evolution of traits of these kinds. If consciousness and cognition involved nothing more than experiencing colors, for example, as having certain intensities and hues, then the evolutionary explanation for their emergence would remain obscure. But if they are crucial components in acquiring information and beliefs about an agent's (or an organism's) environment, the evolutionary explanation for their emergence would become abundantly clear. Our beliefs have causal consequences of our behavior. We act on the basis of our beliefs and when they are true, our actions are, in those respects appropriately guided; when they are false, however, those actions may be inappropriate and misguided. The place to begin, accordingly, is with the character of mental states such as beliefs as properties of human beings.

Indeed, the property that links issues in the philosophy of psychology about beliefs with issues in the philosophy of biology is that some are true and others false. The fundamental distinction between "units" of selection and "levels" of selection matters here. The units of selection are that which is selected—that is, what is perpetuated during evolution—which appears to be individual genes as the transmissible entities underlying heritable traits. The level of selection concerns how those units are selected—especially, whether the causal mechanisms of selection operate exclusively upon individual organisms or perhaps upon larger entities, such as groups. While many prominent evolutionary theoreticians such as George Williams (1966), insist that selection operates exclusively at the level of individuals, others, such as David Sloan Wilson (1989) contend that some kinds of selection operate at higher levels, a problem explored in Fetzer (1998).

The notion of level of selection is related in turn to a traditional distinction between "broad" and "narrow" conceptions of the content of mental states in the philosophy of psychology. Specifically, when narrow content is understood as consisting of (the content of) mental states with respect to their intensions, meaning, or sense, while broad content encompasses (the content of) those mental states with respect to their extensions, truth, or reference, the basic difference between actions and successful or unsuccessful actions becomes explicable. An agent may act on the basis of his beliefs, but his actions tend to succeed only when those beliefs are true. Even though any agent's actions must be based upon the narrow content of their mental states, the success or failure of those actions tends to depend on their broad content or their truth.

While I shall focus upon the explanation of human behavior as the most complicated and interesting, the consequences that follow from this analysis may apply to other species, especially those capable of behavioral plasticity, whose conspecifics can manifest specific behavioral tendencies that vary from organism to organism and from time to time as a function of their history and environment. While genes are principally responsible for an organism's innate cognitive capacity to acquire narrow content, behavior is primarily responsible for that organism's tendency to survive and reproduce. Organisms that have a propensity to acquire mental states that are appropriately related to the world, therefore, should possess obvious adaptive advantages. Though genes are thus the proper units of selection, behavior itself appears to be the appropriate level.

1. Behavior and Causation.

In the book, Philosophy and Cognitive Science (1991/96) and elsewhere, I have suggested that a complete account of the kinds of factors that can affect human behavior should include motives, beliefs, ethics, abilities, capabilities, and opportunities. Motives, of course, might be biological or psychological in character, ranging from the need for food, shelter, and sex to the desire to be rich, famous, and exercise political power. Beliefs obviously include whatever we take to be the case, ranging from pedestrian beliefs about our own name, where we live and our social security number to theoretical beliefs about the nature and origin of the universe, the existence or non-existence of God, and everything in between. Although many discussions of human action focus on motives and beliefs as determinants of behavior, they are clearly incomplete.

The function of ethics, for example, is to exclude some behaviors as unacceptable on moral grounds, especially because they would cause harm or, in other ways, violate the rights of others. For most of us, the knowledge that money can be made robbing banks, counterfeiting credit cards, and trading in stolen merchandise does not influence our choice of careers, even though we aspire to make money. We thus tend to exclude those alternatives, not because they are ineffectual in securing that end, but because they violate (what we take to be) the rights of others. Those who are less scrupulous, of course, may not rob banks but manufacture unsafe products. A more complete account of human behavior thus has to take morality into account, too.

In ordinary conversational contexts, of course, we tend to take for granted that most persons have the ability to pursue their objectives, guided by their beliefs and consistent with their morals. That assumption, however, may be overridden when we discover, for example, that Eugenio did not understand the officer's warning when he ran the red light, because he knows no English; that Janice could not fix the flat tire, even though she knew how to use a jack, because she did not have a spare; or that Max was unable to call for help when the house caught fire, because the phone had gone dead. When we lack either the ability to perform an action or are incapacitated from performing that action—either because we lack the resources or are otherwise restrained—then we may find ourselves explaining why an act was not done rather than why it was.

Moreover, even when somebody has the ability to perform an action and is not physically incapacitated or morally inhibited from its pursuit, the success or failure of his actions tends to depend upon and vary with the completeness and accuracy of the beliefs upon which those actions are based. When Jim steps on the accelerator in order to pass a slower car, when Julia puts a cake in the oven to bake, and when Sarah answers questions on a physiology exam, each of them—we may assume—is guided by their beliefs about driving, cooking, and anatomy. When their beliefs are true, then their actions are, to that extent, at least, appropriately guided; when those beliefs are false, however, then their actions are, to that same extent, inappropriately guided. The effects of acting on those beliefs, even if false, however, may be no more serious than a lost point or a burnt cake.

On the other hand, of course, their consequences might be more serious. More than one motorist has died while trying to pass a slower car when a third automobile unexpectedly appeared before them, they lost control of their own vehicle, or other unanticipated factors intervened. Had they only known better, they might have endured a different fate. Their actions were brought about by the complex interaction of their motives, beliefs, ethics, abilities and capabilities. Thus, when our motives, abilities and capabilities are equal to the task, the consequences of our actions—their success or their failure—is then typically determined by the extent to which the situation in which we were in was the one we thought we were in, which in turn fixes our opportunities. Consider the case of predators and prey.

A hunter who wants to hit his target (motive) and who believes that his target is present (belief) and does not rule out firing at such a target on moral grounds (ethics) may hit his target only if his skills are equal to the task (ability) and his rifle and ammunition are available (capability). But success crucially depends on the presence of the target in the vicinity (opportunity), in the absence of which a hunter may have no chance to bag his prey at all. Indeed, speaking generally, it should be apparent that the <u>actions</u> we attempt are manifestations of the causal interaction of our motives, beliefs, ethics, abilities and capabilities, while the <u>success or failure</u> of our actions are manifestations of the causal interaction between our motives, beliefs, ethics, abilities, capabilities and opportunities—at least, when these events are brought about on purpose rather than merely by chance or luck!

That chance and luck often contribute to evolution has not escaped the notice of others. In a recent paper, "On Cognitive Luck: Externalism in an Evolutionary Frame" (forthcoming<u>a</u>), for example, Ruth Garrett Millikan has observed that "the history of life is like a lottery", where, even though the vast majority of forms of life fail to survive and reproduce, nevertheless, some are bound to win "because so many bought tickets and there [are] so many different drawings". While it is perfectly appropriate to describe evolution as "a gamble with life", what I would add is that, as in life, there still can be no winners. She also affirms that, "Higher fitness lends only a higher <u>probability</u> of survival and reproduction", in relation to specific evolutionary contexts, with which I entirely agree. When she suggests there are no laws of evolution, only mechanisms, however, I must take exception.

When properly understood, the causal mechanisms that are the hard core of evolutionary theory include genetic mutation, sexual reproduction, genetic drift, and genetic engineering (as potential sources of genetic variety) and natural selection, sexual selection, group selection, and artificial selection (as mechanisms for separating between them). The causal processes of genetic mutation, sexual reproduction, and so on, qualify as the causal processes of evolutionary theory. Different versions of evolutionary theory may be distinguished on the basis of which subset of these mechanisms they take to be adequate to account for evolution. When these causal processes are applied to specific circumstances that obtain during the history of the world, historical evolutionary explanations result, where the set of events thereby described reflects the evolution of species.

The causal processes that define these causal mechanisms are (described by) the laws of evolution, which means that the laws of evolution tacitly correspond to those causal mechanisms. The presumption that there is a mutually exclusive disjunction between laws of evolution, on the one hand, and causal mechanisms, on the other, simply reflects misunderstanding about the nature of laws. Laws need not have infinite instances or many instances or even a few, when properly understood as logically contingent subjunctive conditionals that attribute dispositional properties (as single-case causal tendencies of variable strength) to everything possessing a corresponding reference property (Fetzer 1981, 1993). Indeed, the belief that there are no laws of evolution appears to be founded, at least in part, upon the popular view that species are not classes but individuals.

Millikan attributes the idea that species are "big, scattered, historical entities, enduring for longer or shorter periods though time" to Michael Ghiselin and to David Hull. Even if species are not "spatiotemporally unrestricted classes" with infinitely many instances, however, they are not therefore _individuals_ in some ontologically basic sense. Indeed, among the most fundamental laws of biology are those that relate genotypes _Gi_ (where _i_ ranges over 1, 2, . . .) to phenotypes _Pi_ under the influence of environmental conditions _EFi_ and that relate phenotypes _Pj_ to behavioral tendencies _BTj_, under the environmental conditions _EFj_, which can be formalized by combining subjunctive conditionals ". . . ==> ___" with (probabilistic) causal conditionals ". . . =*n*=> ___" along the following lines:

(L1) (*x*)(*t*)[*G1xt* ==> (*EF1xt* =*m*=> *P1xt**)]

(L2) (*x*)(*t*)[*P1xt* ==> (*EF2xt* =*n*=> *BT1xt**)]

. . .

Table V. Basic Laws of Developmental Biology.

where, for any genotype of kind *G1* at time *t*, being exposed to environmental factors of kind *EF1* would bring about (with strength *m*) its development into a phenotype of kind *P1* at *t**; and, for any phenotype of kind *P1* at time *t*, being exposed to environmental factors of kind *EF2* in turn would bring about (with strength *n*) the development or acquisition of behavioral tendency *BT1* at t*; **. . .** , the ranges of variation of which are "norms of reaction" (Sober 1984, p. 106). Indeed, if there were no such laws, there could be no science of biology.

The use of subjunctive and of causal conditionals (of universal or of probabilistic strength) becomes important in distinguishing merely accidental generalizations (as correlations) from genuine lawful relations, which may be simple or causal in kind. When a property *A* is a *permanent property* of some other *R*, then there is no process or procedure, natural or contrived, by means of which *A* could be taken away from something that is *R* without making it no longer *R* (Fetzer 1981 and 1993). A property that could be taken away while that thing remained a thing of kind *R* is *transient*. Given the definition of a specific kind of thing, say, "gold" defined as whatever is made of an element with the atomic number 79, then the shape, the size, and the selling price of things that are gold area among their transient properties, while their melting points, boiling points, and specific gravity are not. This justifies the use of the subjunctive to assert, "If *x* were gold, then *x* would have a melting point of 1064° C", which would be true, while "If x were gold, then x would sell for $500 an ounce" would be false. And analogous considerations apply in contrasting correlations from causation.

In his paper, "Rational Action" (1962), Carl G. Hempel observes that motives and beliefs are epistemically interdependent, insofar as testing for the values of variables of one of these kinds presupposes assuming values of the other. What we have discovered is that motives and beliefs are not the only variables whose values make a difference to behavior, where epistemic interdependence in Hempel's sense must extend across simultaneous values for motives, beliefs, ethics, abilities and capabilities (with respect to actions themselves) and opportunities (with respect to their success or failure). Consider, for example, the difference in possible values of variables of these kinds that could causally interact to produce as their effect a young man saying to a young woman, "I love you!", when they are on a date, when they are actors on a stage, and when they are in love.

The interdependence of motive, belief, ethics, ability, and capability attributions has not been misunderstood by law enforcement officers across the U.S.A. In my newly adopted state of Wisconsin, for example, more than one hunter has been brought before a judge charged with illegally firing a weapon from a vehicle as a consequence of a game warden's sting. Those entrusted with upholding the law in that vicinity have created tempting targets for hunters who are willing to employ illegal means to bag their prey in the form of stuffed dummy antlered deer, which are situated a few yards away from the highways at just the edge of the surrounding forests. When hunters stop in the road and take a shot, they are providing clear and convincing evidence that they possess the motives, beliefs, ethics, abilities and capabilities to perform actions of that kind.

The notions of motive and belief as well as those of ability and capability, of course, are generalizable to other species. In his book, The Evolution of Culture in Animals (1980), for example, John Bonner reports that E. coli bacteria are able to detect the presence or absence of twenty different chemotactic substances, of which twelve are attractants and eight repellants. Specific receptor proteins located on the cell surface of these bacteria combine with these substances to bring about the rotation of their flagella, which move them toward or away from those substances, respectively. Assuming that E. coli are attracted to some substances because they are beneficial to them and repelled by others because they are detrimental, it makes sense, from an evolutionary point of view, to infer that E. coli have evolved these behavioral tendencies as adaptations that are still adaptive.

It may or may not make equally good sense, from a theoretical point of view, to attribute motives and beliefs to E. coli bacteria, even though their abilities and capabilities are not in serious doubt. When their environments are frozen or their flagella are removed, their responses to chemotactic substances are not the same. When "motives" are broadly construed as variables whose values determine the energy characteristics of organisms (intensity, persistence, and such) and "beliefs" as variables whose values determine the directional characteristics of organisms (regulating, organizing, and such), as Kurt Madsen (1960), among others, has proposed, then a distinction may be drawn between motivation variables understood as dynamogenic function variables and cognitive variables understood as directive function variables. In this case, even lowly bacteria can have motives and beliefs.

The possibility that bacteria might have motives and beliefs in some broad or technical sense, of course, does not imply that they possess mental states or have the capacity for cognition in narrower or stronger senses. It does suggest that at least one measure of the strength of a motive would be the frequency and intensity with which forms of behavior that tend to satisfy that motive are indulged, under suitable conditions, and that a comparable measure of the nature of a be-life would be displays of behavior that are consonant with that belief, once again, under suitable conditions. Indeed, the conditions that are suitable for organisms whose behavior manifests the causal interaction of motives, beliefs, ethics, abilities and capabilities would be specific values for each of the other variables in relation to specific values of those very variables, an analysis that is broadly dispositional.

Thus, if we consider a complete set of specific values for each of the other variables that make a difference to behavior as a context Ci (where i ranges over 1, 2, . . . as diverse complete sets of specific values for those variables, which, as in the case of ethics, may be null), then what it means for an organism to be in a specific motive state M1, for example, would be the totality of differences to response behavior of kinds R1, R2, . . . that having this motive would make in varied contexts. When a person happens to be extremely thirsty, for example, they might walk out of a lecture to reach a nearby water fountain, even though, under normal circumstances, that is something they would not do; drink a glass of warm water, if that was the only thing available to drink, even though, under other circumstances, that is something they would not do; and so forth (cf., for example, Fetzer 1989, 1991).

2. The Matter of Meaning.

Precisely the same pattern of analysis can be applied to specify the meaning, intension or sense of attributions of beliefs, ethics, abilities, and capabilities via this broadly dispositional approach, according to which factors of each of these kinds can best be understood on the basis of their causal influence on behavior. The meaning of a specific belief, B1, for example, such as that I have fifty cents in my pocket, could then be explained using subjunctive and causal conditionals to stipulate the difference that that specific belief would make to my behavior:

(D1) (x)(t)[C1zt ==> (B1zt = m = > R1zt*)] ;

(D2) (x)(t)[C2zt ==> (B1zt = n = > R2zt*)] ;

. . .

Table VI. The Meaning of a Specific Belief.

where, for any person z in context C1 at time t, having belief B1 would bring about (with strength m) response behavior of kind R1 at t*; and in context C2, would bring about (with strength n) response behavior of kind R2 at t*; . . . .

This broadly dispositional conception of the nature of meaning is motivated in large measure by the problem of primitives, which arises from the realization that units of language can be defined, explained or otherwise understood on the basis of other units of language only if those other units are antecedently understood, which generates an infinite regress of previously understood units of language or circular definitions where antecedently understood units of language are used to define themselves. While Jerry Fodor has posited the existence of an innate "language of thought" that is both genetically determined and species-specific, he overlooks the possibility that primitive concepts might be acquired as non-linguistic dispositions of organisms and provide a foundation for learning a language without an innate language of thought (Fetzer 1989, 1991, 1991/96).

An account of the meaning of primitives in terms of their causal influence upon actual and potential behavior relative to different contexts suggests that different primitives that have the same causal influence upon actual and potential behavior relative to different contexts are causally equipotent or equivalent in their meaning. The beliefs that you have fifty cents in your pocket and that you have half-a-dollar in your pocket would be causally equipotent for most if not all purposes relative to different contexts. But there are some with respect to which, say, having two quarters rather than a fifty-cent piece might make a difference. This approach supports the notion that analyticity in the sense of intersubstitutability salva causalati should be understood as a matter of degree, where similar considerations apply to motives, ethics, abilities, and capabilities.

It should also be emphasized that the use of names and predicates to refer to individual things and specific properties allows the possibility of unique patterns of association between words and things that might vary from person to person and from time to time. It therefore permits private languages. In this respect, moreover, the account of meaning advocated here presupposes only that human beings are predisposed to acquire concepts to which words might be attached on the basis of (what turn out to be) linguistic habits rather than that human beings are disposed to have an innate mental language that does not vary from person to person or from time to time as a matter of natural law (Fetzer 1991). Indeed, among the reasons for preferring the present theory over Fodor's account is that mine makes unsuccessful translations between languages a theoretical possibility.

Even less appealing theories of meaning than Fodor's have arisen from what are known as causal theories of reference, according to which meanings are not really in the head, as it were, but rather in the external world, where intensions are specified by extensions, senses by reference, and so forth. The general idea is that meanings are dependent upon causal connections to the things for which words stand, such as thoughts of apple trees being causally dependent on apple trees. When thoughts of apple trees are taken to be apple-tree-thought-tokens and apple trees are taken to be apple-tree-token-things, this approach contends that what apple-tree-thought-tokens are properly understood to mean must be traced back to apple-tree-token-things to which they have been related causally by users of those thought-tokens by means of historical-causal linguistic chains.

Although this approach has been promoted and endorsed by Hillary Putnam, Saul Kripke, and others unnamed, there appear to be infinitely many notions for which there are thought-tokens that cannot possibly stand in causal connections to token-things for which they stand. These include non-existent things (such as werewolves or vampires, in the case of predicates; and Santa Claus or Mary Poppins, in the case of names), abstract properties (such as pi and the square root of -1), theoretical properties (such as gravitational attractions and electric currents), non-observable properties (such as conductivity and malleability, not to mention motives and beliefs). None of these token-things stands in any obvious causal relation to their thought-tokens, which suggests that this approach is rooted in confusion between intensions and extensions, sense and reference (Fetzer 1991/96).

The difference between broad and narrow content becomes readily apparent from this point of view. For a person who happened to be very thirsty and who observed a cold class of a clear liquid might drink it down with a flourish, only to discover he had polished off a shaker of martinis by mistake. The action that he had attempted—of drinking a glass of ice-cold water—was not the one that he achieved. Thus, if we want to explain what he did and why, we must acknowledge an explanatory ambiguity, since an adequate explanation of why he drank the cold glass of clear liquid (believing by mistake that it was ice-cold water) is not going to coincide with an adequate explanation of why he drank the shaker of martinis (believing by mistake that a cold glass of clear liquid was a glass of ice-cold water). The latter explanation requires at least one additional premise.

The difference between what our actions are intended to achieve and what they may or may not achieve—their success or failure—reflects precisely the difference between narrow-based and broad-based conceptions of content. If we want to explain our successes and failures in coping with the world, we have to include those properties of the world that contributed to those successes, when we did succeed, and those failures, when we did not. Indeed, strictly speaking, a complete explanation for those successes and failures would not only have to account for our mistake in taking a cold glass of clear liquid to be a glass of ice-cold water but for our success in taking a thing to be a cold glass of clear liquid to begin with. The abilities and capacities that contribute to our successes and failures in coping with the world include perceptual as well as inferential ones.

The difference between broad and narrow content can be displayed even with respect to E. coli bacteria. It appears reasonable to infer that the explanation for the acquisition of the E. coli's tendency to avoid eight chemotactic substances and to encounter twelve others qualifies as an adaptation, understood as a characteristic, property, or tendency that has proven beneficial in the past. Thus, the evolutionary situation appears to have been as follows. E. coli bacteria collectively have minor genetic variations, which give rise to minor phenotypic or behavioral variations. While initial encounters with different chemotactic substances in their environments may have occurred more or less in a random fashion, those encountering toxic substances were harmed, while those encountering nutrients thereby benefited. The subpopulation tending to avoid toxic substances and to encounter nutrients thus enhanced its prospects for survival and reproduction.

The evolution of the tendency to avoid toxic substances and to encounter nutrients thereby spread within the gene pool of E. coli bacteria because it had conferred adaptive benefits upon them in the past. But adaptations that have been adaptive in enhancing prospects for survival and reproduction in the past may or may not remain adaptive in the future. Suppose, hypothetically, that the chemotactic substances that have been harmful in the past were to become beneficial and that the chemotactic substances that have been beneficial in the past were to become harmful. Then a previously adaptive adaptation would become maladaptive. Presumably, enough genetic variation would remain in the gene pool to permit evolution to bring about a corresponding change in future gene pools, which might occur fast enough for E. coli to survive rather than become extinct.

The conclusion these examples ought to bring home is that the behavior of bacteria, like that of human beings, is brought about by the interaction of specific values of motivational dynamogenic function variables and specific values of cognitive directive function variables. The motivational variables in both instances are broadly biological (in quenching thirst, for the human being; in avoiding toxicity and deriving nutrients, for E. coli bacteria). And even their cognitive variables, however different they may be in functional complexity, are surprisingly similar, since E. coli bacteria use specific receptor proteins at the bacterial cell surface to detect the presence of these substances as a primitive form of perception, where adaptations themselves function as a form of memory, while human beings use different forms of perception and memory —and inferences based on them—to fix the values of their cognitive variables.

No doubt, some of the similarities displayed by these examples are coincidental rather than invariable features, where the range of factors that affect the behavior of human beings is vastly larger and more complex, especially when alternative psychological motivations are taken into account, than is that for E. coli bacteria. From the perspective of the distinction between "broad" and "narrow" content, however, the striking feature appears to be the same, namely: that organisms of both kinds act on the basis of expectations, which are determined by the values of variables of internal states of the organisms. When motives and beliefs are properly understood as dynamogenic function variables and as directive function variables, it becomes apparent that actions are determined by the complex interaction of the internal states of organisms.

Since actions are determined by internal states of organisms, including beliefs understood as directive function variables, but tend to succeed or fail depending upon whether or not they are appropriate in relation to properties of the external world that affect their success or failure, the problem that confronts organisms of every species appears to be that of maintaining beliefs as directive function variables whose values stand in appropriate relations to the external world. The problem might have an evolutionary solution were it the case that the values of beliefs as directive function variables always track the values of corresponding environmental variables, such that beliefs as directive function variables were invariably appropriate in relation to those properties of the external world that affect the success or failure of an organism's actions.

But adaptations that have been adaptive in the past may or may not remain adaptive in the future, due to change. Indeed, within philosophy, the problem of anticipating the course of the future on the basis of information concerning the past is referred to as <u>the problem of induction</u>. We know that the future will not be like the past in every respect and that it will be like the past in at least some respects. If we assume that the future should be like the past in <u>every</u> respect, therefore, our expectation will be false. If we assume that the future should be like the past in <u>some</u> respects, however, our expectation will be trivial, unless we happen to know in which specific respects the world will or will not change. What we want to know are the respects in which the world will and will not change which make a difference to survival and reproduction.

The causal mechanisms that evolution has produced to cope with the problem of induction are those implicit in the cognitive capacities of various species. In his book, <u>Darwin Machines and the Nature of Knowledge</u> (1994), for example, Henry Plotkin has identified three capacities that nature has produced, namely: _the primary heuristic_ of the biological process of genetic-developmental change through evolution by selection; _the secondary heuristic_ of the immune system and intelligence that compensates for many shortcomings in dealing with rapid chemical changes and rapid physical changes; and _the tertiary heuristic_ of culture that compensates for even more rapid forms of change than individual intelligence can handle. Species possessed of immune systems and intelligence, not to mention culture, thus may cope with problems that other species cannot.

Plotkin's scheme supports the realization that the evolutionary strategies of various species may be strongly affected by their respective cognitive abilities. Species whose members display the same behavior under the same conditions independently of their histories and experience are largely limited to the first heuristic of genetic-developmental change through evolution. Those with the capacity for variable behavior under the same conditions as a function of their histories and experience—under the influence of classic, operant, or other forms of conditioning—may be capable of benefiting from the second. And those with the capacity for teaching and learning from each other's history and experience —especially those who have some collective capacity for storing, processing, and transmitting information about the past—may benefit even more from the third.

The question is largely a matter of behavioral plasticity. Species such as _E. coli_ bacteria are essentially constrained to coping with change on the basis of the primary heuristic, because their behavior does not appear to be influenced by classic, operant, or other forms of conditioning, for example, whereby _E. coli_ might learn from experience. In the absence of changes in individual bacteria induced by their personal histories, therefore, biological evolution seems to be the principal if not exclusive causal mechanism that can bring about change in

E. coli behavior. The case of human beings appears to be quite different, how-even, since we are not only capable of learning from our own experiences but also from the experience of others, which might be transmitted to us by means of teaching and learning via lectures, books, and other modes of communication.

Behavioral plasticity appears to depend upon cognitive versatility, insofar as organisms with greater cognitive capacities ought to be more competent at insuring that their beliefs as directive function variables are appropriate to guide their behavior in pursuing their motives as dynamogenic function variables than those with lesser cognitive capacities. The resources at our disposal include our capacity for imagination and conjecture, our ability to use language and other modes of communication, our deductive and inductive reasoning ability, and the information we are able to derive about the world on the basis of observation, experimentation and measurement. The strength and variety of the cognitive capacities possessed by human beings may be our most important difference from other forms of life, even if, relative to higher primates, this difference is merely a matter of degree.

In her paper, "The Mind and Its Ecological Niche, Its Language Community", of course, Ruth Millikan has correctly observed that we cannot expect (what she refers to as) cognitive systems to be infallible and never make mistakes, that is:

> . . . it is helpful to keep clearly in focus what the cognitive systems are for. Their mission is not, for example, the acquisition of justified certainty. As modern skeptics are aware, no one lives by justified certainty. (C)ognitive systems are not at fault or malfunctioning when they take risks, when they rely, as they must, on environmental statistics rather than on certainties.

She thus suggests that reliance upon many different fallible methods for various cognitive activities—such as recognizing the same person, the same property, the same species, the same disease—where one method can be used under some conditions, while others can be used under others—is "the strategy that gets us by".

Or doesn't't! Indeed, as Millikan herself repeatedly observes, the typical outcome of evolutionary processes is not the survival of a species but its extinction. Plotkin even estimates that 98% of species ever to have evolved no longer exist. Since the conditions for successful cognition arise from causal interactions with the environment, we may count upon our "cognitive luck", as Millikan suggests, and hope we find ourselves within a "cooperative environment". But we might be able to do better. The strategies that have got us by in the past may or may not be the strategies that can get us by in the future. What naturalized theories of content and cognition do not provide are resources necessary for the consideration and evaluation of alternative cognitive strategies to determine whether or not we should adopt more efficient, effective, and reliable cognitive methods.

The relationship between naturalized theories of content and cognition and normative epistemology thus comes to this. Naturalized theories attempt to explore the cognitive methods that biological evolution has produced as cognitive dispositions and predispositions of organisms which belong to different species. Normative epistemology, by contrast, attempts to discover means and methods that are capable of attaining specific cognitive objectives, whether or not those strategies are ones that nature has produced. When it succeeds, the naturalistic approach provides a description of where we stand as an evolved species with respect to the cognitive strategies that we happen to presently employ. When it succeeds, the normative approach provides a prescription of where we ought to stand as a species with respect to cognitive strategies that we should employ if we want to enhance our prospects for reproduction and survival as a species.

Nothing about normative epistemology affords any guarantee that methods are available that guarantee success in attaining cognitive objectives. What we take to be the truth may not be the truth, and there are no infallible strategies. However, by exploiting the resources that normative epistemology can supply, it may be possible to better understand where we stand in relation to our evolutionary history. What we need in order to pursue this objective will include higher-order methods for evaluating the efficiency, effectiveness and reliability of various lower-order methods, which may be based upon their relative-frequency of success in attaining cognitive objectives. These success relative-frequencies, in turn, provide an evidential foundation for drawing inferences about the reliability of various methods as propensities of cognitive systems.

3. Cognitive Strategies.

The place to begin, no doubt, is with the possibility that there might be infallible methods. If there were, after all, surely we would want to employ them. We therefore need to understand what an infallible method or cognitive strategy would be and why they do not appear to be available. As it happens, in his book, Philosophical Explanations (1981), Robert Nozick considers principles such as these that capture kinds of cognitive infallibility:

(P1) if p were true, then z would believe p;

(P2) if p were false, then z would not believe p.

Table VII. Two Principles of Logical Omniscience.

These principles describe (what might be referred to as) logical omniscience, insofar as they imply the possibility of the direct acquisition of true beliefs unmediated by any method of discovery. In this sense, it is a simple theory.

Several comments qualify the conception of logical omniscience thereby described. The first is that the distinction between (P1) and (P2) seems to be appropriate, insofar as, if z were to believe everything—of every p and its negation, ~p, that it is true—then it would be the case that, if p were true, z would believe p; but, of course, that would be trivial, since z would also believe ~p. Similarly, if z were to believe nothing—of every p and its negation, ~p, z would believe neither—then it would be the case that, if p were false, z would not believe p. The problem is to believe all and only those things that are true, if possible. But principles such as these also imply the ability —the inevitability—of possessing true beliefs about the origin of the universe, the existence of God, and such, automatically—merely because they are true!

Since different people hold different beliefs about the origin of the universe, the existence of God, and so forth, it cannot be the case that everyone is possessed of logical omniscience, since otherwise their beliefs would have to be consistent as a necessary condition of their collective truth. It should therefore be obvious that truth is not solely a function of simplicity, insofar as at least one simple theory is false. Not the least of the problems confronting this approach, moreover, is the failure to distinguish between truths that reflect relations between ideas (which are more or less "analytic" in the traditional sense) and those that reflect matters of fact (which are more or less "synthetic", in the traditional sense). The properties of methodologies which might be appropriate to different kinds of true belief make a difference here.

Consider, for example, some alternative principles that are relative to the adoption of a specific methodology SM in application to this problem, namely:

(P3) p ==> [SMzt ==> B(p)zt*] ;

(P4) ~p ==> [SMzt ==> B(~p)zt*] ;

Table VIII. Two Principles of Methodological Infallibility.

where, according to (P3), if p were true, then if z were to use method SM, then z would believe that p; and, according to (P4), if p were false, then if z were to use method SM, then z would believe that ~p. Even given a distinction between analytic and synthetic knowledge, the strongest methods that might be employed would be deductive reasoning applied to premises that are true by stipulation (as a matter of meaning or not does not matter here). The history of mathematics, however, suggests that even the most interesting theorems—such as Fermat's Last—do not satisfy this conception.

Neither logical omniscience nor methodological infallibility appear to be defensible conceptions that might apply to cognitive agents, human or otherwise. On the principle that ought implies can, which applies within epistemic and cognitive contexts as well as within ethical and moral ones, it would be unjustifiable to maintain that cognitive agents should aspire to logical omniscience or methodological infallibility. The more modest—and more appropriate—approach would be to consider methods for the acquisition of beliefs that are available to cognitive agents rather than those that are incapable of realization. Here some obvious alternatives include observation, memory, and testimony as potential sources of justified belief. The problem becomes that of evaluating their respective degrees of reliability.

The manner in which this might be done would be to conduct empirical tests, under controlled conditions, to measure the relative frequency with which beliefs acquired by means of these methods happen to be true. Thus, calculate the relative frequency for the successful use of each such method:

(SM1) Observation: #observe p & p/#observe p = m1/n1 >>> 0

(SM2) Memory: #remember p & p/#remember p = m2/n2 >> 0

(SM3) Testimony: #testimony p & p/#testimony p = m3/n3 > 0

Table IX. Comparisons of Relative Frequency of Method Success.

where the relative frequency with which the method (observation, memory, testimony) yields p when p is the case relative to applications of each method produces a measure of their relative degrees of reliability, where I have made the empirical assumption that observation is more reliable than memory, etc.

The justification for supposing that observation is more reliable than memory and that memory is more reliable than testimony depends upon the causal connection between them, where observations do not depend upon memory or testimony, memories depend upon observation but not upon testimony, and testimony depends upon both observation and memory. Indeed, it turns out that observation proves highly reliable. According to recent studies, eyewitnesses are as much as 98% complete and 98% accurate in reporting their observations when what they are observing appears to them to be significant (Marshall et al. 1971). It qualifies as common knowledge, moreover, that memories tend to be less reliable with the passage of time and that testimony is all too often affected by causal factors that tend to bring about deviations from the truth.

Information about the relative frequencies of successful application of various methodologies not only provides a basis for evaluating their relative reliability in the past but also affords a foundation for drawing inferences about the reliability of the cognitive mechanisms that produce them. In general, if these relative frequencies prove to be stable relative frequencies that remain relatively constant across large numbers of tests under a wide variety of test conditions, it would then become appropriate to infer that these relative frequencies are manifestations of the cognitive propensities of the cognitive systems that produced them. Thus, if the success ratio of observation is m1/n1, it would be appropriate to infer that the success propensity for observation is m1/n1, and so forth, assuming data acquired under suitable test conditions.

With regard to higher-order cognitive strategies, the situation becomes one in which the exercise of rational criticism appears to be even more important than empirical tests to epistemic evaluations of alternative methodologies. With respect to the discovery of natural laws, for example, at least three methodologies qualify as alternatives: Inductivism, Deductivism, and Abductivism. The issue that arises within this context thus becomes whether one of these is a more efficient, effective, or reliable method for attaining that objective. The methodology known as Inductivism, which is widely popular, assumes science is a process that proceeds in four stages of Observation, Classification, Generalization, and Prediction. Mere observation, unconstrained by specific hypotheses, however, tends to produce scientifically insignificant findings (Hempel 1966).

The fact that many textbooks in scientific disciplines endorse this conception does not help. Inductivism is founded upon a specific rule of inference, known as induction by enumeration (IE) but it is also referred to as "the straight rule":

(IE) From "m/n observed Rs are As" infer (inductively) "m/n Rs are As",

assuming that a suitable number have been observed over varied conditions. This rule, unfortunately, suffers from serious defects. Because its application depends on the existence of both observable reference properties and observable attributes, it cannot be applied to theoretical properties (including gravitational attractions and electric currents) or non-observable properties (such as conductivity and malleability, not to mention motives and beliefs). Indeed, if there is more to causation than mere correlation, then (IE) cannot possibly provide a suitable logical foundation for inferences to law (Fetzer 1981, 1993).

The methodology known as Deductivism, by contrast, appears to be capable of overcoming some of the most important objections that Inductivism encounters. Deductivism likewise assumes that science is a process that proceeds in four stages, which in this case are Conjecture, Derivation, Experimentation and Elimination. Insofar as Conjectures are not restricted to observational language alone, they may be formulated by means of theoretical and non-observable properties which have proven to be of enormous importance during the history of science. Classical mechanics, quantum mechanics, and special and general relativity are but four examples of scientific theories that Deductivism would permit but that Inductivism would prohibit. Moreover, Deductivism allows for conjectures that are causal, even if causation involves more than correlation (Fetzer 1981, 1993).

The rule of inference on which Deductivism is founded is modus tollens (MT):

(MT) From "hypothesis h entails e" and "not-e", infer (deductively) "not-h".

That the logical relation between the theory h and its consequence e is deductive, where e must be true if h is true, does not undermine the fallibility that attends the employment of the rule (MT), precisely because the evidence on which the inference that e is false is based might be in error. It would therefore be wrong to assume that applications of Deductivism guarantee true beliefs (Popper 1963).

But while Deductivism enables us to draw justified conclusions about which of the available alternatives ought to be rejected as false, it does not—apart from the class of hypotheses we have yet to reject—tell us which we ought to accept! In that respect, it provides a negative solution but not a positive solution to the cognitive problem of establishing the values of directive function variables that are essential for appropriate actions. In this respect, therefore, Abductivism appears to provide a highly desirable methodological alternative, since it provides for the acceptance as well as the rejection of hypotheses and theories. According to Abductivism, science is once again a process proceeding in four stages, but now those of Puzzlement, Speculation, Adaptation, and Explanation, where the stage of Adaptation incorporates the principles of Deductivism among its basic elements.

And Abductivism is based on inference to the best explanation (IBE), namely:

(IBE) The alternative h that provides the best explanation for the available evidence e is the preferable hypothesis; and when the available evidence e is sufficient, the preferable hypothesis h is acceptable. Thus, under those conditions, infer (inductively) that h is true.

The conditions that must be satisfied for an hypothesis to qualify as a possible explanation for the available evidence exclude non-scientific hypotheses from consideration, but cannot be guaranteed to include every scientific possibility. (IBE) must therefore be regarded as a fallible methodology. Nevertheless, for the purpose of making inferences about laws of nature, it is the most efficient, effective, and reliable among the available methodologies (Fetzer 1981, 1993).

Evidently, different methodologies can be appraised by means of different methodologies, where the relative reliability of observation, memory and testimony were appraised on the basis of their relative frequency of successful employment based upon empiricial procedures, while the relative reliability of the scientific methodologies of Inductivism, Deductivism, and Abductivism were evaluated on the basis of their theoretical potential for successful employment based upon rational criticism. On the basis of (what appear to be) their differing degrees of reliability as ordinary methodologies, it appears justifiable to infer that, in cases where their results conflict, observational findings should take precedence over remembrances of things past and remembrances of things past should take precedence over the recollections advanced by means of testimony.

On the basis of (what likewise appear to be) their differing degrees of reliability as scientific methodologies, moreover, it appears justifiable to infer that, whenever possible, the conclusions of scientific inquires ought to be based upon the methods of Abductivism rather than those of Deductivism or of Inductivism. Indeed, these findings reflect the more general consideration that, in the process of forming subjective expectations about the future on the basis of experience of the past, knowledge of causal propensities established by means of (IBE) should take precedence over knowledge of relative frequencies that is based upon (EI). Subjective expectations (or degrees of conviction) should be based on knowledge of causal propensities whenever possible. Subjective expectations that are not based on frequencies or propensities do not qualify as forms of rational belief.

Rationality of belief becomes especially important to higher species of organisms in permitting them to subject potential actions to rational criticism before they undertake them. In this sense, we are able to formulate hypotheses and theories on the basis of which we might act and kill them instead of ourselves, as Popper often emphasized (Popper 1978). When we embrace the method of Inference to the Best Explanation, for example, we acquire the disposition IBE, given evidence E at time t, to accept beliefs Bi (i ranges over 1, 2, . . .) at t*:

(IBE1) (x)(t)[IBEzt ==> (E1zt =m=> B1zt*)] ;

(IBE2) (x)(t)[IBEzt ==> (E2zt =n=> B2zt*)];

. . .

Table X. Cognitive Strategy IBE.

We thereby adopt a cognitive strategy that promotes our prospects for survival and reproduction by establishing appropriate values for the beliefs we act upon.

Human beings, of course, are among the species that have the cognitive flexibility to embrace alternative strategies on the basis of their degree of empirical success or on the basis of how well they withstand rational criticism. A phenotype of the kind Homo sapiens HSi at time t might thus be such that exposure to environmental conditions of kind EFj (including lecture courses with specific assigned readings and in-class exams) could thereby induce disposition IBE at t*:

(L3) (x)(t)[HS3zt ==> (EF3zt =m=> IBEzt*)] ;

(L4) (x)(t)[HS3zt ==> (EF4zt =n=> IBEzt*)] ;

. . .

Table XI. Acquiring Cognitive Strategy IBE.

He would thereby acquire the adaptive advantages that attend forming beliefs on the basis of methods of reasoning that transcend those otherwise available, which in turn maximize the rational expectation for the success of his actions.

These considerations shed light on the underlying problem of the units and the levels of selection, which possesses several dimensions. The first is that selecting which organisms survive and reproduce might be regarded as a function of genotype, phenotype, or behavior. Strictly speaking, however, genotypes Gi give rise to phenotypes Pi as (ordinarily unique) temporary organisms, whose adaptive fitness depends on their potential for successful interaction with their environment. As George C. Williams has observed, the fitness of most organisms rapidly moves toward zero, where environmental pressures overcome them, causing them to succumb (William 1992). What successful sexually reproducing organisms pass along to offspring, therefore, cannot be their unique genotypes and phenotypes, but specific sets of genes.

If genes are the units of selection as what is passed along during selection, however, the level at which selection itself occurs is not thereby determined. For species for which the same behavioral tendencies are properties of every member who possesses a similar phenotype, as in the case of bacteria, it may not be impermissible to consider the phenotype as the level at which selection occurs. For those species whose behavioral tendencies can vary from member to member even when they possess similar phenotypes, however, as in the case of human beings, behavior seems to be the level at which selection occurs. Indeed, the very existence of behavioral plasticity demonstrates that phenotypic properties alone do not determine success or failure. Acknowledging behavior as the level of selection yields a more suitable uniform standard across species.

The difference between broad and narrow content thus appears to have led us to consider the difference between rationality of action and rationality of belief, between behavioral plasticity and cognitive flexibility, and between naturalistic cognition and normative epistemology. The success of our actions, at the first level of explanation, appears to be explainable on the basis of the extent to which the situation we were in was the situation we took ourselves to be in as a matter of the opportunities that we actually confronted. At the second level of explanation, however, the situation we took ourselves to be in arose as a function of the cognitive strategies we employed in processing the information available. Whether or not we might have done better appears to be explainable in turn by exploiting the resources of normative epistemology.

Although languages can be private—and, to some extent, they always are—there are adaptive advantages to public languages that become obvious upon reflection. When different members of a community can speak the same language with the same intensions, meaning, and sense, they thereby contribute to enhancing their prospects for successful communication. The adaptive advantages of successful communication in turn represent (what may well be) the most important example of collective adaptation that evolution has ever produced, because successful communication promotes cooperation between conspecifics and cooperation between conspecifics promotes the attainment of shared objectives and goals. Those with the capacity to teach and learn from one another by means of language thus derive benefits that culture can confer.

Perhaps the greatest advantage of human beings over other species is that we have the capacity to exercise our rational faculties and to evaluate and improve upon our language, our theories, and our methods. Whether or not we are able to alter our motives (as values of dynamogenic function variables), we are capable of changing our beliefs (as values of directive function variables) and thereby potentially enhance our prospects for survival and reproduction. The difference between human beings and other animals, especially the higher primates, may be a matter of degree, but it seems to be a difference of degree that properly qualifies as a difference in kind. We have behavioral plasticity, at least in large measure, because we have cognitive versatility. And we can exploit our cognitive versatility by taking advantage of our rational faculties.

Species whose members lack behavioral plasticity and cognitive versatility, of course, are creatures whose behavior remains completely under the control of the process of evolution. We, however, have the prospect of being able to influence the course that it will take. But that requires knowledge. To explain and to predict the behavior of organisms, we need to know not only laws that relate genotypes to phenotypes and to behavior (in the case of instincts), but that relate experience to behavior (in the case of condition-ing), and beliefs to behavior (in the case of rationality). Knowledge of nature holds the key to our success. We need epistemology to understand biology even more than we need biology to understand epistemology. We have the chance to minimize luck as a factor in cognition, action, and evolution, which may be our greatest advantage and most important difference from bacteria.

CHAPTER 6: ANIMAL MENTALITY

No one has contributed more to the study of animal mentality, consciousness and cognition than Donald Griffin, whose work on this subject—including Animal Thinking (1984) and Animal Minds (1992)—virtually defines the field. The problem that confronts this discipline is the existence of the phenomena to which its investigations are directed. Different views about the existence of animal mind extend from the "common-sense" opinion (that animals think about their behavior and deliberate over their options) to the "behavioristic" position (that mental phenomena are no more than epiphenomena that may be correlated with but do not causally influence behavior). The range of views that have been advanced about the existence of animal mentality has therefore been very broad, indeed.

Thus, if behaviorism were correct, then there could be no science of cognitive ethology, understood as the analysis of the cognitive processes that affect the behavior of non-human animals, because cognitive processes do not affect the behavior of human or of non-human animals. And if mentality, consciousness or cognition does make a difference to behavior, then behaviorism, understood as the analysis of behavior strictly on the basis of the public properties of organisms and their environments (including their histories of reinforcement), has to be misconceived, insofar as cognitive variables lie beyond its scope. In his efforts to resolve this difficulty, Griffin provides numerous case studies that provide empirical support for the existence of the phenomena basic to this discipline.

The range and variety of behaviors Griffin describes provides grounds for inferring that the underlying problems that confront cognitive ethology are not empirical but are instead conceptual and methodological. Griffin—along with many other contributors to this field—varies between the Cartesian paradigm (according to which self-awareness is the criterion of mentality and introspection is the appropriate methodology) and the computational conception (according to which mentality is reducible to the manipulation of symbols for which written and verbal behavior provide suitable access). While Griffin supports the conclusion that animals may possess at least two kinds of consciousness, his conception of the nature of mentality remains unclear.

Griffin's distinction between perceptual consciousness (understood as the state or process of being aware of something) and reflective consciousness (understood as the state of awareness of one's own awareness) is a valuable contribution, but his work does not provide a definition of "mentality" that could be applied to humans, to other animals, and even to machines, if such a thing is possible. The purpose of this chapter and following, therefore, will be to explore the prospect of moving beyond the Cartesian paradigm and the computational conception in search of a more adequate theory of mind. The view that emerges from these reflections is that the conception of minds as semiotic (or "sign-using") systems affords a framework of this kind. Before introducing that approach, we shall consider further research in this domain.

1. Do Animals Have Minds?

In her remarkable book, Through Our Eyes Only? (Dawkins 1993), for example, Marian Stamp Dawkins advances a valuable study of the nature and existence of animal mind that both clarifies and illuminates relevant work. Perhaps no other issue in animal ethology has created as much controversy or generated as much disagreement as has this. With the appearance of this study, however, most of that controversy should subside and most of that disagreement disappear, where those who continue to deny the existence of animal mind are now seen to support a cause that is lost.

Dawkins has not only written an immensely readable study that ought to have appeal far beyond the bounds of academia, but has also produced an important synthesis of recent research on this problem that deserves to be taken seriously by everyone who is interested in cognition. While she mentions two specific groups as her intended audience—namely, those who reject the existence of any but human mentality and those who accept the existence of animal mentality as obvious—her potential audience encompasses most philosophers, psychologists, biologists, and ethologists, in general.

Dawkins appears to appreciate what unreflective thinkers tend to overlook—namely, that without committing ourselves to some account of mind, we do not know what we are accepting or rejecting when we take a stand on either side. If we reject the existence of non-human kinds of mentality, for example, yet accept the existence of human mentality, what are we denying to other forms of life that we are ascribing to ourselves? Surely the first lesson of a scientific education is that we must understand the meaning of an hypothesis before we can subject it to test and accept or reject it.

The apparent hazard of any alternative approach is that literally we do not know what we are talking about. It can happen, however, that we, at least initially, only vaguely and incompletely understand the phenomenon that interests us, which arises when dealing with consciousness. Dawkins thus surveys (what she takes to be) varieties of consciousness that range from sensation and perception to recollection and abstract thinking, but confines herself (for the time being) to the conception of "consciousness" as immediate awareness, avoiding premature definitional commitments.

As Dawkins observes, the existence of consciousness even has ramifications for morality. If things that are conscious are things that deserve to be treated with respect, for example, then if non-human animals are also things that are conscious, then they deserve to be treated with respect. If non-human animals are not conscious, "then possibly we can get on with our meals and eradicate pests and do all sorts of things to them without being disturbed by the moral issues that might trouble us if we thought they were" (Dawkins 1993, p. 6). So the question has a moral dimension.

Even more strikingly, however, consciousness also poses a problem of explanation from the perspective of evolution. Since it exists, it must be either an adaptation, which has provided adaptive benefits in the past, or an exaptation, whose presence has to be accounted for on non-adaptive grounds. Virtually every adaptive benefit that consciousness can be supposed to confer, such as learning to avoid bodily damage, however, might instead have been secured by non-conscious organisms or even by programmed machines. The rationale for its existence is therefore obscure.

Dawkins acknowledges two properties of (even human) consciousness that appear to make it scientifically problematic. One is that it is an essentially private phenomenon: what goes on inside of your head is not something to which anyone else has access. The other is that it is therefore impossible for anyone to possess certain knowledge about conscious phenomena—at least, in the case of anyone other than myself! The first seems to be an ontic (or ontological) property of consciousness as a special kind of being, the second an epistemic (or epistemological) consequence thereof.

The ascription of these properties to consciousness has a history that dates at least from the work of Descartes, but longevity does not imply validity. The privacy of consciousness may preclude others from direct access but it does not prevent indirect access: we typically draw inferences about the mental and emotional states of others based upon our observations of their speech and bodily behavior. And the absence of certain knowledge is compatible with the presence of uncertain knowledge: scientific knowledge is characteristically inductive and uncertain.

The Cartesian paradigm, according to which beliefs must be certain to qualify as knowledge, could be sustained only if knowledge were limited to what can be deduced from premises that are syntactical or semantical truths, which would preclude the possibility of any empirical knowledge. Indeed, Descartes' position was even less defensible, because he interpreted "certainty" as indubitability, which is a subjective property that varies from person to person. The Cartesian paradigm, properly understood, is no more than a prejudice having no significance for scientific inquiries.

The Cartesian paradigm is often accompanied by methodological commitments to analogical reasoning as the only kind possible for acquiring knowledge of other minds. This association, however, appears to be unwarranted on several grounds. Analogical reasoning involves comparing two things or kinds of things, where because one possesses properties A, B, C, and D, for example, and the second possesses A, B, and C, the second is supposed to possess D as well. Since I am a human and I feel pain if I burn myself on a hot stove, I infer the same is true of other humans, etc.

When there are more differences than similarities or few but crucial differences or such inferences are taken to be conclusive, however, then analogical reasoning is fallacious. The similarities and differences which matter are supposed to be relevant, in the sense that they make a difference to the outcome. When comparisons are drawn between members of different species, there may be more relevant differences than similarities.

Even when comparisons are drawn between members of the same species, there can still be crucial differences. Such reasoning is always uncertain.

Since analogical reasoning is always uncertain, while Cartesian knowledge is always certain, it cannot provide Cartesian knowledge. Fortunately, Dawkins commits herself to the common-sense position that, "despite the impossibility of never (sic) really knowing what other people experience, we all go about our daily business as though we were perfectly well able to do so" (Dawkins 1993, p. 10). She severs the Cartesian knot by not defining "knowledge" in terms of certainty, which makes her reliance upon the use of analogical reasoning consistent with her concept of knowledge. But her methodology may actually be far more sophisticated in practice.

Dawkins thus maintains that the fundamental difficulty in reasoning about other species is to ensure that there are sufficient relevant similarities to warrant analogical arguments. She also emphasizes that different species have different bodies and inhabit different environments, where:

> To be truly open to the discovery of what conscious experiences in other animals might be like, we must be prepared to go beyond the narrow - minded, rather arrogant anthropomorphism that sees human conscious experiences as the only or even the ultimate way of experiencing the world and make ourselves open to the much more exciting prospect of discovering completely new realms of awareness (Dawkins 1993, p. 14).

Indeed, she displays a refreshing sensitivity to the idea that other animals have "a point of view" that must be appreciated to fully understand them.

Dawkins acknowledges the existence of an enormous barrier to understanding other species, which takes the form of <u>language</u>. Indeed, some thinkers have gone so far as to insist that language is essential to thought, where absence of language implies absence of mentality. Communication between humans and non-humans may be limited, in Dawkins' view, but is not therefore impossible. It would be a blunder to assume either that other animals cannot communicate with one another without language or that animal modes of communication must always parallel human modes.

As soon as Dawkins turns her attention to criteria that may be used as evidential indications of the presence of animal consciousness, it becomes apparent her conception of consciousness may be somewhat broader than mere "immediate awareness". Her first criterion of consciousness, (CC-1), say, is complexity of behavior, where "the complexity of behavior and the ability to adapt to changed circumstances are some of the hallmarks of a conscious mind" (Dawkins 1993, p. 20). As an example, she offers vervet monkeys, who have different alarm calls for different kinds of predators.

Dorthy Cheney and Robert Seyfarth (1990) have studied the sound patterns that vervets make under a wide variety of different conditions. They have discovered that the monkeys use at least four types of grunts under specific social conditions, two of which are made when encountering socially dominant and socially inferior conspecifics, respectively, and two of which are made when moving into an open area and when observing unfamiliar monkeys from other groups. When tape-recorded sounds of these kinds were played to unsuspecting monkeys in the wild, moreover, they displayed responses appropriate to those particular messages.

Dawkins also discusses findings concerning female ostriches, red deer stags, and female black grouses that suggest ingenious strategies for raising chicks, picking fights, and selecting mates, where animal behavior is strongly influenced by subtle cues that are more complex but also more reliable than simpler alternatives. Dawkins' second criterion of consciousness, (CC-2), is adapting behavior to variable conditions (Dawkins 1993, p. 36), where the fulfillment of this condition is taken to imply the existence of "undeniable evidence of the ability to learn", which is exhibited by the pecking order of flocks of hens, the song-identification of white throated-sparrows, and concealing-of-food behavior of marsh tits and chickadees.

Indeed, her discussion of marsh tits and chickadees, who tend to hide hundreds of food items in the course of a single day, displays a great deal of methodological sophistication. In order to establish that these creatures are actually remembering exactly where they stored these items of food, a variety of alternative explanations—which might explain their remarkable ability by means of other causal mechanisms—may have to be eliminated. D. F. Sherry (1982, 1984) and S. J. Shettleworth and J. R. Krebs (1986), for example, have subjected these hypotheses to empirical tests by employing artificial trees and controlling for other conditions that might be relevant.

In order to accept the hypothesis (H1) that chickadees and marsh tits have phenomenal memories, it was necessary to eliminate possible alternatives, including (H2) that they locate hidden seeds on the basis of smell or other subtle cues and (H3) that they have simple rules or routines they use for hiding and recovering food. Insofar as chickadees and tit marshes do not search systematically and follow no apparent routines, their behavior undermines hypothesis (H3). And because they tend to search in just those locations where they have stored food even after that food has been removed from those locations, their behavior also defeats hypothesis (H2).

The methodology applied here goes beyond mere analogical reasoning. A set of alternative possible explanations—some of which may be inspired by analogies—is introduced and subject to systematic evaluation. Hypotheses that explain more of the available evidence are preferred over those that explain less. Those that are preferable when sufficient evidence has become available are acceptable as true. Hypotheses that are inconsistent with that evidence are rejected as false. Any hypothesis that is accepted might still be false, but is the most rational among the alternatives. This exemplifies <u>inference to the best explanation</u>, as introduced in Chapter 1.

Other students of cognitive ethology have employed this methodology without acknowledging it by that name. The most striking instance with which I am familiar is Carolyn Ristau's study of the piping plover (Ristau 1991), which apparently deliberately feigns injury to lead predators away from its young, where she systematically eliminates the alternatives that this behavior is explainable (H1) as a reflexive or a fixed action pattern response, (H2) as conflict behavior, (H3) as an approach/withdrawal tendency, (H4) as a pre-programmed sequence of behavior, or (H5) as a kind of learning, where only (H6) as purposive or intentional behavior remains.

(h1) The bird's behavior is a reflexive fixed-action-pattern response.
(h2) The bird's behavior is a manifestation of conflicting motivations.
(h3) The bird's behavior manifests approach/withdrawal tendencies.
(h4) The bird's behavior is a pre-programmed sequence of behavior.
(h5) The bird's behavior has been acquired as a function of learning.
(h6) The bird's behavior is intentional or purposeful in its character.

The behavioral observations (observational evidence) includes that injury-feigning is not random, not simply away from nest or from intruder, etc., not inconsistently leading away from the bird's nest, not rigid and inflexible, not acquired from repeated exposures, etc.

Table XII. Ristau's Inference to the Best Explanation.

Ristau's study, like those of Sherry, Shettleworth and Krebs, also illustrates that every relevant alternative explanation must be taken into consideration. Otherwise, the true explanation need not be a member of the set of possible alternatives. Thus, the discovery that some possible alternative explanation has been overlooked may necessitate reconsideration of the inferential situation as a manifestation of the tentative character of scientific knowledge. Most importantly, however, it displays how hypotheses that make reference to cognitive variables are capable of being subjected to tests involving controlled experiments and focused observations.

The third criterion of consciousness Dawkins introduces, (CC-3), is learning from others (Dawkins 1993, p. 45), which goes beyond learning from experience for oneself to include benefiting from the experience of others. It thus raises the prospect of communication and cooperation for the benefit of the community as a manifestation of the transmission of information from one generation to another as a form of "culture" or "tradition". What may be most surprising is that the example that Dawkins discusses is rats, who exemplify mental abilities that exceed what our preconceptions imply.

Dawkins discusses clever experiments involving pairs of rats conducted by Bennett Galef (1986, 1991), in which he would expose one member of the pair (the "demonstrator" rat) to food scented with cocoa or cinnamon. The second member of the pair (the "observer" rat) would notice if the demonstrator appeared to be healthy after having eaten and would associate the scent it detected with the palatability of the scented food. The presence of the smells thus function as useful indications of correlated causes (scented foods) and effects (healthy or not) where one rat could learn from another.

Even more elaborate studies suggest that information about potential dangers can be transmitted within whole colonies of rats. A colony was regularly fed food of two kinds, X and Y. Food of kind X was then treated with lithium chloride, which makes rats ill but does not kill them. As a result, the whole colony stopped eating food X and only consumed food Y, an effect that persisted through subsequent generations, even though food X was no longer being treated with lithium chloride and was just as palatable as food Y. Although Dawkins does not phrase it this way, the rats are apparently thereby perpetuating a "tradition" (Dawkins 1993, pp. 48-52).

Dawkins introduces two additional criteria of consciousness in the form of (CC-4) <u>behavior involving choice</u> and (CC-5) <u>behavior involving cooperation</u> (Dawkins 1993, p. 53). An example of "choice behavior" in this sense is that of cock house sparrows, who must decide whether or not to swoop after food on the lawn when a threat in the form of a cat might or might not be in the vicinity. Studies by M. A. Elgar (1986a, 1986b) found that sparrows would behave one way or another under various conditions and even seemed to be making calculations about their risks and benefits. The sparrows were confronting options, weighing alternatives, and then acting.

Dawkins also discusses G. S. Wilkinson's studies of vampire bats (Wilkinson 1984), who share their food with other vampire bats, especially with those who have shared their food with them in the past. They are not inclined to share their food with others unless the others have been willing to cooperate with them in the past. These creatures thus display behavior involving what is known as <u>reciprocal altruism</u>, where they help each other when they are in need in the expectation of reciprocation on other occassions. Vampire bats thereby rely on their knowledge of each other's past history to cooperate in ways that may turn out to benefit the community.

Dawkins provides convincing reasons to conclude that consciousness, properly understood, makes an important difference to the behavior of organisms that possess it, especially coping with problems that are novel or unpredictable, where unconscious and routine responses may not provide solutions that are adequate to handle adaptive problems. This generates a difference that enhances the relative fitness of organisms possessing this property in contrast with organisms that do not, which supplies a plausible explanation for the existence and evolution of consciousness.

If Dawkins has carried this off well, at least three ingredients appear to have been enormously important in contributing to her remarkable success. The first is that Dawkins did not allow herself to become embroiled in premature disputes over the precise nature and definition of "consciousness". The second is that Dawkins rejected the Cartesian conception of knowledge as certainty and substantially advanced tentative scientific understanding. The third is that Dawkins belief in analogical reasoning complemented rather than interferred with her practice of inference to the best explanation.

Among the more striking features of her work is that many of the kinds of consciousness that Dawkins considers—including most of those satisfying (CC-1) through (CC-5) as well as others she discusses—go beyond mere "immediate awareness". We may even want to admit that some forms of consciousness exist that do not satisfy even this modest conception. If internal bodily processes, such as digestion and gestation, for example, can take place without having any "immediate awareness" of those internalized activities, then it might turn out to be important to distinguish between (what could be called) <u>sentience</u> from the stronger forms of <u>consciousness</u> she considers.

We may ultimately acknowledge a continuum of grades of consciousness from sentience to awareness on to awareness with the ability to convey the contents of awareness and self-awareness consistent with Dawkins' position. And there may be more adequate conceptions of mentality than to identify it with consciousness. But their benefits are ontic rather than epistemic. I happen to believe that minds are best defined as sign-using (or "semiotic") systems—an approach we are about to explore—but I also know there are no better methodologies for scientific inquiries than those she has employed.

2. The Nature of Minds.

The place to begin is with the theory of signs of Charles S. Peirce (1839-1914). According to Peirce, a sign is a something that stands for something (else) in some respect or other for somebody. The sign relation is therefore triadic, involving (a) a causal relation between a somebody (a sign user) and a something that stands for something (a sign); (b) a semantical relation between that something (sign) and that for which it stands (the something else); and (c) a pragmatical relation between that something and that for which it stands (which may be itself or other things), and that sign user. This general conception may be diagrammed as a triangular figure for which the vertices are respectively the sign, "S", the user "z", and that for which it stands "x"; indeed, absent some user, nothing functions as a sign for anyone at all, namely:

```
                    Something
                        S
                      *   \
Causation            *      \        Ground
                   *          \
                  *             \
                 z ------------ x
             Somebody       Something

                   Interpretant
```

Figure 12. The Triadic Sign Relationship.

Peirce distinguished between three different grounds as kinds of ways in which things might stand for other things in some respect or other, namely: (i) resemblance relations, where things that resemble other things are therefore icons; (ii) cause-and-effect relations, where causes and their effects are therefore indices; and (iii) habitual associations, where things that are merely habitually associated with other things are therefore symbols. While iconic and indexical relations may exist in nature whether anyone has noticed them or not (as tree rings, for example, are effects of the age of a tree), they can only serve as signs when someone has noticed a relationship by virtue of which those things (tree rings) can stand for associated properties of other things (the age of the trees).

Among the most familiar examples of symbols are the words that occur in ordinary languages, such as English, French and German. Words such as "snow" and "white" do not resemble the forms of frozen water and absence of color for which they stand, respectively, and therefore do not qualify as icons. And while speakers of English may use those words to describe aspects of their experience, the presence of snow by itself no more produces those words absent speakers of English than absence of snow inhibits the production of those words in the presence of speakers of English. Speakers of other languages, no doubt, would use other words under the same conditions, which indicates that words similarly cannot properly qualify as indices. They are properly characterized as symbols.

The relationship of habitual association that grounds symbols to things might be said to reflect an artificial rather than a natural connection, because, unlike resemblance and cause-and-effect relations, we must create them for them to even exist. Relations of resemblance and of cause-and-effect, by comparison, reside in nature whether we notice them or not. Habitual associations between words and objects are dispositions of sign users to use specific signs to stand for specific things in specific respects, where variations in usage between sign users are always possible. Indeed, there is no reason to reject the possibility that every sign user might use signs in ways that differ from any other user—not for every individual sign, necessarily, but for all of them considered together as a collection.

The prospects for what are often called "private languages" are therefore abundant (Fetzer 1989). Consider the case of a sailor, stranded on a deserted island, who decides to study the flora and the fauna he encounters, identifying and classifying them on the basis of a taxonomy of his own design and introducing names denoting specific animals and plants and predicates that designate their various properties. It would be unsurprising in the extreme for him to have thereby adopted a set of linguistic dispositions unlike those of any other botanist or zoologist the world has ever known. He would possess a constellation of dispositions for speech and other behavior that reflect a unique set of correlations between language and the world.

Although in this instance the sailor's language would be his alone, that condition might turn out to be temporary, for example, were another party to be stranded on the same island who adopted his novel taxonomy. That languages may be private does not imply that they are therefore unlearnable or could not be taught to someone else. An argument against the very possibility of private languages attributed to Ludwig Wittgenstein (1958) seems to hinge on the changeability of dispositions with each use of a word or an inscription, since their constancy cannot be guaranteed. It is logically possible for sign users to change dispositions from time to time, but if this were a frequent occurrence, even public languages would be impossible.

A similar argument could also be transferred to things in the world, whose properties might change arbitrarily from time to time and therefore be incapable of systematic prediction or explanation. Indeed, this was a thesis of David Hume, who denied the existence of "natural necessities" that could not be violated and could not be changed. Hume's position presumed that belief in the existence of non-observable properties and relations was never epistemically justifable, thus overlooking the evident consideration that the existence of unchangeable and inviolable lawful regularities could be subjected to empirical test by attempting to falsify them, where unsuccessful attempts are positive evidence that they exist.

Without a certain degree of constancy in the properties of things in the world and of organisms in causal interaction with those things, not only language and perception but also communication and cooperation would be difficult to achieve. Communication situations, for example, typically involve two or more sign users interacting with the same sign, where they may or may not interpret it the same way by assigning it the same meaning. This becomes especially problematic with respect to symbols, since there are no resemblance relations or cause-and-effect relations to establish standards for comparing the degrees of similarity between one symbol and another until sign users arrive at some common understanding.

This general phenomenon may be represented by a pair of triangular figures that share at least one point, namely, a sign, "S", where user "z1" takes it to stand for "x1" and user "z2" to stand for "x2", where "x1" may not be the same as "x2":

```
                          Sign
                            S
S stands for x1          * / \ *          S stands for x2
                       *   /   \   *
     for z1          *    /     \    *          for z2
                   *     /       \     *


              z1 - - - x1           x2 - - - z2

                        Does x1 = x2?
```

Figure 13. Communication Situations.

As a result, communities tend to be highly motivated to take measures to insure that their members speak the same language through institutions that perpetuate specific linguistic practices distinctive of those communities as their conventions. Although, in almost every case, the members of these communities do not use all and only the same words exactly the same way—and thus have private languages —public languages are defined by the conventions adopted by those communities.

The use of the term "adopted", no doubt, must be understood historically insofar as many, perhaps most, of the linguistic dispositions that define these conventions are perpetuated as customs, traditions and practices of those communities, which may have a long lineage. Since these customs, traditions and practices can change across time, however, they require periodic reaffirmation as the current practices of their respective communities, whose study falls within the domain of empirical linguistics. But the normative significance of linguistic practices also falls within the province of philosophers, who attempt to demarcate between various aspects of their meaning and use. These conventions tend to fall into at least two domains.

The study of the meaning of words (sentences, paragraphs, and so on) falls into the category of semantics, which attempts to distill the meaning of words that are used by the members of language-using communities. Results of these studies are commonly codified in the form of dictionaries, which report upon the meanings of those words in practice during specific temporal intervals and may require revision as new practices are adopted and old ones discarded. The term "fuzz", for example, meant police officer to street gangs in New York City during the 1950s; but that use of the term has long since been abandoned. As a consequence, dictionaries that are not periodically revised may cease to describe current practice within a community.

The study of the use of language (to inform, to persuade, and so forth) falls into the category of pragmatics, which attempts to discern the conditions under which different uses of language occur. Many of these studies concern typical situations in which informative conversational exchanges take place, which are governed by cooperative principles such as maxims of quantity ("Say as much as but not more than is required") and of quality ("Say nothing you believe to be false or for which you lack adequate evidence"). But not all uses of language are for the purpose of the truthful exchange of information, since language may also be employed to mis-lead or to confound, for example, which may appropriately violate these standards.

Although dictionaries may be repositories of common practice, it has long been apparent that every word within a dictionary could be defined by means of other words within that dictionary only if either (i) some words are ultimately defined by means of themselves, thereby generating circular definitions, or (ii) old words are defined by new words, which are defined by new words, ad infinitum, generating an infinite regress (Fetzer 1991d). So long as vocabularies are finite, the only way to avoid circular definitions—where a is defined by b and b by c and so forth until a is defined by a again—would be by reliance upon some words that are not defined, where these words are primitive (or undefined) elements of a language.

The problem of primitives thus becomes that of explaining how it is possible to understand the meaning of words that are undefined. This difficulty has been appreciated by Jerry Fodor (1975), who has suggested that learning a language L presupposes understanding what it means. (Fodor's position is so instructive that I shall discuss it several times in this book.) Thus, learning that the meaning of a is the same as b can only occur for those who already understand the meaning of b—presumably, relative to their respective languages, A and B. Thus confronting the choice between an infinite progression of metalanguages A, B, C, . . . and the existence of a base case, an unlearned language, Fodor chooses the existence of an innate mental language called "mentalese" and known as the language of thought.

Fodor's position entails an initially appealing conception of perception according to which perception consists of the subsumption of experience by means of the private language of thought, which can be made public through speech. In order to have the ability to subsume every possible experience—past or future—however, its resources—from primitive man to Homo sapiens—must be sufficiently rich to encompass any innovation in art or literature or science or technology, no matter how technical and obscure, a scheme that precludes the gradual evolution of language or mind. For if mentalese lacks this property, there can be examples of learning new words that it cannot explain, which reinstates an infinite regress.

If learning new words implies the reinstatement of an infinite regress, then the language of thought hypothesis no longer provides the simplest or most adequate explanation of the phenomena of language learning, since it requires both an innate base mental language and an infinite regress of metalanguages, while its alternative posits only the existence of an infinite regress of metalanguages. Assuming that an adequate theory of language learning must be consistent with evolution, the language of thought must be rejected. But it also implies that every neurologically normal human being must have the same innate language and that unsuccessful translations between different languages must be systematically impossible, necessarily.

Even more importantly, the language of thought hypothesis and its regress alternative both appear to have been motivated by a misunderstanding on Fodor's part. Fodor's suggestion—namely, learning that the meaning of a is the same as b can only occur for organisms that already understand the meaning of b—implies the existence of their respective languages, A and B, only if that prior understanding has to be linguistic (Fetzer 1989)! Otherwise, learning that the meaning of a is the same as b may occur on the basis of prior non-linguistic understanding of the b-phenomenon that a might then be used to describe. Indeed, there are many commonplace cases in which we display the ability to understand phenomena prior to describing them with words.

The most familiar instances involve <u>ostensive definitions</u>, in which the meaning of words is explained by offering samples or examples of things of that kind. For those who are unacquainted with the meaning of "chalk", for example, we might show them some pieces of chalk, write on the blackboard with them, break them into pieces and such, to convey the sort of thing meant by that word. In such a case, we are trying to convey the meaning (or <u>intension</u>) of the word by exhibiting examples that satisfy its meaning (and therefore fall within its <u>extension</u>). We may not always succeed, since incidental properties of the members of the sample, such as their size, shape or color, can be mistaken for necessary properties of everything of that kind. But we often do.

3. <u>The Role of Concepts</u>.

Other cases appear to be analogous. Infants can learn to suck a nipple, bounce a ball, or draw with crayons <u>without knowing</u> that what they are sucking on is called "a nipple", that the thing they are bouncing is called "a ball", or that the marks they are making are made by "a crayon". Once they have acquired an understanding of the properties of things of those kinds, however, through causal interaction or even by observation and inference, neurologically normal <u>Homo sapiens</u>, under suitable conditions of acquisition, readily assimilate corresponding linguistic dispositions. They not only learn to <u>bounce balls</u>, <u>draw with crayons</u>, and so on, but also learn that what they are doing is "bouncing a ball", "drawing with a crayon", and so forth.

The non-linguistic understanding that comes prior to language learning appears to consist in the acquisition of specific sets of habits of action and habits of thought, which constitute corresponding <u>concepts</u>. Thus, the things that you can do with a ball (bounce it, roll it, squeeze it, throw it) become associated through experiences with things of that kind, such that seeing a ball (rolling a ball, and such) may bring to mind squeezing it (throwing it, and such), which in turn may bring about corresponding actions (of squeezing, throwing, and such). These patterns of association become mental habits because these properties come and go together as features of things of that kind, while others (such as where they can be found) may vary.

Since there might be infinitely varied conditions under which the properties of a ball would be displayed (by dropping it from greater and greater heights, for example), the content of our concepts may be strengthened through inference and the acquisition of knowledge about things of that kind, some of which (their behavior in weak gravitational fields, for example) may come as a surprise. This does not imply that the content of every concept has to be derived from experience, as some versions of empiricism may require. Our knowledge of which contingent properties of things are lawful properties of things of that kind and of which are not obviously requires empirical support, but it does not therefore have to be direct (Fetzer 1993).

These reflections are consistent with Peirce's analysis of the content of a concept by means of the causal role it would exert upon behavior under varied circumstances. Peirce thus distinguishes between verbal definitions and the concepts they are (very inadequately) used to describe, where the most adequate account of a concept that mere words can convey would consist of a description of the sets of habits of mind and habits of action that the presence of that concept would produce under various conditions. In the case of human beings, no doubt, those conditions would have to take into account not only motives, beliefs, abilities and capabilities in relation to thought processes, but those and ethics as well in relation to actions in the world.

The acquisition of linguistic dispositions that relate some signs to other signs (words to their linguistic definitions) on its own cannot overcome the problem of primitives, whose solution requires relating those signs that remain undefined to specific sets of habits of mind and of action, which determines their meaning (what they stand for). The relationship between signs and what they stand for thus has to be mediated by sign users, since, in the absence of corresponding concepts that are embedded within them, they have no meaning. And this includes icons and indices as well as symbols, since, even though resemblance relations and causal connections can exist in nature without having been detected, they cannot function as signs for anyone unless sign users are able to detect their presence and what they stand for.

These reflections raise the possibility that sign users may be precisely the kinds of things that properly qualify as "minds". This conception appears to be justifiable for many reasons, since without sign users, the problem of primitives could not be successfully overcome and nothing would stand for anything for anyone at all. Indeed, it is an anthropocentric prejudice to suppose that sign users have to be somebodies, when other animals or even inanimate machines might be systems of this kind. Let us therefore define minds as semiotic (or "sign using") systems, which are things (humans, animals, or machines) that can take something to stand for something else in some respect or other (Fetzer 1988a, 1989, 1990a, 1991/96).

It follows from the definition of minds as semiotic systems that there may be as many kinds of minds (or modes of mentality) as there are kinds of signs. Thus, systems that are capable of utilizing icons qualify as minds of Type I, those capable of utilizing indices as minds of Type II, and those capable of utilizing symbols as minds of Type III (Fetzer 1988a, 1990a, 1991/96). There are higher kinds of mentality, but for present purposes, these will do. These are successive stronger and stronger kinds of minds, insofar as the capacity to utilize symbols presupposes the capacity to utilize indices and the capacity to utilize indices presupposes the capacity to utilize icons. Systems of each type can differ in the number and variety of signs that they utilize.

It thus becomes obvious why the Fodorian conception of perception has to be rejected. Dreams and daydreams commonly occur as sequences of images and thereby exemplify iconic (or Type I) mentality. To the extent to which they include events that stand to other events as cause-to-effect, of course, they may also exemplify indexical (or Type II) mentality. While they may include the use of symbols, such as the occurrence of speech and other linguistic activities, which exemplifies symbolic (or Type III) mentality, nothing inherent in dreams or daydreams requires it. And similarly for perceptual situations, such as drivers encountering traffic lights at intersections. These activities involve signs but do not depend on the use of language.

Unlike the language of thought conception, this approach may also apply to other animals, such as bats, monkeys, or bacteria. Unless we are prepared to endow them with bat-language, monkey-language, and bacteria-language, those who accept that account must bite the bullet and deny that they are capable of thought or perception. This seems very odd if perception, for example, is indeed an adaptive function, since presumably it has evolved through successive species in a long evolutionary process over millions of years. Current studies suggest that many forms of animal life other than human display behavior exemplifying thought and perception. The problem has been to discover a framework that make the phenomena intelligible, which the conception of minds as semiotic systems appears to provide (Fetzer 1990a, 1991/96).

The nature of consciousness and of cognition has been the subject of many recent studies, including Daniel Dennett (1991), Roger Penrose (1995), and David Chalmers (1996). These works display the tendency to assume that "consciousness" involves "awareness", understood as the conscious subjects not only having experiences but being aware of having those experiences as well. This approach carries with it the temptation to assume that consciousness not only involves awareness of having experience but an awareness of the subject itself as that which is having experience. Although this tendency has a Cartesian legacy, it may not sufficiently distinguish between having sensations, interpreting them, and higher orders of consciousness.

Thus, when minds are defined as semiotic systems, consciousness is relative to kinds of signs that those systems use. Such a system (whether human, animal, or machine) is conscious with respect to signs of specific kinds (i) when it has the ability to use signs of those specific kinds and (ii) is not inhibited from the exercise of that ability. And cognition occurs as the effect of a causal interaction (i) when a system that is conscious with respect to signs of those kinds (ii) encounters signs of that kind within suitable causal proximity. Those specific effects depend on the system's other internal states, which constitute its context (Fetzer 1989, 1990a, 1991).

Consciousness is thus understood as a semiotic phenomenon involving (i) ability and (ii) capability, while cognition is a complementary semiotic phenomenon involving (i) consciousness and (ii) opportunity. When someone is suffering from a severe cold or has been blindfolded, their capacity to exercise their ordinary ability to use signs of specific kinds is thereby impaired. And when those who are not color-blind or otherwise visually impaired are within suitable causal proximity of red lights, for example, the effects that are thereby produced depend on their other internal states, including previously existing motives, beliefs, abilities and capabilities, which might variously yield perception of the presence of stop lights or of fire engines, and so on.

These reflections raise the possible existence of different kinds of consciousness. Insofar as the occurrence of the same stimulus (say, the presence of a red light) may bring about the occurrence of different responses (such as perception of a stop light, a fire engine, and so forth), these aspects of the phenomena of consciousness and of cognition require careful differentiation. The patterns of neural activation that are induced by an external cause (such as a red light within suitable causal proximity) might be qualified as sensations, in which case the ability to experience them might be regarded as the lowest level of consciousness. In that case, the interpretation of sensations by subsuming them under specific concepts should qualify as perception.

An alternative approach has been advanced by Dennett (1996), who raises the possibility that there may be no more to consciousness than its lowest level, which he identifies as sentience. Dennett suggests that, while sentience presumably combines (what he calls) sensitivity with some additional factor x to produce consciousness, perhaps there is no additional x factor and there is no more to consciousness than sensitivity. This may come as a rather peculiar claim given some of his own examples—photographic film, which is sensitive to light; thermometers, which are sensitive to heat; and litmus paper, which is sensitive to acidity—which appear to be appropriate illustrations of sensitivity without sentience. But, before pursuing this matter further, we may consider the nature of sensation in additional detail.

Neurologically normal human beings have the benefit of at least five sense modalities, including sight, hearing, taste, touch, and smell. Systems of the kind Homo sapiens, unlike bats, ants, and bacteria, are heavily dependent upon their visual abilities for information about their environments. From an evolutionary point of view, these sense modalities have evolved because of their adaptive contributions to the survival and reproduction of the species. Their cognitive function in acquiring and processing information about their environments matters not only because it positively affects the development of individual organisms but also because it makes a difference to the evolution of the species. These specific abilities have evolved because of their tendency to enhance fitness.

The neurology of perception is a complex causal process, which can be illustrated with respect to vision. Light rays pass through the cornea, a transparent membrane covering the eye, and through the lens to the retina at the back of the eyeball. The image is then sent to the brain by way of optic nerves, which induces the activation of patterns of neurons. Precisely which patterns are activated depends upon causal interactions between the patterns of light derived from some specific source—which, in ordinary experience, has an external cause—and the properties of the cornea, the lens and the retina, as well as the condition of the optic nerves and the state of the brain. Different effects are brought about by variations in the shape of the eyeball or curvature of the cornea, which may affect the pattern of activation (Vernon 1971).

When the eyeball happens to be elongated or the cornea is too steeply curved, for example, images are focused in front of the retina causing distant images to be blurry. When the eyeball is too short or the cornea too flat, images are instead focused behind the retina causing near images to be blurry. Thus, in cases of these kinds, patterns of neural activation that might otherwise be familiar and readily subsumed by means of present concepts remain blurry and indistinct. The effect may therefore be the occurrence of an impression rather than of a perception, where the sensations experienced are not capable of subsumption by more exact concepts but are unfocused and fuzzy. They may be subsumable only by those habits attending fuzzy and unfocused images.

From this perspective, therefore, perception can be characterized as a process that involves two or perhaps three separable stages. The first is the acquisition of some pattern of <u>neural activation</u>, which may have many possible sources (including internal causes, such as the influence of drugs or even brain damage). The second is the subsumption of that pattern of activation by <u>conceptualization</u>, whereby that pattern may or may not become an instance of a familiar kind. The third is that of <u>description</u>, where an instance of that kind happens to be described by the use of language. Mistakes of misidentification and of misclassification can occur between stage one and stage two, just as mistakes of misdescription or of miscalculation can occur between stages two and three. The prospect of non-linguistic perception, of course, motives envisioning the subsumption of a sensation by means of a concept as "perception". Perception thus requires concepts, but does not require language.

Thus, if Dennett (1996) were right—if there is nothing more to sentience (as the lowest level of consciousness) than sensitivity—then his own samples of sensitivity without consciousness—photographic film, thermometers and litmus paper--have to be conscious, after all, which is not an enviable position to defend. The missing ingredient x whose existence he doubts appears to be the subsumption of sensations by means of specific sets of habits of action and habits of thought. The reason why his examples are such appropriate illustrations of non-conscious things is that no one would be inclined to suppose that any causal interactions between photographic film and light (thermometers and heat, and so on) involve any subsumption by concepts.

The key to understanding consciousness and cognition specifically and mentality in general thus appears to be their distinctively semiotic dimension. Processes that involve the use of signs are properly qualified as mental activities, while those that do not are not. The term "sentience" appears to be perfectly appropriate in relation to the capacity to experience sensations. But unless those sensations are subsumed, in turn, by sets of habits of action and habits of thought with distinctively semiotic character, it does not properly qualify as "consciousness". And forms of consciousness that entail an awareness of the use of signs by a system, especially through the use of signs that stand for consciousness itself, may properly qualify as higher order.

The highest order of consciousness, from this point of view, may involve not only awareness of the use of signs by a system, but that system's own awareness that it is the system using those signs as "self-consciousness", a capacity that does not appear to be the exclusive prerogative of human beings. Thus, E. coli bacteria swim toward twelve chemotactic substances and away from eight others (Bonner 1980), an evolved response that at least exemplifies sentience. Bats employ echo location by means of high-frequency sound vibrations (Griffin 1984), an evolved response that appears to exemplify consciousness. And chimpanzees display forms of self-awareness that seem to properly qualify as kinds of self-consciousness (Cheyney and Seyfarth 1990).

None of these forms of consciousness—from sentience to self-consciousness—seem to be reducible to mere sensitivity. But it is fascinating to discover that precisely the same sensation as a pattern of activation of neurons in the brain might be interpreted iconically, indexically, or symbolically. Consider again, for example, a red light at an intersection. It might be taken iconically when the sensations that it brings about cause mental transitions to other patterns of activation that stand for other things that resemble its color (its shape, and so on), such as the dress that his wife wore the night before. Taken indexically it might cause a repair man to think about possible reasons why it is not working properly. Taken symbolically it might cause a driver to stop.

Indeed, as a generalization, it appears to be the case that for something to stand for something for a system presupposes a point of view relative to which something experienced as a pattern of neural activation becomes identified, classified or categorized as a thing of a certain kind. This function, of course, can be fulfilled when the system possesses corresponding concepts, in the absence of which it has no "point of view". These sets of habits of action and habits of thought occur as preexisting inner states of that system, which affect the tendency for the activation of one pattern of neurons to bring about the activation of another, which might be iconic, indexical, or symbolic. The strength of the tendency for specific patterns of neural activation to bring about other specific patterns has the nature of a propensity (Fetzer 1991/96).

As properties of semiotic systems, mental dispositions might be deterministic or probabilistic. They are deterministic when, under precisely the same (internal and external) conditions of stimulation, the system would respond in precisely the same way by effecting the same transitions between mental states and bringing about the same behavior as an outcome. They are probabilistic when, under precisely the same (internal and external) conditions of stimulation, the system would respond by effecting one or another transition between mental states and bringing about one or more behaviors as its outcome, each with constant probabilities. The system, in this case, possesses mental and behavioral propensities as probabilistic dispositional properties. Thus, animal mentality can be explained semiotically as the use of signs by various subjects (animal or human) who are able to sense and perceive their world (possibly including themselves) from a specific point of view, subsumed by sets of habits of action and of habits of thought, according to their respective semiotic abilities and capabilities.

CHAPTER 7: THE MINDS OF PRIMATES

Perception is obviously a cognitive function and, more importantly, an adaptive cognitive function, namely, one that contributes to the survival and reproduction of organisms. Thus, the adaptive virtue of perception is its tendency toward veridicality (truth), which is not the same thing as veridicality. The term is commonly used as a success term, where perceiving thing x implies the existence of thing x. Yet misperception is always a possibility, such as when I look into the refrigerator and see what I take to be a bottle of beer, later to discover it was instead a new fruit drink my daughter brought home that comes in bottles that look like bottles of beer, a difference I ascertain only when I actually have the chance to drink it.

This approach, of course, tends to explain at least one of the differences between direct realism and phenomenalism, since the process of interpretation by subsuming specific sensations as instances of specific concepts and thereby identifying, classifying, and categorizing them by relating them to specific habits of mind and habits of action allows for the possibility of misidentification, misclassification, or miscategorization as varieties of mistakes. The ability to make mistakes, moreover, appears to be a general criterion of mentality as an evidential indicator of the presence of mentality for minds as semiotic systems, since systems that can commit mistakes must have the ability to take some things to stand for other things, albeit wrongly.

As a consequence of the causal influence of evolution, perception (in normal organisms) is usually reliable for the purpose of acting within their environment, but things are not always the ways they are taken to be, not just as a matter of accident but sometimes quite deliberately. This extends to the deception of other members of the community, such as a lioness who behaves as if everything were normal with other lions in her pride in order to avoid sharing her new kill and to save it for her own cubs (Dawkins 1993). Cases of this kind illustrate the role of deception in animal life and offer evidence that other animals, as well as human beings, are capable of making mistakes and therefore appear to possess minds.

Errors that arise from faulty perceptions or misinterpretations of experience include when parallel lines appear to converge, dreams are mistaken for reality, or mirages induce false beliefs. Illusions can be said to differ from hallucinations, where hallucinations involve beliefs in the existence of things which do not exist, while illusions involve the belief in non-existent properties of things that do exist (Fetzer and Almeder 1993). These kinds of mistakes are highly interesting theoretically, because they exemplify the possibility of patterns of neural activation that are brought about by the influence of factors other than their typical causes, such as the influence of hallucinogenic drugs (hypnotic suggestions, and so forth).

1. The Great Apes.

Another important contribution to understanding the nature of animal mind has been made by Merlin Donald, Origins of the Modern Mind (1991). Donald attempts to describe and to explain the emergence of successively stronger and stronger forms of cognitive ability by means of what he takes to be three primary transitions between distinct stages in the evolution of animal life. These are represented by shifts from what he refers to as "episodic" to "mimetic" to "mythic" to "theoretic" modes of thinking. Although, strictly speaking, each mode qualifies as a different response to a distinct evolutionary niche, each mode appears to be stronger than its predecessor, suggesting a kind of evolutionary progress regarding the evolution of minds.

The evolutionary forms of animal life Donald characterizes in terms of these dominant types of cognitive ability are the great apes, Homo erectus, Homo sapiens (early) and Homo sapiens (late). The episodic mentality of the great apes, for example, is dominated by stimuli in the immediately-present environment, where gestures are the prevalent form of communication. By the time of Homo erectus, however, the capacity for re-enacting events that have occurred in the past has emerged, which represents a new kind of communicative capacity that depends upon enhanced neural memory abilities.

The novel cognitive capacities represented by Homo sapiens (early) are somewhat more complex, involving two transitional stages. The first involves the use of varying "tones of voice", which he (following Darwin) tends to interpret as "song". The second involves the use of speech, especially as it is reflected by differences in vocal apparatus. The novel cognitive capacities represented by Homo sapiens (late) are typified by the emergence of reading and writing, which vastly extends the ability of a species to record and transmit information between members, as other authors have noted.

The principal theme that emerges from this study, which appears to be its main thesis, is that these transitions in cognitive capacity are primarily differences in memory storage and information retrieval abilities, where the computer revolution represents yet another great leap forward in our storage and retrieval abilities and thereby marks yet another step in the evolution of Homo sapiens (modern). The broadest features of the position that is developed in this book can therefore be outlined roughly as follows:

Stage:	Level (A):	Level (B):
I. The Great Apes	Episodic	Gestural (stimulus bound)
II. Homo Erectus	Mimetic	Gestural with re-enactment
III. Homo Sapiens (early)	Mythic	(1) Song (tones of voice)
		(2) Speech
IV. Homo Sapiens (late)	Theoretic	Reading and Writing

Table XIII. Donald's Four Stages of Cognitive Evolution.

This is merely an outline, of course, which does not begin to do justice to the supporting evidence that he produces, including studies of neurophysiology and various kinds of paleo-anthropological evidence, etc. Thus, there is much more to Donald's position than I have described here. Nevertheless, if I have understood him correctly, then these are the major features of the stages of cognitive evolution as he presents them, where the difference between "Level (A)" and "Level (B)" is simply that between the general conception of cognition at that stage and a counterpart analysis of capabilities.

My basic criticisms of this approach are two-fold. In the first place, the distinctions that he draws between episodic, mimetic, mythic and theoretic do not appear to be fully developed and adequately justified. I should add that I am more intrigued by the episodic/mimetic distinction than I am by the mythic/theoretic distinction. The former strikes me as far more plausible than the latter, especially because primitive myths can be viewed as prototypes of theories. In the second place, the referential (or "propositional") conception of language that he relies on requires further refinement. The central problem about language, I believe, is better envisioned as the problem of meaning rather than as the problem of reference. While some words and sentences have referents, others can be meaningful even without them.

What I have in mind is the difference between a model of language that focuses upon names and predicates as standing for objects and properties in the world (which seems to be the conception Donald adopts, although I am unable to claim this with certainty) and models which do not. The primary function of language on a referential model is therefore that of making assertions that are either true or false. The most important kind of sentences for a model of this kind are declarative sentences, which are the only type of sentences that are ordinarily supposed to be either true or false. Other kinds of sentences assume a subservient role, if they are considered at all.

In my estimation, an adequate understanding of the nature of language from an evolutionary point of view requires abandoning a referential model of this kind in favor of a "speech-act" conception, where different kinds of sentences are acknowledged to fulfill different linguistic roles. From such a perspective, declarative sentences may turn out to be far less important to the evolution of cognition than other kinds of sentences, especially exclamatory sentences (which express attitudes or emotions) and imperative sentences (which issue directions or commands). "Ouch!" and "Look out!" are not sentences in the declarative mode and are neither true nor false, but their evolutionary significance might still qualify as extremely important.

These are kinds of sentences, moreover, for which "tones of voice" can make a tremendous difference. Consider the various degrees of emphasis that can be placed upon the same sentence, such as "Be quiet!" When said softly, it can have one kind of meaning; when uttered more forcefully, another kind of meaning. The functions that sentences of these kinds can fulfill include alerting, warning, encouraging, discouraging, entreating, soliciting, and so forth, where their role in shaping behavior appears to be undeniable. More importantly, they appear to be forms of communication that are already exhibited by the great apes, a point we are about to discover.

In lieu of the interpretation Donald and Darwin would place upon differences in tones of voice as forms of "song", therefore, I interpret them as different kinds of emphasis that can be employed to convey different degrees of seriousness or importance with respect to corresponding behavior.

I also conjecture that the use of sounds that originate as effects of various causes (such as those of pleasure or of pain, under specific circumstances) can be separated from their original stimulus-bound conditions and begin to function as conventional signs that stand for experiences of that kind.

This, of course, is very much as he proposes in separating the mimetic from the episodic, which I applaud. If we embrace the far broader conception of minds as sign-using (or "semiotic") systems elaborated in my Philosophy and Cognitive Science (1991/96), it becomes fairly obvious that, even if we want to restrict the concept of language to apply strictly to declarative and to interrogatory sentences, there are other communication modes involving signs that precede those involving declarative sentences and which appear to be even more important in effecting transitions from lower cognitive forms to higher cognitive forms among animals.

Moreover, although Donald does not elaborate a theory of the mind, he does provide examples of the kinds of functions that he takes to be characteristic of cognition. They include imitation, focused attention, memory, dreaming, imagination, reasoning, caution, tool usage, abstract intelligence, self-consciousness, and various social and moral capacities, encompassing social cooperation, mutual defense, social bonding, and social intelligence (Donald 1991, pp. 28-31). Among these, the one on which Donald places greatest emphasis is memory, where his "stages" in the emergence of the modern mind involve increased memory storage and retrieval capacities.

Donald's use of these specific aspects of human and animal activities may be appropriate as examples of human and animal cognition, but without an explicit conception of the nature of mind that he does not provide, it is impossible to tell. A more adequate account of the emergence of the modern mind, therefore, might benefit from the introduction of a modern conception of the nature of the mind. An account that promises to serve the function of providing a framework for understanding cognition as an evolutionary phenomenon can be developed on the basis of the theory of signs proposed by Charles S. Peirce, which we have explored in Chapter 6.

According to Peirce, a sign is a something that stands for something (else) in some respect or other for somebody. By inverting and generalizing Peirce's account, the conception of a mind as a something for which other things can stand for other things is made available. Minds thus become the kinds of things that are capable of utilizing signs. Indeed, since Peirce suggested that there are three basic kinds of signs—where icons stand for other things because they resemble them, indices because they are their causes or effects, and symbols because they are habitually (or conventionally) associated with those other things—there seem to be at least three corresponding kinds of iconic, indexical, and symbolic minds.

Things that are capable of utilizing signs that stand for other things because they resemble those other things (as different instances of the same shapes and sizes, for example) thus possess the most basic kind of iconic mentality. Things that are capable of utilizing icons and signs that stand for other things because they are causes or effects of those other things (such as food standing for satiation of hunger, for example) have a higher grade of indexical mentality. Things that are capable of utilizing icons, indices, and signs that stand for other things because they are merely habitually associated with those other things (such as the words of ordinary language) have an even higher grade of symbolic mentality.

An extension of Peirce's conception suggests that there are higher modes of mentality, where the capacity for formal reasoning, especially inductive and deductive reasoning on the basis of rules of inference, distinguishes transformational mentality, and the capacity for criticism (of ourselves, our methods, and our theories) exemplifies the highest grade of metamentality within the scope of this conception. For all five kinds of mentality, the same criterion serves as a usually reliable but not infallible indicator of the presence of mentality, namely, the capacity to make a mistake, because, in order to make a mistake, something must have the capacity to take something to stand for something, while doing so wrongly.

This framework can be applied to Donald's examples of cognitive functioning. Mental functions such as focused attention, memory, and dreaming could be properties of iconic minds (of Type I), since the objects of focused attention, of memories, and of dreams might be merely images—perhaps sequences of images—that resemble what they stand for. Functions such as tool usage, imitation, and self-consciousness, by comparison, seem to require indexical minds (of Type II), since they involve comprehending cause and effect relations of various kinds. Imitation is an interesting example, since it also appears to involve some analogical reasoning capacity.

Social cooperation, mutual defense and social intelligence (which ants, termites, wasps and bees display) may or may not require mentality that goes beyond the indexical, especially when they are instinctual behaviors. Indeed, the difficulty encountered in evaluating whether or not functions of these sorts involve mentality and to what degree is that it depends upon their sign-using (or "semiotic") character. Abstract intelligence and reasoning appear to go beyond indexical mentality to the level of symbolic minds (of Type III). Indeed, when reasoning takes the form of dependence upon rules of inference (as in the construction of deductively valid or inductively proper arguments), then transformational minds (of Type IV) are involved.

What turns out to be most intriguing about caution, from this point of view, is that it appears to exhibit the exercise of the critical capacity indicative of metamentality (of Type V). Since prudent behavior can result from behavior-shaping experiences (of the kind that operant conditioning, especially, can produce) as well as from critical reflection on alternative beliefs and behavior, however, this case too requires further contemplation. The distinctive feature of metamentality is the use of signs to stand for other signs (using words to talk about images, for example). Unless signs are being used to stand for other signs, prudent behavior need not be of Type V.

If birds can mistake the shapes and sizes of vinyl owls for the shapes and sizes of the real thing, if dogs can salivate at the sound of a bell as if it were going to satiate their hunger, and if pigeons can press bars in the false expectation of receiving pellets, for example, then things of each of these kinds can make mistakes and have minds. From this perspective, I would suggest, the conception of minds as semiotic (or "sign-using") systems affords a framework for understanding the evolution of minds of successively stronger and stronger kinds that promises to go far beyond the distinctions that Donald has drawn in his extremely stimulating work.

CONJECTURE: Minds are semiotic systems (sign-users).

DEFINITION: mentality =df semiotic ability

CRITERION: the capacity to make a mistake

Type I:	Type II:	Type III:
definition:	definition:	definition:
iconic	indexical	symbolic
criterion:	criterion:	criterion:
type/token recognition	classical conditioning	operant conditioning

Type IV:	Type V:
definition:	definition:
transformational	metamentality
criterion:	criterion:
logical reasoning	criticism

NOTE: Applicable to humans, to other animals, and to machines:

(1) species are predisposed toward types of mentality;

(2) machines have mentality if they are semiotic systems;

(3) a thing has a mind if it is capable of making a mistake; etc.

Table XIV. The Theory of Minds as Semiotic Systems.

It seems plausible, for example, that different species possess distinct semiotic abilities in the form of distinctive ranges and capacities for the utilization of signs of various kinds. Some of these semiotic abilities may be in-born (or innate), while others are learned (or acquired). Presumably, if the semiotic systems conception is right-headed, lesser forms of life should exhibit lesser kinds of mentality and higher forms of life higher forms of mentality, where their exact range and variety depends upon specific social and environmental variables. The semiotic abilities distinguishing various species may even turn out to be the key to their behavior.

One of the most fascinating aspects of my study of his work, I should add, was the dawning realization that Donald's approach could benefit—perhaps greatly benefit—from adopting a speech act model of language in lieu of the referential model which is presupposed. Indeed, it is never really clear that Donald is wholly comfortable with the model of language he relies upon, in part because of his ambivalence about the work of Noam Chomsky and Jerry Fodor and in part because he often seems to want to go beyond it without feeling confident about how to do that. Whether or not the semiotic systems conception is ultimately embraced, too much work in philosophy and psychology, including this book, which reflects a clear understanding of the evolutionary problem, continues to be dominated by a preoccupation with propositions when speech acts are more fundamental.

From the semiotic systems perspective, in other words, the great apes are already engaged in the use of iconic and indexical forms of communication, where the emergence of mimetic uses out of episodic uses seems to represent an important transitional stage, as he suggests. The use of gestures with re-enactment also appears to provide a crucial bridge between non-symbolic (or non-conventional) uses of signs and what seem to be the first symbolic (or conventional) uses of signs. The transition to Homo sapiens (early) from Homo erectus thus appears to depend upon the use of (more or less) conventional exclamatory and imperative signs (first stage) and declarative and interrogatory signs (second stage), where reading and writing come with Homo sapiens (late), as Donald here maintains.

2. The Mountain Gorilla.

As it happens, the adequacy of the conceptual framework that the semiotic systems approach provides can be tested on the basis of studies of the mountain gorilla that have been undertaken by Dian Fossey, Gorillas in the Mist (Fossey 1983). As Fossey observes, Homo sapiens and the other three members of the Great Apes—orangutan, chimpanzee, and gorilla—are alone among primates without tails. Only about 240 mountain gorillas were still alive when she lived among them in the vicinity of the intersection of Zaire, Uganda, and Rwanda. Recent upheavals there make it highly unlikely that this number survive today. But we continue to benefit from Fossey's studies.

In particular, she recorded nine distinct sounds that they make and use to communicate, which are reported in Appendix E (Fossey 1983) as follows:

Figure 14. Roar
Figure 15. Screams.
Figure 16. Wraagh
Figure 17. Question Bark.
Figure 18a. Cries going into Shrieks.
Figure 18b. Cries subsiding.
Figure 19. Pig-Grunts.
Figure 20a. Belch Vocalizations 1.
Figure 20b. Belch Vocalizations 2.
Figure 21. Chuckles.
Figure 22a. Hootseries
Figure 22b. Hootseries preceeding Chestbeats.

The first point to notice about these sound patterns, no doubt, is that they are among the possible sound patterns that organisms with the physiology of mountain gorillas can make. These sound patterns are known as "phonemes" as sound patterns to which meanings might be attached. The meanings that might be attached, in turn, are known as "morphemes". Apart from the contexts within which those phonemes are expressed, however, it is impossible —at least, virtually impossible—to understand their function as morphemes.

Let us therefore consider the context within which each of these phonemes occurs and attempt to ascertain the meaning, if any, that they may convey.

Roars, for example, "were heard only from silverbacks in situations of stress or threat and were primarily directed at human beings, although occasionally at buffalo herds. The vocalization was always followed, on the part of the emitter, with varying degrees of display, ranging from bluff charges to small forward lunges" (Fossey 1983, p. 251). Searching for an analogue in human speech and behavior, it does not appear inappropriate to regard these aggressive calls (as Fossey describes them) as serving the same function as "Get away!" or "Don't mess with me!" in human contexts.

Screams "were heard from gorillas of all ages and sex classes, but more frequently from silverbacks. The vocalization was most often heard during intergroup disputes, though it could be directed toward human beings or even ravens if alarm, rather than threat, was the motivation for the call" (Fossey 1983, pp. 251-252). These alarm calls appear to serve a function analogous to that of "Damn it!" or "Watch it!" in human contexts. Observe, in particular, that both the use of the roar and the use of screams seem to fulfill functions that are similar to those of imperative and of exclamatory modes of speech.

Wraaghs "were heard from all adult gorillas but far more frequently from silverbacks. They were usually precipitated by sudden situations of stress—the unexpected arrival of an observer, duiker alarm calls, rockslides, thunderclaps, or loud wind noises. The vocalization was most effective in scattering group members and, unlike the roar, was never accompanied by aggressive display behavior" (Fossey 1983, pp. 252-253). Fossey considers wraags to be another kind of alarm call, whose closest analogue in human speech may be "Look out!" as a form of warning that might be employed in a variety of different contexts, depending upon the nature of the problem encountered.

Question barks, consonant with its characteristic composition of sounds —three notes with the 1st and 3rd lower than the middle—were as if asking, "Who are you?" Fossey observed, "It was usually given in situations of mild alarm or curiosity and was a common response to discovery of an obscured observer or to branch breaking noises by gorillas not readily visible to other group members" (Fossey 1983, p. 253). Thus, it functions as a third kind of alarm call, which mildly inquires, "Who are you?" or perhaps "What's up?"

Cries, which resemble wails of human infants, "were heard only from infants or young juveniles and most frequently occurred when they had been left alone, thus temporarily separated from their mothers, or, in the case of [captives], when one was separated from the other or from myself. In both the free-ranging and the captive young gorillas, the cries built up into temper tantrums if a stressful situation was prolonged" (Fossey 1983, p. 254). Indeed, cries not only resemble wails of human infants but appear to have precisely the same function as vivid and vocal expressions of unhappiness.

Pig-grunts "were most frequently heard when individuals were traveling, for this was when trail disputes and altercations over limited food resources were more apt to occur. On such occasions, pig-grunts were effective rebuttal vocalizations and also served as disciplinary enforcements between adults and young" (Fossey 1983, p. 255). Thus, pig-grunts fall into the category of (what Fossey refers to as) coordination vocalizations, which function to induce misbehaving youngsters to mind themselves better, just as humans attempt to control their offspring by saying "Stop!" or "Behave!"

Belch vocalizations, which were "most frequently heard from stationary gorillas at the end of a long, sunny resting period or when in a lush feeding site" or from silverbacks "as a means of establishing location in dense vegetation" (Fossey 1983, p. 255), like chuckles, which were emitted from young engaged in play activities, such as wrestling, tickling, and chasing each other, were expressions of contentment, in the first instance, or of happiness or joy, in the second. There is an ambiguity for belch vocalizations, since they have an alternative (locational) significance, which is settled by context. Their human analogues in belching and laughing, no doubt, do not require explanation.

Hootseries, which were far more frequently emitted by silverbacks, were often concluded with "mechanical noises such as chestbeating, ground thumps, branch-breaking, or runs through thick foliage....... The farther the distance between callers—the hootseries may travel for roughly a mile—the less frequently the intergroup vocalization was terminated by mechanical noises. Hootseries thus functioned well as a type of vocal probing that did not reveal the precise location of a group or of a particular gorilla (Fossey 1983, pp. 256-257). The function of the hootseries followed by chestbeats, for example, thus seems to be analogous to that of humans affirming "I'm here!" or perhaps "My space!"

Table XV. Phonemes, Morphemes, and their Semiotic Type.

The benefits that may be derived from a speech-act approach toward understanding communications between conspecifics thus become quite evident in cases of this kind. The roars, screams, wraags, and pig-grunts, for example, have decidedly imperative character as instructions, directions, or commands intended in influence the behavior of others. Cries, belch vocalizations (in one of its forms), chuckles, and screams (again) clearly have exclamatory functions as expressions of unhappiness, contentment, happiness, or anger. Hootseries and question-barks are especially interesting from this perspective, insofar as they exemplify (what appear to be) declarative functions of making assertions and interrogatory functions of asking questions, respectively, as we have seen.

Perhaps even more important from the perspective of the theory of minds as sign-using systems, however, is that Donald's analysis can be supplemented by an analysis of the kind of connection that obtains between these respective sounds/phonemes (as signs) and their meaning/morphemes (as other things). While cries, belch-vocalizations, and chuckles are clearly indexical in their character (as effects that are related to corresponding causes of which they are invariable or probabilistic manifestations), roars, screams, wraags, question-barks, pig-grunts and hootseries with chestbeats all appear to be merely habitually associated with that for which they stand, which makes their character symbolic! This is a fascinating outcome, since it suggests that there may be an alternative analysis that emphasizes the semiotic quality of these modes of communication:

Stage:	Level (C):	Level (D):
I. The Great Apes	Gestural*	Iconic/indexical/symbolic mentality
II. Homo Erectus	Gestural* with re-enactment	Iconic/indexical/symbolic mentality
. III. Homo Sapiens (early)	(1) Exclamatory/ Imperative	Iconic/indexical/symbolic mentality
	(2) Declarative/ Interrogatory	Iconic/indexical/symbolic/ transformational mentality
IV. Homo Sapiens (late)	Reading and Writing	Iconic/indexical/symbolic/ transformational/critical mentality

[Gestural* means already including some imperative and exclamatory ability.]

Table XVI. Four Alternative Stages in Cognitive Evolution.

Indexical and symbolic modes of semiotic mentality, of course, presuppose iconic mentality, since the recognition of different instances of sounds as instances of the same sound (phonemically) or of the same meaning (morphemically) in relation to their context implies the capacity to recognize them as the same. Insofar as the mountain gorilla already exemplifies the use of symbols, there appear to be grounds here for inferring that the most important stages in the evolution of mentality predate any transitions from episodic to mimetic to mytic and theoretic forms of cognition. More importantly, it offers evidence that the semiotic conception can clarify and illuminate the nature of animal minds.

3. A Precocious Chimpanzee.

Kanzi: The Ape at the Brink of the Human Mind (Savage-Rumbaugh and Lewin 1994) reports the results of years of research at the Yerkes Regional Primate Center located near Atlanta, GA, where Sue Savage-Rumbaugh and others have conducted painstaking and systematic studies of higher primates, especially chimpanzees and bonobos, in an attempt to uncover what properly should be envisioned as the mental abilities of other animal species. Her work not only provides insights about the modes of operation of the minds of other animals but also explores reasons why scientific research in this area has been plagued and inhibited by mistaken paradigms and inadequate methodologies.

These mistaken paradigms have revolved about various doctrines that have been widely accepted in the past, especially theses about the nature of language as a distinctive attribute of Homo sapiens, a view that derives principally from the work of Noam Chomsky, who has dominated theoretical linguistics for most of the second-half of the 20th C. Chomsky's emphasis on syntactical structures has encouraged the conceit that the study of these structure has the ability to lay bare the nature of the human mind and its corollary that all languages can be properly unified only by appealing to Chomsky's innate universal grammar.

From this point of view, the phrase, "human mind", assumes a certain kind of redundancy, insofar as Chomsky has cultivated the notion that languages are unique properties of humans, which implies that minds, as language-dependent information-processing mechanisms, are likewise uniquely human—where any "mind" must be human. As Savage-Rumbaugh observes, however, this attitude appears to be incompatible with evolution, where the emergence of adaptations crucially depends upon multiple sources of genetic variation and mechanisms of selection, where higher-level properties typically have lower-level antecedents.

Chomsky's approach would be plausible, therefore, only if it were reasonable to suppose that Homo sapiens should be expected to have abilities and capacities of fundamental importance to its successful adaptation that differ from those of its evolutionary ancestors not merely in degree but in kind. This conception calls to mind the image of Athena, full-grown and armed, springing from the head of Zeus without the benefit of gestation. Strictly speaking, outcomes of both kinds might not be logically impossible (inconsistent with the laws of logic) but they appear to be highly improbable if not physically impossible (inconsistent with natural laws).

Her reservations about Chomsky's approach, moreover, have received powerful support from the research of Thomas Schoenemann (1999), who observes that the principles of evolution suggest that syntax is more adequately understood as an emergent property of the explosion of semantic complexity that occurred during hominid evolution, where the grammars that typify ordinary languages should be envisioned as conventional features of cultural practices rather than as the result of a genetically-based universal grammar of the kind Chomsky and Pinker (1994) have proposed. Schoenemann provides striking confirmation for the conception of human beings as possessing predispositions in the form of conceptual abilities for the acquisition of semiotic abilities of diverse kinds under suitable conditions.

Indeed, Savage-Rumbaugh's studies provide extensive evidence for capacities and abilities that, superficially, at least, look like modes of mentality exercised by bonobos and chimps. Sherman and Austin, for example, young male chimpanzees, proved quite adept at the use of lexigrams as arbitrary combinations of geometric forms arranged in a sequence on a keyboard, each of which stands for one word, including verbs, nouns, and adjectives. These two chimps were then exposed to samples or examples of things of the kind for which specific lexigrams stood in an effort to teach them the names of various objects through a process of association.

Savage-Rumbaugh soon discovered that Sherman and Austin were not learning the meaning of the banana-lexigram, for example, when she showed them bananas. On the contrary, they were preoccupied with the reward they would receive when they pressed the symbol key. Instead of the physical banana serving as "stimulus" for a banana-lexigram press "response", the chimps were pressing the lexigram as a "stimulus" for their investigators to give them food. Once the researchers began to <u>reward</u> them after they displayed appropriate responses, however, the process of mastering lexigrams proceeded smoothly and immediately led to rapid learning.

The difference involved here appears to be that between classical conditioning and operant conditioning, which makes a great deal of sense, especially since the process of association was not followed by reinforcing rewards. When examples were no longer displayed, the chimps experienced frustration, until they grasped (what Savage-Rumbaugh calls) the referential use of lexigrams, namely: their use to refer to objects and events even when those things were not physically present. This ability was manifest, for example, in the form of requests, where one chimp might request a banana, another juice, even when they were inaccessible to view.

Savage-Rumbaugh was thus motivated to distinguish at least four aspects of lexigram learning: (1) that "words" are more than simple associations between symbols and objects; (2) that even complex utterances can be produced without implying comprehension; (3) that developing comprehension entails violations of stimulus-response chains; and (4) that comprehensions are manifest, in part, by requests for food and other indications of future behavior. Subsequent studies with Kanzi, a male bonobo, who proved quite adept at learning English words as well as lexigrams, often without explicit instruction, were even more impressive.

One of the most remarkable of these studies involved comparisons between Kanzi and Alia, the daughter of a colleague, when Kanzi was 7 1/2 and Alia was 2:

> Over a nine-month test period, both Kanzi and Alia had demonstrated a well-developed ability to comprehend all types (and subtypes) of sentences [including conditionals], with Kanzi scoring just a little ahead. Overall, Kanzi correctly answered 74 percent of the sentences, while Alia's figure was 65. (p. 171)

Other results were extremely interesting in different ways. Sherman and Austin, for example, were able to use food lables (package wrappers) for Doritos, M&Ms, and Velveeta cheese when lexigrams were unavailable, even though this was not something that either of them had been taught. And bonobos turned out be highly skilled in using hand gestures to indicate the motions desired of others, including communicating to sex partners the positions that they wanted them to assume.

Ultimately, Savage-Rumbaugh concludes that comprehension is more essential or fundamental to language than is production, while offering the hypothesis that comprehension drives language learning as an alternative to Chomsky's account of an innate grammar. She observes that Chomsky's position has been widely regarded as the "default" option in the absence of reasonable alternatives, even though no anatomic evidence for innate language modules has been discovered. Envisioning languages as forms of symbolic communication appears to provide a more adequate conception, which can be subsumed within the theory of signs.

Peirce, of course, as we know by now, distinguished between three different ways in which things can stand for other things (in some respect or other) for sign users, namely: when that something resembles that something else; when that something is a cause-or-effect of that something else; and when that something is habitually associated with that something else. Signs as things that can stand for other things thus fall into three types as icons (including photographs and statues), indices (smoke, fire and ashes), and symbols (words and sentences). Ordinary languages involve the use of symbols, which are only one among three kinds of signs, and thus involves the highest but not the only kind of mentality.

All symbols are signs, but not all signs are symbols. All symbol users have minds, but not all minds are symbol users. Anything that has the ability to use signs by taking something to stand for something else in some respect or other qualifies as having a mind, whether iconic, indexical, or symbolic in kind. It is therefore essential in the study of the mind not to presuppose whether human beings, other animals, or inanimate machines can or cannot possess minds. That explains why, in defining "minds" as sign-using systems, it is indispensable to say "for something", and not "for somebody", to avoid precluding possibilities.

It is fascinating to observe that the chimpanzees and bonobos that Savage-Rumbaugh studies exemplify the use of signs of all three kinds: lexigrams, for example, are arbitrary signs that are merely habitually associated with that for which they stand (and therefore qualify as symbols); package wrappers may be viewed as (admittedly artificial) causes of the contents for which they stand (and therefore qualify as indices); and hand gestures to indicate the motions desired of others (in specific ways) resemble them (and therefore qualify as <u>icons</u>). Savage-Rumbaugh thus adduces evidence that these are sign-using (or semiotic) systems.

Indeed, some of her descriptions are exactly what ought to be expected from the perspective of the conception of minds as semiotic systems. If the use of symbols presupposes the use of indices, then we should expect outcomes such as this:

> When apes produce symbols, they are attempting to affect the behavior of others—for example, to ask for a banana. When apes comprehend symbols directed toward them, they are expected to bring about the effect intended by the user of the symbols. (p. 126)

This passage, after all, illustrates that symbolic mentality presupposes indexical, where the use of symbols can function as causes-or-effects in social interaction. This relationship is more subtle than that indexical mentality presupposes iconic, because the use of signs as causes-or-effects presupposes the ability to recognize different instances of uses of signs as instances of uses of signs of the same kind, where comprehension appears to involve subsuming things by means of concepts.

An even stronger indication that the theory of minds as semiotic systems fits the empirical data that Savage-Rumbaugh has obtained with chimps and bonobos emerges from her finding that the language of apes was unlike human language:

> It wasn't a complex language, not a language with syntax. It was more a culture language, a complex set of behaviors that was the way the chimps' lives were lived in the laboratory. It made one think of <u>Homo sapiens</u> without sophisticated spoken language—intelligent, sensitive creatures, able to communicate and coordinate their behavior in a collective subsistence effort. (p. 85)

And this is exactly what ought to be expected, because understanding the meaning of a sign is a process of acquiring habits of action and habits of mind relating signs to behavior, where the meaning of a sign should be viewed dispositionally.

Consider a simple case, such as a red light at an intersection. What this sign means for those who have mastered the rules of the road and understand road signs is to apply the breaks and come to a complete halt. When a driver comes up to a stop sign, of course, his behavior may not conform to those expectations, precisely because he is affected by other internal states, such as other beliefs, motives, and ethics. Felons with the police in hot pursuit would be expected to run the light and risk a collision, even though they understand its meaning, just as a husband whose wife has gone into labor might cautiously continue without stopping, because he is eager to get her to a nearby hospital for a safe delivery.

Thus, these internal states constitute a context in relation to which the meaning of signs must be understood, where the same sign means the same thing to other sign-users just in case they would have dispositions of the same or similar strength to display all and only the same behavior under the same conditions if they were in the same context, which includes their abilities and capabilities as well (Fetzer 1989, 1991, 1996). Savage-Rumbaugh is therefore entirely correct to maintain, as she does, that "Unlike chemicals, [animal] behaviors cannot be reasonably separated from the entire context in which they occur" (p. 254).

Savage-Rumbaugh concludes that comprehending and producing language turn out to be very different things, which is precisely what we should expect from the semiotic point of view, because comprehension is roughly analogous to the totality of uses to which signs might be put, while production is the use of specific signs on specific occasions for specific purposes. Thus, focusing on production rather than on comprehension (understanding or meaning) appears to be a misconception as serious as taking the use of signs of one kind—namely, the use of human language—as essential to mentality. Mentality is far broader.

During the course of her closing chapter, Savage-Rumbaugh also makes several astute observations about inadequacies of methodology. She rightly rejects the Cartesian conception of other animals as mindless automata and challenges the applicability of experimental methods employed by the physical sciences. Descartes' influence on the study of behavior has been uniformly detrimental; it is therefore refreshing to find that she, like Marian Stamp Dawkins, among others, is not bound by the tradition of misconceptions discussed in Chapter 6.

But it does not follow from her work that the methods fundamental to the natural sciences do not apply within the social science, including this domain, when properly understood as inference to the best explanation. Her own work, from this point of view, convincingly displays that the methods of inquiry that apply within physics, chemistry, and biology apply within cognitive ethology. In the final analysis, Savage-Rumbaugh has provided a brilliant tour de force supporting her conception of Kanzi as an ape at the brink of the human mind that further illustrates the power of the theory of minds as semiotic systems.

CHAPTER 8. COMPUTERS AND COGNITION

The conception of minds as semiotic systems provides an alternative to some prevalent—even paradigmatic—views for understanding language and mentality. These may be considered to be alternative hypotheses or possible explanations of linguistic and mental phenomena, provided that the notion of "language" receives sufficiently broad interpretation to encompass the communicative mechanisms that might be employed by lesser species (including termites, bees, and ants) as well as by higher species (including Homo sapiens and the Great Apes). Among the prevalent blunders of philosophers and other students of the nature of mind tends to be the presumption that thought cannot occur in the absence of language and that language has to be understood as it emerges in human forms.

The simplest of these alternatives may be viewed as the propositional model, with its focus on declarative sentences that make assertions. These communicative forms, which refer to or describe objects and their properties, are therefore either true or false: true when those objects to which they refer have the properties they ascribe to them and otherwise false. The most obvious limitations of the propositional model are overcome by the speech-act model, which expands coverage beyond declarative sentences to the multiple uses of language in achieving different effects, such as directing (amusing, misleading, . . .) with various intentions (motives or purposes). While a propositional model tends to identify meaning with reference, a speech-act model tends to identify meaning with use.

Indeed, from the speech-act perspective, it becomes obvious that declarative uses of language are only one special function within a family of functions. Thus, the conception of minds as semiotic systems not only shatters the myth that sentences are the basic units of communication in favor of signs but also transcends even the tendency to identify meaning with use. The dispositional model, which it implies, focuses instead upon the causal influence of signs upon behavior as a function of contexts, where those contexts include other motives, beliefs, ethics, abilities and capabilities and where the success or failure of an action depends (if not exclusively, at least in large measure) upon opportunities. Meanings are now identified, not with reference or even with use, but with dispositions to behave in various ways within different contexts in the presence of specific signs.

The scope of this approach easily ranges from the mountain gorilla (Fossey 1983) to marsh tits and chickadees (Dawkins 1993) and promises to deliver for every other species. The capacity of marsh tits and chickadees to hid hundreds of food items in the course of a single day, indeed, even suggests that memory plays a crucial role in their successful survival and reproduction, which lends support to Merlin Donald's emphasis on the importance of information storage and retrieval (Donald 1991). If the computer revolution marks (as it certainly must) yet another great leap forward in our information storage and retrieval abilities, then perhaps computers have something to teach us about the nature of mind. The most important alternative to the semiotic conception turns out to be what is known as the computational conception of language and mentality.

1. The Computational Conception.

The fields of computer science, artificial intelligence, and what is known as cognitive science are dominated today by the computational conception according to which thinking is reducible to reasoning, reasoning is reducible to reckoning, reckoning is computation, and the theory of computability defines the boundaries of thought (Haugeland 1981). This approach receives support from analogies between digital computers and human beings, insofar as computers receive inputs, which are processed in accordance with a program to yield outputs, while people receive stimuli, which are processed in accordance with cognition to yield responses. The package is quite concise and appealing in suggesting that cognition is nothing more than computation.

Some of the most fundamental premises adopted in AI and cognitive science, however, seem to be fraught with ambiguity or to trade on equivocation. An especially striking instance is the physical symbol system hypothesis that Alan Newell and Herbert Simon have advanced, according to which being a physical symbol system (in their sense) is both necessary and sufficient for mentality or "general intelligent action" (Newell and Simon 1976). The problem with their conception appears to be that something can qualify as a "symbol" (in their sense) whether or not it stands for anything else for anyone at all. Consequently, Newell and Simon's "symbols" might or might not be signs of the kind Peirce called "symbols", which stand for other things on the basis of habitual associations, but may be merely meaningless marks that might be processed on the basis of their shapes, their sizes and their relative locations.

Their conception thus defines what ought to be called "syntax processing" or "string manipulating" systems, where the meaningfulness of that syntax or of those strings is not thereby guaranteed. Newell and Simon may have thought they captured the necessary and sufficient conditions for mentality, but they manifestly have not. If a system can be a physical symbol system (in their sense), yet not be processing meaningful marks, it can still have no semantic capacity essential to mentality. Consequently, it might not qualify as a semiotic system of Type III, which has the ability to use signs that are symbols (in Peirce's sense). Even without assuming that minds are semiotic systems, therefore, it is evident that their physical symbol systems are not minds. While the syntax processing capacity that Newell and Simon define might be necessary for the possession of mentality, it is not also sufficient.

The inspiration for the computational conception of language and mentality has always been the presumptive parallel between computers and minds, namely, that hardware is to software as bodies are to minds. This has been succinctly captured by John Haugeland's recommendation, "Why not suppose that people just are computers (and send philosophy packing)?" (Haugeland 1981, p. 5). What has now become evident, however, is that the capacity to process syntax might not be sufficient for mentality. Even Haugeland seems to concede this point by defining "computers" as automatic formal systems, which automatically manipulate the marks of formal systems according to the rules of those systems as self-contained, perfectly definite and finitely checkable systems, but where the meaningfulness of the marks subject to manipulation is a matter lying beyond their scope (Haugeland 1981, p. 10).

Upon initial consideration, Haugeland seems to have formulated a conception going far beyond Newell and Simon's by imposing the requirement that the rules for mark manipulation should be self-contained, perfectly definite and finitely checkable, which Haugeland takes to define what makes a system "digital", but which perhaps more closely approximate "algorithmic". When algorithms are defined as effective decision procedures, for example, they have the properties of being completely reliable routines, procedures or processes that can be carried out in a finite number of steps to solve a problem, as the Preface, for example, has already explained. Newell and Simon's conception and Haugeland's converge at this point, however, in view of the consideration that the conduct of physical symbol systems is supposed to be governed by programs as implementations of algorithms for these machines.

Algorithms are available to solve a rather large class of problems, including, especially, problems of mathematics. But an important distinction must be drawn between "algorithms" and "programs", where programs implement algorithms in a form suitable for execution by machine. This requires that an algorithm be translated into a programming language (such as Pascal, LISP, or Prolog), where the corresponding program might be loaded into a computing machine and then compiled into machine language for execution. Ultimately, therefore, distinctions must be drawn between at least four different senses of "program", namely: (a) as algorithms, (b) as encodings of algorithms, (c) as encodings of algorithms that can be compiled or (d) as encodings of algorithms that can be compiled and executed by a machine (Fetzer 1988c, p. 1058). The sense appropriate to Newell and Simon and Haugeland thus corresponds to (d).

While Haugeland's assertions about his conception seem to be weaker than Newell and Simon's about their conception (since he acknowledges that marks manipulated in accordance with the encoding of an algorithm may or may not be meaningful), it should be evident that the underlying objection still obtains, namely: that the marks that are manipulated by means of programs might be meaningful for the users of that system—especially, presumably, for those who program them—but are not therefore meaningful for use by that system itself. It may sound appealing to suggest that people just are computers, but so long computers are nothing more than syntax processing mechanisms as automated formal systems or even as physical symbol systems, the meaningfulness of the marks they process appears to derive from those who use and who design them. If people have minds but computers do not, people cannot simply be computers.

According to (what is known as) the thesis of strong AI, computers actually possess mentality when they are executing programs. On the assumption that programs as encodings of algorthms are capable of providing solutions to the problems to which they are being applied, the executions of programs by computers are purposeful activities in relation to their users. But that no more implies that computers therefore have minds than the fact that having an unmowed lawn is a problem that can be solved by cutting it with a lawnmower, which is also a purposeful activity in relation to its user, implies that a lawnmower has a mind. Certainly, neither the physical symbol system conception nor the automated formal system conception satisfies conditions that might plausibly qualify as being enough for mentality. They have the ability to manipulate marks or to process syntax, but that is not sufficient to infuse those marks with meaning.

According to (what is known as) <u>the thesis of weak AI</u>, by comparison, computers are simply tools, devices or instruments that are or may be useful, helpful or valuable in the study of mentality but do not possess minds, even when they are executing programs. Indeed, from this perspective, automatic formal systems and physical symbol systems may be envisioned as physical counterparts that at least partially realize the logical properties of Turing machines in the form of complex causal systems of those very kinds. As long as these machines are constructed to appropriate specifications and subjected to appropriate empirical testing, including quality controls that ensure their reliability or trustworthiness, they need not possess the least inkling of the faintest whiff of the slightest trace of mentality at all. Perhaps automatic formal systems and physical symbol systems define "computational systems" rather than "minds". (This thesis is developed relative to various conceptions of AI in Fetzer 2004a.}

Haugeland concedes as much when he maintains that automatic formal systems that consistently make sense—where the semantics follows the syntax, under an appropriate interpretation—are semantic engines and that intelligent beings are things of that kind (Haugeland 1981, p. 24 and p. 31). But it should be obvious by now that this formulation trades upon the same ambiguity as before, namely, that an automatic formal system might consistently make sense to the users of that system without consistently making sense—or making any sense at all—to that system itself. It should come as no surprise that formal systems that are constructed with an interpretation in mind consistently make sense—where the semantics follows the syntax, under some appropriate interpretation—when the syntax was intended to sustain that interpretation by the designers of that system. Only confusion arises from confounding interpretability with mentality.

Indeed, as most students of formal logic are aware, even the construction of simple arguments in sentential and in predicate logic assumes that marks and sequences of marks that occur more than once—that appear in both conclusions and premises, for example—must have the same meaning or stand for the same thing throughout the formulation of those arguments. Otherwise, fallacies of ambiguity arise, where conclusions that follow from premises on the basis of the syntactical rules of inference may have conclusions that are false even when their premises are true. If "John has lost his marbles" occurs in both places, for example, then it must be assigned the same interpretation, lest we infer from John's loss of some small, round balls used in children's games to John's loss of mental capacity. This semantical condition—the requirement of a uniform interpretation—must be satisfied, not only by semantic engines, but by every formal system that is consistent.

Neither the conception of physical symbol systems nor the conception of automatic formal systems supports the thesis of strong AI rather than its alternative, where these conceptions properly apply. Even the conception of semantic engines does not appear to salvage the situation, since the properties that distinguish computers under that designation are precisely those we would expect them to have as formal systems that can be designed and constructed for the purpose of executing algorithms by means of machines. Neither conception is able to overcome the objection that causal systems with the capacity to manipulate marks or to process syntax—even on the basis of programs that have the capacity to solve problems—do not satisfy conditions sufficient to qualify them for possession of mentality. While the users and designers of these systems must be capable of interpreting them, we have found nothing that would enhance the credibility of the thesis of strong AI.

A stronger blow against the computational conception, however, might be struck if it could be shown that the conditions it would impose are not merely insufficient for mentality, as we have already discovered, but are unnecessary for mentality, as well. The appropriate strategy in adopting this approach would be to discover some properties—preferably, of a general kind—that are satisfied by any kind of thought that properly qualifies as computational, yet are not always satisfied by thinking things. There appear to be such features. One of the more appealing features of formal proofs for most students, I have observed, is that they begin at a definite starting point—given premises—and end at a definite stopping point—the desired conclusion. Similarly, algorithms begin with a problem, which is given, and end with a solution, while programs begin with input and end with output. What goes on in between, of course, involves the application of rules, processes or procedures.

Moreover, the application of those rules, processes or procedures has the property that they are supposed to be appropriate to derive those conclusions from those premises (in the case of proofs), to obtain that solution for that problem (in the case of algorithms) and to generate that output from that input (in the case of programs). Not only are such rules, processes or procedures designed to produce results when they are applied, they are also supposed to yield the right result (as valid proofs, correct solutions, or accurate outputs). And, of course, securing the right result has to be something that can be accomplished in a finite number of steps. Otherwise, the system would not satisfy the conditions either for being a semantic engine (as an automatic formal system that is self-contained, perfectly definite, and finitely checkable) or for being algorithmic (as a completely reliable routine, process, or procedure that can be carried out in a finite number of steps to solve a problem).

On the assumption that nothing causal interferes with its physical operation, the execution of software by hardware has the effect of creating a system whose behavior conforms to special normative constraints defined by these properties. Indeed, that is precisely what we should expect of a computational system that has been designed to fulfill the requirements of an automatic formal system or of a physical symbol system. Computational systems thus appear to be properly envisioned as complex causal systems that are designed and constructed as syntax-processing or mark-manipulating systems, which conform to the restrictions imposed upon semantic engines or physical symbol systems. They have the ability to execute algorithms encoded into the form of programs by means of a programming language that enables them to function properly. They thus appear to be normatively-directed, problem-solving, syntax-processing causal systems.

On the assumption that the kind of syntax-processing systems under consideration are classic (or "von Neumann") digital machines, there are many indications that regarding them as normatively-directed, problem-solving causal systems is appropriate within in this context. Robert Cummins and Georg Schwarz (1991), for example, define "computing" as the execution of functions, which entails the execution of algorithms: "computing a function f is executing an algorithm that gives o as its output on input i just in case f(i) = o" (Cummins and Schwarz 1991, p. 62). Executing an algorithm, in turn, involves disciplined step satisfaction or satisfying various steps "in the right order". This conception thus presumes the existence of a beginning (input) and an end (output), where the application of an appropriate routine, process or procedure (algorithm) yields the right result in a finite number of steps. They are normatively directed, problem-solving systems.

Moreover, as Eric Dietrich has observed, the same function may be implemented in more than one way. Indeed, "Computer scientists frequently distinguish between computing a function and executing a procedure because every procedure realizes exactly one function, but the same function can be realized in several different procedures" (Dietrich 1990, p. 192, emphasis added). This distinction has great merit, not only because the same algorithm can be implemented in various different programs but also because "computing a function" appears to be a more abstract description than is that of "executing a procedure". Indeed, pure mathematics may perhaps be best understood as a domain of abstract entities between which only logical relations can obtain, while applied mathematics concerns a domain of physical entities between which causal relations can obtain (Fetzer 1988c). It might be helpful to entertain "functions" as abstract and "procedures" as causal.

The multiplication tables of my youth affords an appropriate illustration. My fifth-grade teacher was concerned because I had not learned multiplication and the functions thereby defined, such as that 0 x 0 = 0, that 8 x 7 = 56, that 8 x 8 = 64, and so on, which map values in a domain onto those of a corresponding range:

Domain	Range
< 0 , 0 >	0
< 0 , 1 >	0
. . .	. . .
< 8 , 7 >	56
< 8 , 8 >	64
. . .	. . .
< 9 , 9 >	81

Figure 23. Multiplication Tables.

Strictly speaking, I suppose, it would not have mattered to him whether I had internalized this function by means of addition (where the value of < 8 , 8 >, for example, is obtained by adding 8 to itself 8 times) or by some other procedure, as long as it gave the right results. What mattered was whether I had mastered multiplication by becoming a normatively-directed, problem-solving system of a special kind by implementing this set of functions as a set of mental procedures.

Dietrich (1990) and Cummins and Schwarz (1991) go much further, however, and define "cognition" as the computation of functions. On their view, cognition implies the execution of procedures, which, of course, can be causal counterparts of functions in an abstract domain. Thus, the kinds of things that are capable of cognition are the kinds of things that are capable of the computation of functions (abstractly described), which entails the capacity for the execution of procedures (implemented causally). If the capacity for cognition is the distinctive characteristic of things that have minds, then the kinds of things that are capable of the execution of procedures are also the kinds of things that have minds. Insofar as the execution of procedures entails disciplined step satisfaction, therefore, minds are a species of normatively-directed, problem-solving syntax-processing causal systems. So if our minds satisfy this conception, perhaps people just are computers, after all.

2. Minds and Machines.

It is fascinating to observe, therefore, that many kinds of thought processes of human beings as thinking things fail to satisfy these conditions. Dreams and daydreams, for example, fail to satisfy them because they have no definite starting point and no definite stopping point: they begin and they end, but they have no given premises or conclusions. The sequence of events between their beginnings and their endings has a causal character that is neither normatively directed nor problem solving in kind. They do not have to satisfy appropriateness conditions, and there are no right results for them to yield. They may contribute to solving problems—emotional or otherwise—but when that occurs, it is incidental to rather than constitutive of thought processes of this kind (Fetzer 1994a). Some dreams and daydreams may be pleasant or enjoyable, while others may be frightening or even terrifying. But these thought processes are certainly not computational.

Perception appears to be another case of this kind. Properly understood, of course, the results of perception arise as a consequence of causal interaction between the perceiver and the perceived. As a human phenomenon, it may often involve the use of language to describe the contents of experience. The completeness, accuracy and detail with which experience can be described thus depends upon our ability to use language, but it also depends on our perceptual abilities and the circumstances under which perceptions are acquired. All of these factors vary tremendously from new-born infants to toddling tots to the elderly and the senile and from case to case. Even assuming that perceptual episodes have a beginning and an end, what transpires in between lacks the normative character of always yielding the right result. Perception is a fallible activity, which makes perception a second kind of non-computational thought process.

Memory is yet another case. Since memories are retained as effects of the occurrence of past perceptions, there are at least two ways in which they can be faulty: our original perceptions may be mistaken or our retentions of those original perceptions may be wrong. The very idea of remembering something that never occurred may initially sound anomalous, but when you consider the influence of the multiple conditions that affect perception—including ones both internal and external to the perceiver, including attention span, state of awareness, and perceptual access—as well as the multiple conditions that affect memory—including physical age, temporal proximity to the original occurrence, and presence or absence of impairment—it should be obvious that there is no algorithm for remembering. There is no finite sequence of steps such that, if those steps are followed, then a specific memory will be recalled—not even hypnosis.

One underlying factor that may contribute to confusion about the scope and limits of computational procedures arises from failing to systematically differentiate causal processes that <u>implement the normative procedures that distinguish the execution of algorithms</u> from those that do not. Laws of nature that are causal rather than non-causal—no matter whether they are deterministic or probabilistic in kind—bring about changes in systems across time from state <u>S1</u> at time <u>t1</u> to state <u>S2</u> at time <u>t2</u>. There are no doubt causal laws of dreams and daydreams, perception and memory, just as there causal laws for physical, chemical and biological processes and systems. But special constraints must be satisfied by computational systems that do not have to be satisfied by other kinds of causal systems. Thought processes that do not invariably yield definite solutions to problems in a finite number of steps can still be non-computational properties of thinking things.

What is most striking about dreams and daydreams, perception and memory within this context is that they are familiar phenomena from the life experience of human beings. When we reflect upon our experiences in life, it seems obvious that many if not most of our ordinary thought processes do not properly qualify as the execution of procedures. There are no algorithms for when to start looking and when to stop looking or even how to look such that, if only you follow this procedure, then your perceptions must be accurate and you cannot make a mistake. There are no algorithms for when to start remembering or for how to go about remembering. Saying to yourself, "Remember!", certainly will not do.

The very idea of compelling yourself to remember is at least faintly ridiculous. The case of dreams and daydreams is even more compelling as an example of a causal process each of us experiences that is not a computational procedure.

The question might therefore be posed, "Why should the computational conception be taken seriously at all?", to which I conjecture there are at least three possible answers. One is that we may be uncertain about the nature of thought and of thought processes themselves. If dreams and daydreams, perception and memory are not processes involving thought, then they do not count as counter-examples to the computational conception. Indeed, if cognition turned out to be computation, then they would not be examples of cognition. Such a result, however, would surely strain the plausibility of the computational account severely. Not least of the benefits to be derived from adopting the conception of minds as semiotic systems is that any kind of sign-using system possesses mentality, no matter whether the signs such a system is processing are dreams or daydreams and no matter whether those processes conform to normative constraints or not.

A second possible reason for taking computationalism seriously may be that we have not adequately understood the properties that separate computational procedures specifically from causal processes generally. If changes in systems from state <u>S1</u> at time <u>t1</u> to state <u>S2</u> at time <u>t2</u> in accordance with causal laws always qualified as <u>disciplined step satisfaction</u>, for example, then the difference between computational procedures and causal processes remains obscure. Any causal process could be cognitive. Another benefit to be derived from adopting the semiotic conception of mentality, therefore, is that it can explain why causal processes in physics, chemistry and biology, for example, can involve changes in systems from state <u>S1</u> at time <u>t1</u> to state <u>S2</u> at time <u>t2</u> without displaying mentality on that account alone. Causal processes qualify as "cognitive" only when they involve the use of signs by a sign-using system. Most of them are not cognitive.

A third reason for taking computationalism seriously may be the conjecture that, if some of our cognitive processes are computational procedures, perhaps all of our cognitive processes are computational procedures. Haugeland exemplifies this attitude when he suggests that thought "obeys (at least much of the time) various rules of inference and reason" (Haugeland 1981, p. 3) and covertly implies that thinking is reducible to reasoning. Indeed, if thinking is reducible to reasoning and reasoning is reducible to computing, then perhaps the boundaries of computation exhaust the boundaries of thought. Such an approach, however, not only runs the risk of <u>begging the question</u> by assuming that human reasoning is a computational process but the risk of <u>overgeneralization</u> by assuming that the kinds of routines, processes or procedures that operate in one domain of thought operate in every other. Computationalism thus seems to be founded on fallacies.

Perhaps the most striking effort to bolster the computational conception has been advanced by Barbara von Eckhardt (1993), who adopts the strategy of taking the central aim of cognitive science to be "the human adult's normal, typical cognition (ANTCOG for short)" (von Eckhardt 1993, p. 6). The ANTCOG approach thus excludes from consideration variations in cognitive capacities and abilities ranging from those of new-born infants and toddling tots to those of the elderly and senile. The domain of human cognition is taken to be capacities or abilities that are intentional or purposeful, pragmatically evaluable as more or less successful, coherent when they are successful, usually reliable, and productive in having potentially unrestricted applicability (von Eckhardt 1993, pp. 47-48). The effect of adopting these conditions is to constrict the range of pragmatical phenomena within the domain to which cognitive science is supposed to apply.

The rather flexible character of the properties that von Eckhardt adopts to define the properties of human cognition seems initially promising within the scope of its limited domain, where the course of science should decide whether typical, normal adult human cognition is computational or not. She diminishes the tenability of her own position, however, by adopting (what she refers to as) <u>two major substantive assumptions</u>, namely: that cognition is computational and that cognition involves representations (von Eckhardt 1993, p. 8). Her account of the general character of cognitive science thus implies that non-computational phenomena or non-representational phenomena cannot possibly be cognitive. The basic conception of von Eckhardt, therefore, is that cognition is computation across representations, which is true by stipulation. She thereby precludes the logical possibility that there might be non-computational cognitive phenomena.

From the perspective of the philosophy of science, von Eckhardt's work thus exemplifies the historical dilemma encountered by normal scientists, who have a paradigm in which they believe but are also confronted by anomalies. In this case, of course, the paradigm is defined by the conception that <u>cognition is computation across representations</u>. The anomalies are displayed by phenomena—such as dreams and daydreams, perception and memory—that appear to involve representations but also seem to be non-computational. von Eckhardt's account entails that phenomena of this kind cannot possibly be cognitive, which appears to be a rather difficult position to defend. Those who take the phenomena seriously, after all, already have empirical evidence that falsifies the computational paradigm, while those who adhere to the paradigm have only a definitional stipulation to justify its dismissal. Surely the phenomena have to be taken seriously.

von Eckhardt thus begs the question in taking for granted that cognition must be computational. This is difficult to understand, since she acknowledges that the concepts of computation and of representation "are (for the present, at least) quite open-ended and vague" (von Eckhardt 1993, p. 9). Indeed, her position is untenable in at least two respects. First, she appears to have succumbed to the almost irresistible temptation to identify the discipline itself (as a field of inquiry) with one of the theories that inspired it (the computational conception), a fatal defect in a work that pretends to define the field. The second is that less open-ended and more precise concepts of computation—involving algorithms, functions and disciplined step satisfaction—imply that computational procedures always yield definite solutions to problems in a finite number of steps. Her "flexible" conception of the domain of cognition appears to be inconsistent with her substantive commitments.

Ultimately, von Eckhardt also adopts the conception of computers as devices that are capable of accepting, storing, manipulating, and outputting data or information in accordance with a set of effective rules, characterizing minds—"if they are computers at all"—as automatic formal systems, very much as Haugeland envisions them (von Eckhardt 1993, p. 113). If she senses a tension in her implicit commitment to the twin theses that computers do not have minds, even though minds are computational systems and operate the same way computers operate, which apparently implies that even minds do not have minds, she does not reveal it. Indeed, occasionally she suggests the possibility that the computational model of the mind might be no more than a metaphor; other times, she hints that it has to be taken literally. But she also states that the seriousness with which it should be taken depends upon the level of theoretical detail that is available and desired.

A better definition of "cognitive science", of course, would be that of the science of cognition—whether in human beings, other animals, or even machines, if such a thing is possible—which appears to be the appropriate conception. The constraints that von Eckhardt imposes on the pragmatical phenomena of cognition combined with her substantive assumptions guarantee the emergence of a semantical model of cognition as computation over representations, no matter what the phenomena, which is unscientific. Indeed, dreams, daydreams, perception and memory appear to be typical cognitive experiences of even most normal adult human beings, which is evident from the perspective of Peirce's theory of signs. The images, events and words that are the stuff of dreams, daydreams, perception and memory are things that stand for other things in various respects for somebody, which qualifies them as "representatives" that are components of non-computational cognitive processes.

Even though von Eckhardt adopts Peirce's theory of signs in the guise of a theory of representations, a term that Peirce himself employed—which I applaud—her commitment to computationalism apparently precludes her from appreciating what the theory of signs has the potential to reveal about the nature of cognition. The triadic sign relation, for example, implies (1) the existence of a causal relation between a sign and a sign user; (2) a semantic relation between the sign and that for which it stands; and (3) a behavioral relation between the sign, its user and that for which it stands. The existence of a semantic (or "grounding") relation between signs and what they stand for is significant, first, because it offers an explanation for how a thing can stand for something else (by virtue of a relation of resemblance, of cause or effect, or of habitual association) and, second, because it also explains how something can stand for something else in some respect or other (by virtue of a relation of partial resemblance, of partial cause or effect, or of partial habitual association).

More significantly within the present context, these considerations are able to explain the underlying difference between semiotic systems and symbol systems and automatic formal systems, where genuine mentality presupposes the existence of a grounding relation between signs and that for which they stand. If minds of Type I can use icons as signs that are grounded in resemblance relations, minds of Type II can use indices as signs that are grounded in cause and effect relations, and minds of Type III can use symbols as signs that are grounded in habitual or conventional associations, while symbol systems in Newell and Simon's sense and automatic formal systems in Haugeland's sense cannot, then this can account for their difference with respect to semantics and meaning. Semiotic systems have the ability to use things to stand for other things as signs for those systems, an ability that symbol systems and automatic formal systems do not possess. This property distinguishes between systems with minds and without (Fetzer 1988a, 1990, 1991/96; cf. Searle 1992).

The differences between semiotic systems and symbol systems are not confined to the fact that symbol systems have the capacity to process syntax in the form of meaningless marks, while semiotic systems have the capacity to process signs that are meaningful for those systems. This might be described as a difference in <u>semantic content</u>: semiotic systems process signs that have semantic content for those systems themselves, but symbol systems manipulate marks that are meaningful, if they are meaningful at all, only for the users of those systems. There is, however, another difference at stake here, which is displayed by the fact that dreams, daydreams, perception and memory are processes that do not involve the execution of procedures. This might be described as a difference in <u>causal processing</u>: symbol systems process marks by the execution of computational procedures, but semiotic systems also have the capacity to process signs by non-computational procedures.

The difference in content that exists because semiotic systems have an ability which symbol systems lack can be displayed by means of the following diagram:

```
                 Stimulus                      Input
                    S                            S
                  *   \                         *
Causation      *       \    Ground   Causation  *
                *        \                     *
               *          \                   *
             z  - - - - - x                z ------------- x
          Process      Response        Program       Output

             Interpretant                 Interpretant*
```

Figure 24. Semiotic Systems vs. Symbol Systems.

Some of the differences between symbol systems and semiotic systems are obvious from these diagrams. A grounding relationship between signs and what they stand for for a sign-user does not appear in the symbol system diagram, precisely because the absence of such a relationship is the most important feature distinguishing between systems of these kinds. Indeed, even when something affects the behavior of another thing (as causes bring about effects or as stimuli bring about responses), unless that causal connection obtains because that thing functions as a sign relative to those effects—unless it functions as an icon, an index or a symbol for that system—that connection cannot be semiotic.

"Interpretant" thus stands for a dispositional account of the meaning of a sign for a semiotic system, where the totality of ways in which that system would (invariably or probably) behave in the presence of that sign in relation to different (possibly infinite) specific contexts—including preexisting motives and beliefs but also other abilities and capabilities—is the meaning of that sign for such a system. "Behavior" in this sense includes changing one's mind, where two systems, even when confronting the same sign with the same meaning for them both, would be expected to display the same behavior only when they were in the same context. When drivers approach an intersection and notice a red traffic light, they tend to apply the breaks and come to a complete halt until the light turns green, but possibly not when they are frantic husbands with wives in labor, felons who are fleeing the police, or driving emergency vehicles (Fetzer 1989, 1990, 1991, 1998).

"Interpretant*", instead, stands for a dispositional account of input processing by a symbol system, which is the totality of computations that that system would perform, relative to a specific program—assuming that other components of that causal system function properly—which, however, is not a semiotic phenomenon. von Eckhardt embraces a conception of this kind, which she extends to (what she calls) mental representations, where "The interpretant of a mental representation R for some subject S consists of the set of all possible determinate computational processes contingent upon entertaining R in S" (von Eckhardt 1993, pp 297-298). By virtue of its restriction to computational consequences, however, this conception has the effect of delimiting the causal consequences of cognition to its logical consequences. Human beings are complex semiotic causal systems rather than normatively directed, computational causal systems of the kind she has defined.

3. Consciousness and Cognition.

Other benefits of the semiotic approach may be less obvious. The theory also implies a conception of consciousness (relative to signs of specific kinds) according to which a system is conscious (relative to signs of specific kinds) when it (a) possesses the ability to use signs of that kind and (b) is not incapacitated from exercising that ability. When a system is anesthetized, intoxicated, blindfolded or otherwise impaired, it may be incapacitated from the exercise of some of its semiotic abilities. Moreover, when properly understood, cognition is an effect that is brought about by a causal interaction between the presence of signs of specific kinds (within suitable causal proximity) and a system that is conscious with respect to signs of that kind in relation to its context, consisting of its other internal states, including preexisting motives and beliefs. Rather than computation across representations, cognition is a causal process that involves signs.

This approach also appears to resolve "Block's problem". Ned Block (1995a) has made a plausible case for drawing a distinction between P-consciousness (phenomenal-consciousness) and A-consciousness (access-consciousness), but he has been unable to locate their "real difference" (Block 1995b). However, Block's conception of P-consciousness appears to apply to the causal relationship between possible signs and semiotic systems, while his conception of A-consciousness appears to apply to the causal relationship between actual signs and semiotic systems. P-consciousness thus appears to be the experience of a (potentially semiotic) phenomenon, while A-consciousness is an interpretation of its significance. A semiotic system can have P-consciousness without A-consciousness whenever it is subjected to things that are not signs for that system. P-consciousness thus turns out to be necessary but not sufficient for cognition.

The semiotic theory also compares favorably with that of minds as semantic engines. The difficulty confronting the conception of minds as automatic formal systems that consistently make sense—where the semantics follows the syntax, under an appropriate interpretation—has always been the source and character of that interpretation. The most popular candidates for that role among current alternatives have been the language of thought hypothesis, which posits a genetic species-specific semantics of in-born concepts (especially Fodor 1975), and causal theories of meaning (Schwartz 1977, for example), which effect an interpretation by means of reference, which we encountered in Chapter 5. The first supplies an internalist account for which meanings are innate, the second an externalist account for which meanings are acquired. Neither seems to qualify as a viable alternative to the semiotic theory that languages, for example, are systems of signs that are gradually learned to describe innate or acquired concepts.

The language of thought hypothesis, for example, presumes that understanding a language presupposes understanding another language, which invites the introduction of a base language—the language of thought—relative to which any other language might be acquired. This account not only overlooks the prospect that language learning might be rooted in non-linguistic understanding instead, an approach the semiotic conception embraces, but also implies that unsuccessful translations between different languages must be a theoretical impossibility. Causal theories of meaning, moreover, presuppose the existence of causal chains that connect names and predicates to their referents, an assumption that seems appealing for ordinary uses of familiar terms but appears appalling in any case where causal chains cannot or do not exist: non-existent objects, abstract entities, theoretical relations, and non-observable properties, as Chapter 5 explains.

Perhaps the most far-reaching discovery that has emerged from the pursuit of the semiotic conception of mentality, however, concerns the nature of the laws of thought. While it appears unproblematical to maintain that perception and memory, for example, are semiotic activities governed by causal laws, the conception of cognition as an effect brought about by causal interaction between a sign user and a sign may appear inadequate in comparison with the computational conception of cognition as the execution of procedures, which are causal counterparts of functions in an abstract domain. The causal processes that relate signs to other signs and meaning and behavior for ordinary thought, however, which is neither normatively-governed nor problem-solving in kind, appear to be associationistic rather than computationalistic. They do not satisfy the conditions of algorithmic disciplined step satisfaction but rather approximate the free association of ideas.

Consider, for example, the following panels drawn by the humorist B. Kliban, which are the first and second in a series entitled, "Cornish Game Clams: A False Start in Six Parts" (Kliban 1982). These capture the typical thought processes of ordinary human beings. Panel I, for example, shows a fellow responding to the waiter's presentation by saying, "Ah! Cornish game clams, my favorite seafood!", where the meal itself was an icon that resembled other meals of a certain kind, which, in turn, caused the effect of bringing to his mind symbols by which food of that kind is described. His use of the phrase, "cornish game clams", in turn, is a cause that trigger's off another diner's recollection of related experiences as an effect, where he and Professor Jimbob were exploring an incredibly ancient temple. Thinking of this experience causes him to become pale, which functions as an index for his dining companion, who uses symbols to inquire about its cause, etc.

Figure 25. Panel I of "Cornish Game Clams".

Panel II is, if anything, even more revealing. As he and Professor Jimbob proceed to the temple to rescue Lydia, he hears her cries for help, symbols functioning as causes intended to bring about an effect. Hearing her cries reminds him of similar sounds made by the brakes on his old convertible on the basis of a resemblance relation, which, in turn, was an effect brought about by that cause. Thinking about the car, he recalls associated experiences indexically related to that car, including the night that Shirley's dress got sucked into the carburetor, where she is identified symbolically by her first name, which causes him to try to remember her last name, "Wozzle? Winkle? Workle?", which, successfully recalled, in turn, reminds him of her activities as associated effects thus brought to mind, which included singing at the Pancake House on Thursdays, for example, where one sign causes cognitive connections with other signs as a series of semiotic associations.

<u>Figure 26. Panel II of "Cornish Game Clams"</u>.

These panels (about which a great deal more could be said) thus provide vivid illustrations of the associative character of ordinary thought. In these cases, what we are observing are themselves iconic and symbolic representations of a series of semiotic associations, which displays an absence of the kind of disciplined step satisfaction characteristic of computational systems. These thought processes do not satisfy the computational conception and therefore properly count against it. It should also be observed that <u>the same thing</u>, such as the presentation of food, can function as an <u>icon</u> (by virtue of resembling other things of that kind), as an <u>index</u> (by virtue of being a cause of a future effect, for example), or as a <u>symbol</u> (by virtue of being habitually associated with things of other kinds). The cognitive effects of a sign within suitable causal proximity of a sign-using system that is conscious with respect to signs of that kind, therefore, appears heavily dependent upon context and may be either an indeterministic or a chaotic phenomenon.

Moreover, a distinction parallel to that between intension and extension may be drawn according to which a person's <u>connotation</u> (relative to a word, phrase, or expression) consists of their emotions or attitudes toward things of that kind, while a person's <u>denotation</u> (relative to that same word, phrase, or expression) consists in the subset of the class of things thereby described with which that person has acquaintance (iconically or indexically). Then ordinary thought also differs from logical reasoning insofar as the former is strongly affected by subjective connotations and denotations, as a function of their personal histories, while the latter is generally dominated by objective intensions and extensions, as a function of their language framework. This is a crucial dimension on which (psychological) semiotic associations differ from systematic (logical) reasoning.

It also undermines even the most enticing attempts to defend computationalism, such as Steven Pinker, How the Mind Works (1997), which envisions minds as information processing mechanisms of brains for effecting logical transitions between different "configurations of symbols". Pinker goes so far as to contend that a computational conception of mind is indispensable for understanding the evolution of the mind, where "evolution equips us . . . with a neural computer" (Pinker 1997, p. 27). But it should be evident that an adequate understanding of animal minds, primate minds, and human minds—much less their evolution—is most unlikely to be supplied by the computational conception, which appears to have arisen from an almost irresistible temptation to appeal to a domain in which a great deal is known (formal systems and computability) as a repository of answers to questions in a domain about which very little is known (mentality and cognition), an approach that can no longer be sustained (Fetzer 1994a, p. 25).

The semiotic conception of the mind also supplies a criterion for mentality in the form of the capacity to make a mistake (Fetzer 1988a, 1990, and 1991/96). A system can make a mistake just in case it has the ability to take something as standing for something (else) in some respect or other, but does so wrongly (by taking one individual thing for another individual thing, a thing of one kind for a thing of another kind, the false for the true, and so forth). Insofar as the semiotic conception is intended to apply to systems that have minds, no matter whether they are human, other animal, or even machine (if such a thing is possible), it is indispensable that the very idea of mentality should not beg the question by implying the applicability or inapplicability of this conception to systems of any of these kinds on the basis of a mere stipulation. If other animals or computing machines are capable of making mistakes, then they are possessors of mentality.

It should be observed, moreover, that misdescriptions, faulty inferences, and the like qualify as "mistakes" only if they are unintentional. If we distinguish between standard cognitive situations in which our intentions are truth-directed (in seeking to discover the truth, speak the truth, and so forth), then we tend to make mistakes when the available evidence does not support an appropriate inference—although, of course, even when sufficient evidence is available, we may still make mistakes when reasoning is inductive. A pragmatical condition—the requirement of total evidence—thus insists that, in arriving at conclusions, we must take into account all of the available relevant evidence. When we are in non-standard cognitive situations, however, where our intentions are not truth-directed (in desiring to mislead, to amuse, to insult, and so on), misdescriptions, miscalculations, and misdirections might then not actually qualify as "mistakes" (Coates 1997, pp. 171-197).

The realization that many if not most thought processes—including dreams and daydreams, perception and memory, and ordinary thinking—do not fulfill the conception of being normatively-governed, problem-solving causal activities does not mean that we never function in that capacity. As I and other students of symbolic logic have found, when syntactical procedures are adequately understood (within the context of constructing and evaluating formal proofs, for example), human beings seem to be capable of functioning (more or less) as though we were computational systems. Indeed, as Carol Cleland (1993) has observed, there exists a class of mundane procedures that are often employed to achieve specific effects, such as recipes for cooking and instructions for assembling. When implemented under appropriate causal conditions, these step-by-step routines bring about their effects as an especially interesting class of non-syntactical but still effective procedures.

It should have been apparent from the start, however, that the computational conception—according to which thinking is reducible to reasoning and reasoning is reducible to computing—casts a shallow net in relation to human cognitive abilities. The semiotic activities of human beings are barely tapped by deductive reasoning, where conclusions are drawn from premises and arguments are appraised. The use of declarative sentences that are true or false is not even representative of human linguistic abilities, which include the use of imperative sentences to issue directions and commands, exclamatory sentences to express emotions and attitudes, and interrogatory sentences to ask questions and make inquiries. Once we abandon a propositional paradigm and embrace a speech-act paradigm, where the diversity of human cognitive activities can be more adequately appraised, we soon discover that the dispositional conception that attends the conception of minds as semiotic systems offers an even broader and more powerful theory of meaning and mentality.

Even though human beings are indeed capable of disciplined step satisfaction in formal reasoning and in mundane procedures, activities of this kind seem to be special cases that are not representative of most human cognition. If the theory is taken to assert that all human cognitive activities are computational, it is false; but taken to assert that only some human cognitive activities are computational, it is trivial. Even our own experiences in life display that the computational conception cannot be sustained. Thinking is not reducible to computing, and minds are not merely digital machines. In abstracting from the pragmatic phenomena, its proponents have begged the question by assuming that procedures that may apply in one domain must apply in every other, where the theoretical model that they provide is neither sound nor complete. "Our best theory" is either trivial or false, where the conception of minds as semiotic systems offers something better.

CHAPTER 9. GENE-CULTURE CO-EVOLUTION

In his admirable study, Sociobiology, Sex, and Science (1993), Harmon Holcomb III has made the crucial observation, "Sociobiology does not explain behavior per se. It explains the evolution of behavior, that is, the evolution of behavioral preconditions (whether physical or psychological) and their effects upon behavior. This limits sociobiology's scope, placing limitations on its proper implications". These "behavioral preconditions" typically take the form of predispositions toward the acquisition of specific dispositions, where "A disposition of an organisim to do something is its tendency to behave in a certain manner under given circumstances" (p. 341). It is these organismic capacities and the conditions that trigger their effects that are the appropriate phenomena for sociobiological explanation, relative to their evolutionary determinants.

In Holcomb's view, it was no accident that Wilson's Sociobiology (1975) was written in three parts (on processes of social evolution, on social mechanisms, and on the social species), because those parts correspond to ideal explanations in evolution: "Evolutionary explanations ideally explain (a) past and present distributions of characters in local populations of organisms of various species in terms of (b) the effects of evolutionary processes, given (c) relevant parameters, (d) on mechanisms for survival and/or reproduction operative in the course of the evolutionary past". Thus, Holcomb maintains that "evolutionary theory would be complete if everything in category (a) could be derived as expected from exhaustive specifications of explanatory factors in categories (b), (c), and (d)" by means of explanations of the kind that I discussed in Chapter 1.

Holcomb thus properly rejects Wilson's presumption that sociobiology must subsume the social sciences and denies both the reductionistic and the anti-reductionistic theses "that a completed social science either would or would not be reducible to a completed evolutionary biology" (pp. 297-298). The scientific success of sociobiology, in Holcomb's view, depends upon continued progress in moving from anecdotal evidence and popular beliefs to statistical generalizations and lawful hypotheses about human behavior. The future of the discipline thus hinges upon the discovery of additional causal factors, intervening variables and auxiliary theories that close the gap between sociobiological theory (hypothesis/ explanans) and observed patterns of behavior (evidence/explanandum). Holcomb thereby avoids the pitfall of embracing reductionism or other unworthy ideologies.

Indeed, to the considerable extent to which the social sciences and humanities study emergent properties of human beings, they cannot properly be reduced to biology and evolution alone. Even though there may be genetically-based predis- positions for broad ranges of social behavior, the emergence of social behavior in specific forms, including specific social organizations and specific group behavior, appears to hinge upon the transmission of customs, traditions, and practices as a manifestation of cultural evolution as opposed to genetic evolution, where cultural evolution employs different mechanisms of transmission than genetic evolution. In particular, as we shall discover, cultural evolution permits the inheritance of acquired characteristics (and is therefore Lamarckian), whereas genetic evolution precludes the inheritance of acquired characteristics (and is therefore Darwinian).

1. Minds and Their Bodies.

The last few chapters have been devoted to the elaboration of a theory of the nature of mentality that might apply to human beings, other animals, and inanimate machines, if such a thing is possible, without belaboring the connec- tions between minds and their bodies. In her stimulating work, The Roots of Thinking (1990a), Maxine Sheets-Johnstone has advanced a conception of hominid evolution that emphasizes concepts rather than words and communication rather than language. Indeed, she focuses upon the role of the body in understanding the mind, where their interrelations have gone largely unappreciated in theoretical work up until now, especially at the hands of philosophers. She endorses J. S. Haldane's fundamental axiom of biology, i.e., that the life sciences are properly devoted to the study of the life of organisms as Darwinian bodies.

In criticizing mainstream philosophical research on the nature of mentality, Sheets-Johnstone castigates the artificial separation of the mind from the body:

> Because "the mental" can be conceived as estranged from, and even [as] thoroughly independent of "the physical" (not as a brain in a vat but as a pure spirit or "thinking substance"), and in consequence, because the Darwinian body can easily fall through the crack, it is most reasonable to begin an investigation of the roots of human thinking from the perspective of the Darwinian body, that is, with interacting living creatures in the throes, pleasures, industries, and curiosities of their everday lives. (Sheets-Johnstone 1990a, pp. 304-305)

Thus, from her perspective, Darwinian bodies as products of natural selection should be understood as subject to further transformation by means of other kinds of selection, which include sexual, cultural, and metacultural varieties.

This point of view supports the conception presented in previous chapters of the emergence of Homo as more or less continuous with that of other forms of animal life, where many of our differences are properly viewed as matters of degree rather than as matters of kind. This is especially the case with respect to concepts and communication, which are presupposed by and not dependent upon words and languages as such. Indeed, the most fundamental tenet elaborated in her work may be the existence of a biological disposition to use one's own body as a semantic template in communicating with other members of one's species or of one's group (Sheets-Johnstone 1990a, p. 308).

This species-specific biological disposition manifests itself especially in the form of signals which are common to the members of the species or the group by virtue of reflecting common behaviors. The set of signals common to a specific species or to a specific group, as Sheets-Johnstone reports, are referred to "comsigns" by Stuart Altman. Some comsigns appear to arise as a consequence of analogical thinking hinging upon some commonality of animate form and of tactile-kinesthetic experience, which presupposes the existence of tactile-kinesthetic invariants by every normal member of a species. The common neurophysiology of Darwinian bodies thus creates the potential for similar sensations under similar conditions within species.

Examples that she explores include hardness as a property of teeth and also of stones. The use of the teeth for chewing and biting as well as other tactile-kinesthetic sensations involving the tongue or fingers running over the teeth give rise to the concept of hardness and of the uses to which hard things might be put. In a similar fashion, the association of a bipedal gait and what she calls "recognition counting" involves the recognition of similarities between bodily parts and bodily behavior, where walking involves making one step after another, where each normal member of the species possesses two arms, two legs, and so on, as aspects of their "animate form". Features of our body and behavior thereby provide the roots for thinking.

The role of analogical thinking can be illustrated by Sheets-Johnstone's analysis of hardness. The contact of our tongue with our teeth provides a tactile-kinesthetic introduction to hardness as a property of teeth, which gives rise to the concept of hardness as a property that teeth possess. In broadening our experience of the world to encompass other things which are also hard, such as stones, we tend to reason by analogy that, since our teeth are useful for biting and chewing, perhaps stones are useful for similar purposes. Reasoning by analogy is never conclusive, which means we can sometimes be surprised to discover that we are wrong. But it affords a process of thinking by means of which such concepts can be generalized.

Of course, the discovery of hardness may also have been promoted by observing that somethings can be used to break other things, but not vice versa. This suggests that ordering relations between different degrees of hardness may have emerged early in hominid experience, more or less as as reflection of operational definitions of that kind. Similarly, the ability to count might have been nurtured as much by the need to determine if there is enough food (tools, clothing, etc.) for the members of a group as much as by our bipedal gait. Yet there little room to doubt that different units of measure have been strongly affected by aspects of animate form.

Henry I of England, for example, defined a yard as the length from the tip of his nose to the end of his arm. One inch was the length of three barley corns laid end to end. And the instructions found in an old textbook for land surveyors specified the length of a rod as follows: "Stop 16 men coming out of church on Sunday, and line them up with their left feet touching. The distance from the toe of the first man to the heel of the last is one rod." (Bernstein et al. 1978, p. 1). Comparative concepts of harder than and as hard as and not as hard as, for example, and quantitative concepts of how many or of how much thus appear to have been closely related to or even directly dependent upon specific features of hominid bodies and behavior.

Sheets-Johnstone maintains further that tactile-kinesthetic invariants predispose organisms toward forms of communication that involve (what she calls) "iconicity", precisely because "the most easily formulated, consistently utilizable, and readily understood signals are those that are similar to bodily behaviors and experiences shared by all the members of the species" (Sheets-Johnstone 1990a, p. 126). Biological tendencies toward the use of the body as a medium of communication by means of gestures, expressions, and other movement, however, should not be supposed to be ones of which the members of a species are invariably conscious or aware. Sometimes these signals involve involuntary behavior, but sometimes not.

Although Sheets-Johnstone tends to focus upon the role of the body as a semantic template for individual members of a species, the commonality of the experiences that different members of the same species share itself supplies a foundation for understanding how communication between the members of a species might be rooted in their similar bodies and in their similar experiences. Some basic forms of thought seem to arise when experiences of one kind come to be associated with experiences of another, for example, when tactile-kinesthetic experiences of one kind come to be associated with tactile-kinesthetic experiences of another, which supplies a foundation for anticipating or expecting that one will attend the other.

The prospects for an adequate theory of animal communication and for a more appropriate appreciation of non-verbal modes of communication in relation to the human species are greatly enhanced by Sheets-Johnstone's synthesis of a wide and diversified body of research on animal behavior. Indeed, much of my enthusiasm over the discovery of Sheets-Johnstone's work is that it tends to provide answers for one of the most difficult problems in the theory of language, namely: how did hominids first begin to use language as a form of communication? For it may be that the origin of language can be found in the use of sounds that are naturally connected to that for which they stand (compare Sheets-Johnstone 1990a, Ch. 6).

She focuses attention on the gratuitous and question-begging stance involved in adopting the alternative hypothesis that human speech first began with symbols as sounds that were arbitrarily related to the things for which they stand, which appears to be a wholly untenable contention. As an extension of her approach, it is not difficult to imagine that cries of pain, shouts of anger, laughter and such must have been some of the more basic elements of primitive forms of auditory communication. Thus, some sound that resembles the sound that one hominid would make were a wild animal to attack could readily have come to stand for an attack of that kind, where it might later be replaced by other sounds having the same meaning.

While Sheets-Johnstone tends to emphasize features of "semanticity" or meaning and of "iconicity" or resemblance as essential to comsigns which were utilized by early hominids, at least one more ingredient appears to have played a fundamental role, namely, relations between causes and effects. That different instances of specific sounds are both instances of the same sound depends upon the capacity to recognize resemblance relations between them. Cries of pain, shouts of anger, laughter and the like, however, are surely important as causes or effects of that for which they stand. Their meaning ("semanticity") is not a matter of resemblance at all.

Of course, this qualification may be viewed as little more than a refinement of Sheets-Johnstone's conception, since the reason why cries of pain, shouts of anger, laughter and such are able to function as comsigns within a community of conspecifics appears to be due to analogical thinking of the kind I have already described. Indeed, once we have mastered the relationship between sounds that are cries and sensations of pain, sounds that are shouts and feelings of anger, and sounds that are laughs and experiences of joy, it no longer seems difficult to imagine that the members of a community of conspecifics could tend to communicate on such a basis.

Many of the examples that Sheets-Johnstone employs to illustrate her theses tend to support such an interpretation. When a male pigmy chimpanzee wants to invite a female to join him in sexual activity, for example, he tends to approach within five yards or so and lie back while exposing his erect pink penis and gazing intently in the female's direction (Sheets-Johnstone 1990a, pp. 98-99, which is based upon research by N. Thompson-Handler, R. K. Malenky, and N. Badrian 1984). The pygmy chimpanzee thereby focuses attention upon his preparation for copulation. Unsurprisingly, through the use of his body this way, everyone gets the message.

Sometimes, however, the body is used to conceal rather than to reveal. In a paper, "Taking Evolution Seriously" (1990b), for example, Sheets-Johnstone reports other observations which George Schaller has made of lions. Thus, in one field study, he asserts that a female lioness, after a kill, may sometimes pretend as though nothing has happened to avoid sharing her bounty with other members of her pride (Sheets-Johnstone 1990b, p. 15, n. 22). In many ways, the lioness's behavior may be even more interesting than the penile displays of the pygmy chimpanzee, not least of all because it involves using bodily gestures to deceive other conspecifics and thereby prevent them from doing something that they otherwise would tend to do.

Because thinking in terms of symbols appears to presuppose the capacity to think in terms of causes and effects, and thinking in terms of causes and effects appears to presuppose the capacity to recognize relations of resemblance, these abilities may well represent three stages in the evolution of mentality. While they can be viewed vertically as a hierarchy of modes of mentality of increasing strength, they can also be viewed horizontally as a sequence of stages in the evolution of minds of successively stronger and stronger kinds. Stronger kinds of minds would appear to afford obvious evolutionary benefits, where the capacity to use symbols, especially, supports the capacity to think about any subject, no matter how abstract.

If such an approach is right-headed, then organisms must develop the capacity to detect resemblance relations before they can develop the ability to detect causal connections. And they must have the ability to detect causal relations before they can acquire the capacity to use ordinary language. That the ability to think in terms of causal relations presupposes the capacity to recognize instances of similar kinds should not be difficult to understand, since inferences from causes to effects on various differerent occasions requires the ability to recognize various events as distinct instances of that kind of cause and others as distinct instances of corresponding kinds of effects, presumably because they resemble one another.

That the ability to use words presupposes the capacity to think in terms of causes and effects may be more difficult to appreciate, but it seems to be the case, nonetheless. The association of the word "Stop!", for example, with ceasing to do whatever one is doing presupposes that words can function as commands, which are special kinds of causes in influencing human behavior. The most likely candidates for the rudimentary vocabulary of early humans may be directives and exclamations, where expressions of both kinds tend to function as causes or effects of their meaning. "Oh, no!" can be an effect of a certain kind of situation, just as "Go on!" might be a cause of another.

Although Sheets-Johnstone tends to focus her attention upon things that appear to be important to human forms of life, such as tool making, ways of counting, hominid bipedability in relation to primate sexuality, the origin of cave art and the concept of death, her work appears to be compatible with the thesis that the meaning of a gesture, expression, or word is determined by the totality of behaviors that would be brought about by an organism that has the ability to use gestures, expressions, or words of that kind when aware of their presence. Their meaning as signs is their causal role in affecting behavior under various conditions.

That more than one sign or more than one kind of sign can stand for the same thing or have the same significance is not difficult to discern. When the male pygmy chimpanzee displays his erect pink penis for a near-by female, his erection stands as a partial cause to the effect which he would like to bring about. It functions as a causal invitation to copulat-ory activity, which the pygmy female can accept or not as she prefers. When a human male on the make in a bar asks a human female, "Your place or mine?", those words may be only conventionally and indirectly related to that for which they stand, but their meaning is unmistakable.

It appears important in this context that a theory of minds as things that can use signs supports the capacity to make a mistake—to mis-take a sign as standing for other than that for which it stands—as a general criterion of mentality. As a criterion, the capacity to make mistakes af-fords a usually reliable, but not therefore infallible, evidential indicator of the presence of the property in question. The successful application of this criterion, however, is not therefore unproblematic, since it may be as difficult to decide whether a mistake has taken place as it would be to decide whether or not something has a mind (Fetzer 1990, p. 66).

Nevertheless, some of the cases that Sheets-Johnstone reports are remarkable when considered from this point of view. The lioness who deceives the other members of her pride into thinking that nothing is up after a kill uses her body to create a false impression in the minds of other lions, which suggests that lions have the capacity to make mistakes. The existence of animals that play dead, of chimps that can lie, and even of fireflies that can adjust their flashing behavior to emit false signals as to their identity provides strong evidence that mentality may not be taken as a human prerogative but is instead ubiquitous in nature.

2. Gene-Culture Co-Evolution.

The area of inquiry (or "discipline") known as sociobiology is largely the creation of the evolutionary biologist, Edward O. Wilson, who has authored several books, such as The Insect Societies (1971), Sociobiology: The New Synthesis (1975), On Human Nature (1978a); in collaboration with physicist Charles R. Lumsden, Genes, Mind, and Culture (1981) and Promethean Fire (1983); and, more recently, The Diversity of Life (1992) and Consilience (1999). The primary thesis of these works during a span of more than twenty years is that many facets of social organization, including patterns of individual development, as well as aspects of culture itself, are species-specific, where these characteristics affect the capacity of species to survive and to reproduce. From his perspective, were we "zoologists from another planet completing a catalog of social species on Earth, . . . anthropology and sociology together [would] constitute the sociobiology of a single primate species" (Wilson 1980, p. 271).

Wilson thus wants to assimilate the study of culture within the framework of evolutionary biology, thereby embracing the program of a natural science of social behavior. It should not be surprising that this approach has stimulated enormous controversy with scientists and non-scientists alike, not least of all for taking seriously the idea that human culture might be "on a par" with other species' cultures, rather than "the inevitable outcome of either advanced social life or high intelligence" (Wilson 1978a, p. 22). Wilson invites us to contemplate the possibility of even more complex societies whose non-human members are possessed of superior intelligence, yet which differ from human societies in most respects. From this perspective, therefore, culture itself is no longer an exclusively human prerogative but may also belong to birds, to bees and to chimpanzees.

In extending the concept of culture to species other than Homo sapiens, Wilson tacitly extends it meaning, which typically signifies "the ideas, customs, skills, arts, etc. of a people or group, that are transferred, communicated or passed along, as in or to succeeding generations", where these attainments are more often supposed to be the products of learning than the offspring of genetic endowment (Webster 1988, p. 337). Yet the scope of scientific formulations must be permitted to exceed the nuances of ordinary language, which inevitably occurs when properties that were previously thought to be the exclusive province of humans are discovered to be among the possessions of other species as well. Moreover, even in its ordinary sense, "culture" as a product of learning tends to presuppose differing capacities for attainment as a function of differing genetic endowments in the form of corresponding predispositions.

In Genes, Mind, and Culture (1981), Lumsden and Wilson emphasize the role of mental activity (or of "mind") in the propagation of culture, maintaining

> the genes prescribe a set of biological processes, which we call epigenetic rules, that direct the assembly of the mind. This assembly is context-dependent, with the epigenetic rules feeding on information derived from culture and physical environment. Such information is forged into cognitive schemata that are the raw material of thought and decision. Emitted behavior is just one product of the dynamics of the mind, and culture is the translation of the epigenetic rules into mass patterns of mental activity and behavior........ (Lumsden and Wilson 1981, pp. 2-3)

They proceed to define "culture" in a broad sense as encompassing "the sum total of mental constructs and behaviors, including the construction and employment of artifacts, transmitted from one generation to the next by social learning" (Lumsden and Wilson 1981, p. 3). To encompass "artifacts" of non-human species, therefore, the notion must be extended to cover their effects as inherited or acquired products of human or non-human effort or design.

Thus, insofar as mental activity (construed as a capacity for social learning) contributes to the production and utilization of cultural artifacts (including language, habits, skills, arts, instruments, institutions, and so on), which are transmitted to successive generations by a process of social learning, then to the extent to which these cultural capabilities tend to promote or inhibit the evolution of a species, its reproduction and survival becomes a manifestation of gene-culture co-evolution. But it should be evident that gene-culture co-evolution can take place only if a species possesses the capacity for the transmission of culture from one generation to another by social learning, which thus presupposes "mind" as the cognitive capacity for thought and decision.

Upon initial consideration, the introduction of "epigenetic rules" might seem to needlessly complicate an otherwise elegant approach. The conception advanced in Wilson's On Human Nature (1978a) holds that different species S1, S2, . . . are characterizable by different patterns of social behavior, B1, B2, . . . : things that are ants exhibit age-grading, antennal rites, and so on, whereas those things that are human exhibit age-grading, athletic sports, and so forth. Thus, an apparently parallel conception within natural science holds that various elements E1, E2, . . . , and so forth, are characterizable by different combinations of physical attributes A1, A2, . . . : things that are gold, for example, have a melting point of 1064°C, boiling point of 3080°C, and so on, while things that are titanium, by comparison, exhibit a melting point of 1660°C, ionization potential of 6.82 eV, and so on.

Thus, insofar as the physical and chemical properties of the elements recur in a regular fashion when elements are arranged in increasing order of their atomic numbers (as reflected by the Periodic Table of the Elements), perhaps the personal and the social properties of the various species might be found to recur in a regular fashion when the species are arranged in an order that appropriately corresponds to their genetic origins (as reflected by a counterpart Periodic Table of the Species).

Certain underlying difficulties appear to confront this conception, however, insofar as patterns of social behavior do not appear to be properties of ants and humans in precisely the way that combinations of physical attributes are properties of gold and titanium: things that are gold, for example, possess their melting points and boiling points as properties of discrete individual things, whereas things that are human, by contrast, possess their age-grading and athletic sports, not as concrete individual things, but instead as relations between various individual things.

Thus, physical attributes are properties of individual things distributively (since each thing that is gold has a melting point of 1064°C without regard to its relations to other things that are gold), whereas social behaviors are properties of individual things collectively (since athletic sports, for example, is not a property that one human has as a discrete individual thing, but only exists as a relation between that human and other humans who engage in athletic sports). More importantly, the properties of the elements are permanent, while those of the higher species, in particular, appear to be transient. Just as no human being is born speaking a specific language (such as English, German, or French), no human being is born playing a specific game (such a football, basketball, or golf).

And, if this is the case, then, in order to provide an essential mechanism for the generation of social behavior on the basis of properties of discrete individual things, "epigenetic rules" would need to be introduced to represent the potential for social behavior as a dispositional property of discrete individual things that manifests itself under the relevant social conditions, roughly as Genes, Mind, and Culture (Lumsden and Wilson 1981) tends to suggest. Epigenetic rules, in other words, exist in the form of predispositions to acquire one or another specific behavioral tendency BT1, BT2, and so on, within a specific range of possible tendencies, BTi, where which of these behavioral tendencies happen to be acquired as actual dispositions depends upon and varies with environmental factors, especially in relation to social learning.

For a specific epigenetic rule, the variety of specific behavioral tendencies an individual can acquire as actual dispositions collectively reflects its "selectivity", while the strength of that individual's tendency to manifest one or another of those actual dispositions distributively reflects its "penetrance"; thus, an individual's actual behavioral tendencies during any specific moment in its development may be described by corresponding usage bias curves (Lumsden and Wilson 1981, pp. 55-65). Thus, while Homo sapiens has the predisposition toward athletic sports, this tendency may be manifest by acquiring any of a broad variety of specific dispositions to play soccer, tennis, and so forth, with distinctive strengths of those tendencies relative to different environmental conditions, where which, if any, among these happens to be displayed by particular members of the species is partly a function of social learning. Yet ants, by way of comparison, are completely incapable of acquiring the disposition to play soccer, or tennis, and so on, precisely because they lack the predisposition toward athletic sports that numbers among the characteristics of human genes.

From this point of view, therefore, sociobiology addresses the necessity to

assess the relative influence of genes and of culture (of nature and of nurture) on the social behavior displayed by different species, where if social learning factors are comparatively unimportant in the emergence of various behavioral tendencies, then those specific traits are properly classified as (more-or-less) "biologically determined", but otherwise not. Thus, the major difference between alternative accounts of sociobiology tends to arise at just this juncture. For, as Wilson has observed, sociobiology, in general, is compatible with (at least) three different kinds of relations between genetic predispositions and their behavioral manifestations along the following (cf. Wilson 1978b, p. xi):

(i) every member of the species possesses the same genetic predisposition, and this predisposition is compatible with a broad range of possible behavior;

(ii) every member of the species possesses the same genetic predisposition, but this predisposition is compatible with a narrow range of possible behavior;

(iii) some members of the species possess different genetic predispositions, where these predispositions are compatible with different ranges of possible behavior, some of which are broad and some of which are narrow, respectively.

Although Wilson was not initially committed to one or another of these theoretical alternatives, the genetical, the psychological and the anthropological evidence led him to conclude "that human social behavior is to some extent genetically constrained over the entire species and furthermore [is] subject to genetic variation within the species", which has led him to accept thesis (iii):

> The most emotion laden and least rationally controlled human behaviors are generally consistent in their details with sociobiological theory. These categories include incest inhibition, bond formation, parent-off-spring conflict, sex-biased infanticide, primitive warfare, territoriality, and sexual practice. They are more simply explained by the hypothesis of genetically based predisposition than by the hypothesis of purely cultural determination. (Wilson 1978b, p. xii)

Sociobiology thus provides a framework for explaining the social behavior of different species as a (complex) function of genetic and of cultural factors, where some species will tend to exhibit uniform genetic predispositions, most of which permit only narrow ranges of possible behavior (as befits "the lesser species"), while other species will tend to exhibit variable genetic predispositions, which permit far broader ranges of possible behavior (as befits "the higher species").

3. Is Sociobiology Scientific?

The fundamental principles of sociobiology (as gene-culture co-evolutionary theory) can be presented as a sequence of theses of two different kinds, namely: definitions, which reflect the meanings to be assigned to technical terms in the vocabulary of sociobiology; and conjectures, which reflect the principal relations that are supposed to obtain between these properties, thus understood, if sociobiology happens to be true. "Definitions", therefore, are assumed to be true on syntactical or on semantical grounds alone, whereas "conjectures" are logically contingent empirical assertions that are intended to have the character of lawlike sentences as sentences that would be natural laws if they were true.

Let us begin with deterministic versions of all of these definitions and conjectures—including the laws of Mendelian genetics—and subsequently consider the additional formulations that would be required of their probabilistic counterparts. Then among the most basic assumptions underlying sociobiology is the following:

CONJECTURE 1. Phenotypes P1, P2, . . . develop from genotypes G1, G2, . . . under the influence of environmental factors EF1, EF2, ...

These relations can be formalized by introducing causal conditionals of universal strength ". . . =u=> ___" to complement those of probabilistic strength n to reflect the possibility these relations may be deterministic or probabilistic, respectively:

(L1-D) (x)(t)[Gixt ==> (EFixt =u=> Pixt*)]; or,

(L1-P) (x)(t)[Gixt ==> (EFixt =n=> Pixt*)];

which represent the difference when the occurrence of Gi and EFi would invariably bring about outcome Pi without exception (with universal strength u) and when that result is brought about instead with merely probabilistic strength n. The relevant "environmental factors", of course, must include every internal or external factor that makes a difference to the outcome of specific phenotype Pi.

Comment. This conjecture is a thesis of molecular genetics and of evolutionary biology, which is presupposed by sociobiology. Strictly speaking, instances of phenotypes P1, P2, . . . develop from instances of genotypes G1, G2, . . . under the influence of instances of (internal and external) environmental factors EF1, EF2, ... This thesis has two corollaries when the relationship is deterministic:

COROLLARY IA. Different phenotypes P1, P2, ...must develop from the same genotype Gi under the influence of different environmental factors EF1, EF2,...... ; and,

COROLLARY IB. Different phenotypes P1, P2,.........must develop from different genotypes G1, G2, ... under the influence of the same environmental factors EFi.

Environments that include exposure of genotypes to gamma rays, however, presumably permit the possibility that, under precisely the same genotypical-and-environmental conditions, one or another phenotype may occur as the outcome, because these results are brought about by some indeterministic causal process. When that happens to be the case, then probabilistic lawful relations will obtain,

(L1-P1) (x)(t)[G1xt ==> (EF1xt =n=> P1xt*)]; or,

(L1-P2) (x)(t)[G1xt ==> (EF1xt =1-n=> ~P1xt*)];

. . .

where, when phenotype P1 is brought about with propensity of strength n, then other phenotypes ~P1 (P2, P3, ...) are brought about with propensities equal to or less than 1-n, which represents the sum of the values for alternative outcomes.

Comment. So long as "genotypes" are defined in terms of genetic material and not in terms of their predispositions to develop into "phenotypes" (defined in terms of neurological and of physiological structure), these theses are empirical assertions that are logically contingent and explicitly lawlike. For claims of this kind to be true, the specification of genotype and of environmental factors must include the presence or the absence of every property whose presence or absence makes a difference to the development of corresponding phenotypes. This means that they must satisfy the requirement of maximal specificity. Nomically irrelevant environmental factors are excluded from consideration in these corollaries.

CONJECTURE 2. Epigenetic rules ERi are permanent properties of phenotypes Pi.

Thus, the only phenotypic differences that matter with respect to epigenetic rules are those relative to which they differ, which may render many phenotypic properties nomically irrelevant. Corresponding laws reflect simple lawful relationships:

(L2-1) (x)(t)(P1xt ==> ER1xt);

(L2-2) (x)(t)(P2xt ==> ER2xt);

. . .

Comment. This conjecture is the fundamental thesis of general sociobiology. Strictly speaking, instance of (sets of) epigenetic rules are properties of instances of phenotypes once again, where these properties vary according to phenotype, assuming again that epigenetic rules are permanent properties of phenotypes.

COROLLARY 2A. Every instance of the same phenotype Pi must possess the same (set of) epigenetic rules ER1, ER2, . . . ; and,

COROLLARY 2B. Different (sets of) epigenetic rules ER1, ER2, . . . , cannot be possessed by the same phenotype Pi.

Even if every instance of the same phenotype must possess the same sets of epigenetic rules and even acquire the same behavioral tendencies, however, that is not enough to imply they must also display the same behavior Bi during their lives.

Comment. Corollary 2B is merely the contraposed formulation of Corollary 2A, which is added for emphasis. Notice that every instance of the same phenotype has to have the same epigenetic rules, if they are permanent properties, even though the truth of this assertion does not obtain on logical grounds alone. Even minor differences in neurological and physiological structure may make a difference to the epigenetic rules of different instances of the species. Indeed, the possibility epigenetic rules may not be permanent properties of phenotypes, discussed in Chapter 10, turns out to be important to the nature of intelligence.

In conjunction with (L1-D), for example, (L2-1) and (L2-2) imply as follows:

(L3-D1) (x)(t)[G1xt ==> (EF1xt =u=> ER1xt*)]; or,

(L3-D2) (x)(t)[G1xt ==> (EF2xt =u=> ER2xt*)];

. . .

and similarly the conjunction of (L1-P) and (L2-1) and (L2-2), probabilistically:

(L3-P1) (x)(t)[G1xt ==> (EF1xt =n=> ER1xt*)]; or,

(L3-P2) (x)(t)[G1xt ==> (EF2xt =1-n=> ~ER2xt*)];

. . .

where, as before, "-ER" represents the set of epigenetic rule alternatives to ER1, where these difference reflect the influence of deterministic or indeterministic environmental factors EFi on the development of corresponding phenotypes Pi.

DEFINITION 1. Epigenetic rules ER1, ER2, . . . are predispositions to acquire one or another specific behavioral tendency BT1, BT2, . . . within a fixed range of possible patterns of individual and social behavior, under the influence of specific fixed sets of (physical and social) environmental factors EF3, EF4, ...

When these relations are taken as manifestations of the meaning of "epigenetic rules", then the following theses follow, necessarily, in co-evolutionary language:

(D1-D1) (x)(t)[ERixt ==> (EF3xt =u=> BT3xt*)]; or,

(D1-D2) (x)(t)[ERixt ==> (EF4xt =u=> BT4xt*)];

. . .

which obtain when the same behavioral tendency, BT3, BT4, . . . would be acquired by any organism with the same epigenetic rules, ERi, under the same (internal and external) environmental factors, EF3, EF4,......... Once again, however, probabilistic relations are compatible with the occurrence of more than one possible outcome, BT3, BT4, . . . , under precisely the same conditions, EFi:

(D1-P1) (x)(t)[ER1xt ==> (EF3xt =n=> BT3xt*)]; or,

(D1-P2) (x)(t)[ER1xt ==> (EF3xt =1-n=> ~BT3xt*)];

. . .

An example may be helpful here. Consider biological twin human beings, who are raised apart. Even though their specific environments are no doubt not the same in every respect, so long as they are similar in specific respects that are relevant to the acquisition of a behavioral tendency, such as language acquisition, they may acquire similar linguistic dispositions, including abilities to use similar words under similar conditions. Whether or not they actually do use similar words under similar conditions, however, depends upon the specific conditions to which they are exposed during their lives. Having similar abilities and capabilities still tends to require similar conditions for their similar display.

Comment. The possession of a specific epigenetic rule determines the breadth and variety of potential patterns of behavior that an instance of a phenotype can acquire and can manifest. These potential patterns of behavior assume the form of predispositions, but their range of potential might be broad or narrow.

DEFINITION 2. The smaller the number of specific behavioral tendencies BT1, BT2, . . . , that can be acquired and manifest under different environment conditions in accordance with an epigenetic rule ER, the smaller the range specific behaviors Bi that an organism can display under varied conditions Ci.

DEFINITION 3. The larger the number of specific behavioral tendencies BT1, BT2, . . . , that can be acquired and manifest under different environmental conditions in accordance with an epigenetic rule ER, the larger the range of specific behaviors Bi that an organism can display under varied conditions Ci.

Comment. Here the difference between "selectivity" and "penetrance" seems to matter the most. Epigenetic rules, as predispositions, govern the range of behavioral tendencies that an organism can acquire as dispositions, which are displayed by specific behaviors Bi under specific conditions Ci. The range of those behaviors, however, is constrained by the epigenetic rules that restrict the possible behavioral tendencies those organisms can acquire and display. When a species, such as E. coli bacteria, has only a narrow range of possible behaviors (involving moving toward and moving away from various chemotactic substances) where every member with the same phenotype displays exactly the same behavior, behavioral change may require genetic evolution. For behavior that is more or less instinctual, that is the mechanism of change.

Notice, however, that the possibility of genetic evolution even under these conditions presupposes some variation in the gene pool, since otherwise there would be no possibility for adapting to an inhospitable environment. Minute differences in genotype, even those that bring about only minute differences in behavior, may sometimes be good enough to solve the adaptive problems. And that some differences in single genes may have multiple manifestations and that some properties may be affected by various different genes indicate ways in which even asexually reproducing species may be able to find ways to cope with problematical environments, not by optimizing but by satisficing.

DEFINITION 4. Cultures are composed of behavioral practices involving culturgens.

Comment. This concept applies to sociobiology and to cultural anthropology. Strictly speaking, instances of cultures are composed of instances of behavioral practices involving culturgens as tokens of various types, which can be counted, classified, and so forth (as instances of the use of tools of a specific type, as instances of games of specific kinds, as instances of use of specific languages, etc.).

DEFINITION 5. Culturgens consist of artifacts (including tools, clothing), of behavior (such as speech, skills), and of mentifacts (including thoughts and theories).

DEFINITION 6. Epigenetic rules ERi predispose phenotypes toward the acquisition and manifestation of specific behavioral tendencies BT1, BT2, . . . involving specific culturgens under different (social and physical) environmental conditions EF3, EF4, ...

Comment. Strictly speaking, instances of phenotypes possessing various kinds of epigenetic rules ER1, ER2, . . . are predisposed toward the acquisition and manifestation of specific behavioral tendencies BT1, BT2, . . . , involving utilization of specific instances of culturgens, such as tools of a certain kind, particular forms of speech, etc., under specific environmental conditions EFi.

CONJECTURE 3. Behavioral practices involving culturgens can be transmitted by social learning.

Comment. This thesis is likewise fundamental to general sociobiology. Note, in particular, that this is a logically contingent empirical assertion, which would be false only if behavioral practices involving culturgens could never be transmitted by way of social learning. It might turn out, however, that some behavioral practices involving culturgens are in-born and species-specific dispositions, in which case some such practices would not be transmitted by social learning.

COROLLARY 3A. Every instance of the same phenotype Pi must be predisposed to acquire and to manifest the same behavioral practices involving culturgens under the same conditions of social learning.

COROLLARY 3B. Different predispositions to acquire and to manifest the same culturgens under the same conditions of social learning must be instances of different phenotypes Pi.

Comment. Corollary 3B is merely the contraposed form of Corollary 3A and is added for emphasis. Note, in particular, that while every instance of the same phenotype must have the same social learning predispositions, that would remain the case even if that social learning predisposition were either nonexistent or probabilistic, so long as the same predisposition is possessed by every instance of the same phenotype with the same strength, regardless of what that degree of strength may be. Even when they are deterministic, the following thesis is true:

CONJECTURE 4. Phenotypes Pi possessing the same epigenetic rules ERi may acquire and manifest different specific behavioral tendencies BT1, BT2, . . . involving the use of culturgens under different environmental conditions EF3, EF4, ...

Comment. This conjecture, which is enormously important to sociobiology, must be carefully distinguished from Conjecture 2. That every instance of the same phenotype must possess the same sets of epigenetic rules does not entail that every instance of the same phenotype must acquire and manifest the same specific behavioral tendencies, unless either (a) those behavioral tendencies are in-born and species-specific dispositions whose possession is independent of environmental factors or (b) although they are not in-born and species-specific dispositions, those phenotypes are under the influence of the same sets of (physical and social) environmental factors EFi at causally relevant moments of their lives.

Even in case (b), moreover, that those phenotypes should acquire exactly the same behavioral tendencies implies the underlying laws are deterministic. When the processes of tendency acquisition are probabilistic, then, as we have already ascertained, more than one outcome is possible under the very same conditions. This conjecture has two corollaries that also depend upon determinism, namely:

COROLLARY 4A. Every instance of the same phenotype Pi must acquire and manifest the same specific behavioral tendencies BT1, BT2, . . . involving culturgens if it is subjected to the same sets of environmental factors EF3, EF4, . . . at causally relevant moments of their lives.

COROLLARY 4B. If instances of the same phenotype Pi acquire and manifest different specific behavioral tendencies BT1, BT2, . . . , invol-

> ving culturgens, then they must have been subjected to different sets of environmental factors EF3, EF4, . . . at causally relevant moments of their lives.

Comment. Since instances of the same phenotype Pi have to possess the same epigenetic rules, according to Conjecture 2, yet may acquire and manifest different specific behavioral tendencies BTI, BT2, . . . , nevertheless, this can occur only if those instances were subject to different sets of environmental factors EF1, EF2, . . . at some causally relevant moments of their lives, unless the causal connection between these antecedent conditions and those response outcomes is probabilistic. These possibilities can be represented by the formal apparatus employed above. (L1-D), for example, in conjunction with (L2-1) and (D1-D1) or (D1-D2) implies:

(L1-D1) (x)(t)[(G1xt & EF1xt) ==> (EF3xt =u=> BT3xt*)]; or,

(L1-D2) (x)(t)[(G1xt & EF1xt) ==> (EF4xt =u=> BT4xt*)];

. . .

because any organism of genotype G1 subjected to environmental factors EF1 would have phenotype P1 by (L1-D), any organism of kind P1 would have ER1 by (L2-1), and any organism with ER1 would acquire BT3 under conditions EF3 by (D1-D1) or analogously would acquire BT4 under conditions EF4 by (D1-D2).

An example of the scope of these lawlike generalizations of this kind would include those for biological twins in relation to their acquisition of a language as a specific disposition under suitable environmental conditions. Given they have the same genotype G1, then provided their environments as children and young adults preserved their phenotypes P1 comparable in relevant respects (nothing occurring, such as damage to their brains or harm to their capacity for speech), their exposure to a suitable (implicit and explicit) linguistic environment, which presumably would include some specific instruction in English, if that were the language of their environment, would lead to the acquisition of the ability to use English as a semiotic ability SA as a deterministic or a probabilistic phenomenon:

(L1-D1) (x)(t)[(G1xt & EF1xt) ==> (EF3xt =u=> SA3xt*)]; or,

(L1-P1) (x)(t)[(G1xt & EF1xt) ==> (EF4xt =n=> SA4xt*)];

. . .

While it may be tempting to suppose that phenotypes have minds to the extent to which their behavioral tendencies involving the use of culturgens are under the the influence of social learning, it would have the consequence of precluding the very possibility that the lesser species, whose behavior is not affected by social learning, could possess mentality. Considerations developed in previous chapters, however, suggest that other animals—ranging from E. coli bacteria to the mountain gorilla—have the potential for mentality, when mentality itself is properly understood as semiotic ability. This suggests the following complementary definition:

DEFINITION 7. Species possess mentality to the extent to which they possess semiotic ability.

Comment. Although Lumsden and Wilson (1981) tend to envision mind as the cognitive capacity for thought and decision, the semiotic conception offers a far less vague and much more precise account of minds as sign-using systems, a conception—as we have seen—that applies to humans, to other animals, and even to machines, if such a thing is possible. It remains compatible with Lumsden and Wilson's contention that (the members of) a species can participate in gene-culture coevolution only if they possess the capacity for the transmission of specific behavioral tendencies, especially involving the utilization of culturgens, by means of social learning. The capacity for social learning thus becomes essential to gene-culture co-evolution rather than to the possession of mentality.

A key difference needs to be borne in mind, moreover, between types of behavior and variation within the type, which may or may not correspond with ideas of selectivity and penetrance. E. coli bacteria have the capacity to move toward and move away from various chemotactic substances, which is narrow in terms of types of behavior, but the number of different substances toward which or away from which they may move appears to be constantly evolving. Thus, even if E. coli bacteria appears to be limited to iconic mentality, at best, that does not mean it cannot make the most of the semiotic abilities at its disposal. Survival and reproduction occur if adaptive abilities are "good enough".

DEFINITION 8. (Sexual) species are populations of phenotypes that are capable of interbreeding freely under natural voluntary and unforced conditions.

DEFINITION 9. Societies are (collections of) the members of a species that are organized in a fashion that promotes communication and cooperation beyond what is required to pursue sexual activities.

Comment. These definitions belong to biology, to sociobiology, and to anthropology. Their significance arises from additional theses to which they are related.

CONJECTURE 5. Societies are manifestations of the specific behavioral tendencies that their members have acquired as instances of species (phenotypes) under the influence of environmental factors.

COROLLARY 5A: Societies of the members of species whose epigenetic rules permit only a narrow range of possible patterns of behavior can acquire and manifest only a small number of behavioral responses to different environmental conditions.

COROLLARY 5B: Societies of the members of species whose epigenetic rules permit somewhat broader ranges of possible patterns of behavior can acquire and manifest a larger number of behavioral responses to different environmental conditions.

<u>Comment</u>. The principal difference between distinct species, therefore, consists in the breadth and variety of those fixed ranges of possible behavioral tendencies that their members can acquire and manifest as actual dispositions under the influence of (physical and social) environmental factors: the more narrow the range and the less subject to social learning, the greater the justification for regarding specific behaviors as "instinctual" or as "biologically determined", even though those tendencies invariably (or probably) arise under the influence of (physical and social) environmental factors. These corollaries have obvious consequences for the evolution of species, insofar as broader ranges of possible response to different environmental conditions confers a selective advantage upon a species within a changing world.

From the perspective developed in Chapter 1, therefore, the scientific status of gene-culture co-evolutionary theory should not be in doubt. The general character of this approach has not only been presented informally by means of conjectures, definitions, and corollaries, but the principles that define it have also been formalized through the use of subjunctive conditionals and causal conditions of universal and of probabilistic strength. Although the specific values of the various kinds of variables that have been identified would have to be specified to convert these schemata from the sketch of a theory to a theory, it should not be controversial to observe that theses of this kind appear capable of satisfying the conditions of conditionality, testability, and tentativeness we have previously considered as characteristic of scientific hypotheses and theories. Ultimately, of course, their acceptability necessarily depends upon inference to the best explanation.

Whether or not gene-culture co-evolutionary theory can be tested as freely as theories in other scientific domains, however, raises other issues. One is that experimentation involving human subjects generates moral and ethical questions that deserve to be resolved. We know that evidence that might be enough to confirm a generalization does not necessarily corroborate a corresponding law, which raises a difficult problem. Different versions of sociobiological theory will be distinguished by their ascription of different sets of culturgens, of epigenetic rules and of behavioral tendencies to various species, where these conjectures are intended to be lawlike claims. Conflicts may then arise between science and morality.

To whatever extent already existing societies may exemplify the conditions that would be required to subject these hypotheses to empirical test, there may be no special difficulties; but to whatever extent already existing societies do not exemplify those conditions, exceptional problems are likely to be encountered in relation to ethical aspects of scientific inquiries. Conjectures about incest inhibition, sex-based infanticide, and other behavioral tendencies, after all, are subject to corroboration as lawlike claims only insofar as the nonexistence of properties or procedures whose presence or absence would make a difference to the acquisition or the manifestation of those practices can be established. But there are obvious prohibitions against creating conditions of child abuse, of sexual slavery, and so on, by means of environmental manipulations that might violate basic moral principles.

Another is that, insofar as genetic and cultural evolution tend to operate at different rates, sociobiological hypotheses are necessarily more historical and comparative and less experimental and manipulative. An absence of moral imperatives, after all, would not alter the generally slow and Darwinian character of genetic evolution in comparison to the frequently rapid and Lamarckian character of cultural evolution, which is a crucial matter that we are going to explore in the chapter that follows. This difference can be displayed by adapting a Minskowski space-time diagram to function as a gene-culture coevolution diagram:

Figure 27. (Species Specific) Gene-Culture Co-Evolution Diagram

where the narrow cone reflects the slower rate of genetic change (as a function of gestation) and the broader cone reflects the faster rate of cultural change (as a function of technology). For while off-spring can only be produced at a constrained rate of reproduction within a species, the upper bound on the rate of culturgen transmission for an innovative species (with radio, television, and similar modes of information transmission) can approach the speed of light.

CHAPTER 10. WHAT ABOUT INTELLIGENCE?

The publication of The Bell Curve (1994) ignited a storm of controversy. Even though its authors, Richard Herrnstein, perhaps the leading student of behaviorism at Harvard until his death in 1994, and Charles Murray, Fellow of the American Enterprise Institute in Washington, D.C., were well-known and highly respected, their work provoked hundreds of papers, articles and columns, many of which have been anthologized (Jacoby and Glauberman 19-95). The central thesis of their inquiry, which many find to be intolerable, is that the great divide within American society between the "haves" and "have-nots" (the rich and the poor, the educated and the ignorant) arises not due to differences in social opportunities, but because of differences in underlying intelligence, which are leading to the gradual emergence of a "cognitive elite".

They outline their position by specifying a set of six conclusions related to tests of cognitive ability, such as the ACT, the SAT, and IQ tests, which they formulate as follows and consider to be "beyond significant technical dispute":

> (T1) there is such a thing as a general factor of cognitive ability on which human beings differ;
> (T2) all standardized tests of academic aptitude or achievement measure this general factor to some degree, but IQ tests deliberately designed for that purpose measure it most accurately ;
> (T3) IQ scores match, to a first degree, whatever it is that people mean when they use the words "intelligence" or "smart" in ordinary language;
> (T4) IQ scores are stable, although not perfectly so, over much of a person's life;
> (T5) properly administered IQ tests are not demonstrably biased against social, economic, ethnic, or racial groups; and,
> (T6) cognitive ability is substantially heritable, apparently no less than 40% and no more than 80% (Herrnstein and Murray 1994, pp. 22-23).

Table XVII. Six Theses of The Bell Curve (1994).

Their work extends a previous study by Herrnstein (Herrnstein 1973), in which he argued that if differences in mental ability are inherited, and if success requires those abilities, and if earnings and prestige depend upon success, then social standing (which reflects earnings and prestige) will be based to some extent upon inherited differences between people. As they themselves observe, this position, as formulated, is not especially threatening since, for example, if the genetic contribution to mental ability were small, then its contribution to earnings and prestige would be small. But they cite "hundreds of empirical and theoretical studies"—including especially those based on identical twins raised apart—as establishing support for the conclusion that "the genetic component of IQ is unlikely to be smaller than 40% or larger than 80%" (Herrnstein and Murray 1994, p. 105).

The controversial aspect of their study was less that cognitive ability appears to be approximately 60% heritable than it was their report that these differences have a racial distribution, where reliable IQ tests indicate a distribution of IQs in which African Americans average around 85, European Americans 100, and East Asians as high as 110 (Herrnstein and Murray 1994, Ch. 13). While acknowledging that their data for East Asian subjects are based upon limited studies, their conclusions about black/white differences are supported by 156 studies, which suggests that these findings may be objectively well-founded (Herrnstein and Murray 1994, pp. 276-277). While they explore many alternative hypotheses concerning socioeconomic status and discover some variation at high levels of SES, their results appear to remain robust when subjected to critical scrutiny.

Without attempting to settle the empirical truth of their findings, it ought to be apparent that the hypothesis of genetically-based differences in intelligence might emerge as the best supported among the available alternatives based upon inference to the best explanation, provided the hypotheses under consideration include an appropriate range of alternatives and the available evidence is sufficient. If these differences could be explained on the basis of test bias, for example, when that hypothesis was not among the alternatives under consideration, then clearly the conclusion would not follow, no matter how tentatively and fallibly. Herrnstein and Murray (1994), however, devote a great deal of attention to the available alternatives. Although their conclusion would have to be taken as tentative and fallible, grounds for its rejection are not obvious.

1. Intelligence and Race.

That, however, does not mean that they might not exist. Any hypothesis about the relationship between a reference property R and some attribute A depends upon the existence of R and A, respectively, as well as upon the relationship between them. If there is no objective foundation to classification of individuals into categories of African American, European American, and East Asian, for example, or if there is no objective foundation for attributing different levels of intelligence to those individuals, then the existence of such relationships would be more apparent than real. Moreover, mere correlations are not sufficient to establish counterpart natural laws, whose attributes must be permanent properties of those reference properties, as Chapter 1 explained. Herrnstein and Murray could be attacked on these and many similar grounds.

Stephen Jay Gould (1994), for example, summarized his objections to their findings by criticizing their conception of levels of intelligence: "Intelligence, in their formulation, must be depictable as a single number, capable of ranking people in linear order, genetically based, and effectively immutable. If any of these premises are false, then their entire argument collapses" (Gould 1994). Here and elsewhere, he critiques each of these "premises", contending that alternative explanations may account for the between-group differences:

> . . . , the well-documented fifteen-point average difference in IQ between blacks and whites in America, with substantial heritability of IQ in family lines within each group, permits no automatic conclusion that truly equal opportunity might not raise the black average enough to equal or surpass the white mean. (Gould 1994, pp. 5-6).

While Gould intends to be undermining their central conclusion, it is remarkable how much he concedes to Herrnstein and Murray, including the existence of a "well-documented" fifteen point average difference in IQ between blacks and whites in America, with substantial family-line heritability in each group.

In an earlier book, The Mismeasure of Man (1981), Gould had criticized the intelligence-testing tradition as it has emerged especially among psychologists in America with influence from Alfred Binet, H. H. Goddard, Lewis M. Terman, and R. M. Yerkes, while attacking most severely the work of Sir Cyril Burt as it affected the later work of Charles Spearman and L. L. Thurstone. Indeed, the notion of a general intelligence factor, called "g", was originally introduced by Spearman and later refined by Thurstone employing what is known as "factor analysis". Gould ends that book with a critique of the work of Arthur Jensen (1979) contending Jensen combines "two of the oldest cultural prejudices of Western thought: the ladder of progress as a model for organizing life, and the reification of some abstract quality as a criterion for ranking" (p. 318).

Gould rebuts Jensen's approach by maintaining, "Evolution forms a copiously branching bush, not a unilinear progressive sequence", where Jensen commits a blunder in speaking about "different levels of the phyletic scale

—that is, earthworms, crabs, fishes, turtles, pigeons, rats, and monkeys":

> Doesn't he realize that modern earthworms and crabs are products of lineages that have probably evolved separately from vertebrates for more than a billion years? They are not our ancestors; they are not even "lower" or less complicated than humans in any meaningful sense. They represent good solutions for their own way of life; they must not be judged by the hubristic notion that one particular primate forms the standard for all of life. (Gould 1981, p. 318)

What appears to be most important about Gould's observations, however, is not the implication that Jensen has misunderstood aspects of evolution, but the insinuation that the phenomena require evolutionary explanation.

In an "Afterword" responding to Gould and other critics, for example, Murray remarks that g may be related to the world in at least three ways: first, g might be an arbitrary creation of statistical analysis, with no underlying significance; second, g might function as a surrogate for other factors, such as educational level or socioeconomic status; third, g might be one of the crucial attributes of organisms that properly qualifies as "a (partly) biological phenomenon in its own right—a basic characteristic of the organism that exerts some influence on its ability to reason, think, and learn" (Murray 1996, p. 560). The robust character of findings about g, moreover, suggests that g is not an arbitrary creation of statistical analysis; and there appears to be no way to factor out g on the basis of other variables of these kinds.

The prospect thus remains that g might be among the crucial attributes of organisms that properly qualifies as a biological phenomenon "in its own right". As a preliminary and provisional hypothesis, for example, perhaps "g" reflects a predisposition of variable strength to acquire behavioral tendencies involving the use of signs under various conditions as a flexible form of mentality In this case, a difference should obtain between lower (more or less) instinctual species, such as bacteria, which may have minds but without g as a mental predisposition and evolve in a purely genetic Darwinian fashion, and other, higher species, including the primates, which have g among their mental predispositions, whose evolution encompasses gene-culture co-evolution and is partially Lamarckian. Intelligence is mentality of a certain kind.

The suggestion that g may be identified with higher grades of mentality appears to be consistent with the Lumsden and Wilson (1984) account of epigenetic rules ER1, ER2, . . . as predispositions to acquire one or another specific behavioral tendency BT1, BT2, . . . within a fixed range of possible patterns of individual and social behavior, under the influence of fixed sets of (physical and social) environmental factors EF1, EF2,........ The possession of specific epigenetic rules determines the breadth and variety of potential patterns of behavior that an instance of a phenotype can acquire and can manifest, where that range itself may be broad or narrow. The species that have broader ranges of potential patterns of behavior and that can acquire and can manifest them under more varied conditions are more intelligent.

This suggestion raises the possibility that Lumsden and Wilson's conceptions of selectivity and of penetrance, for example, may harbor an ambiguity with respect to propensities to acquire and to manifest different specific behavioral tendencies, where "selectivity" as a measure of breadth of possible acquisitions and "penetrance" as a measure of strength of tendency to display them would appear to require an additional measure of "ease of learnability" as a function of the rapidity with which those specific behavioral tendencies can be acquired. Epigenetic rules as predispositions would then have three dimensions, namely: the range of dispositions that could be acquired, under suitable conditions; the ease with which those possible dispositions would be acquired; and the strength of acquired dispositions to manifest themselves.

The identification of g with epigenetic rules involving use of signs clarifies and illuminates many perplexing problems that have arisen in the study of intelligence. In separating mentality from intelligence by identifying intelligence as mentality of a special kind—as the kind of mentality that can contribute to behavioral plasticity through the acquisition of semiotic abilities under suitable conditions—it broadens the foundation for explanations that are intended to account for learned or acquired behavior. The lower species are not only those whose behaviors are severely constrained by their genes, as Lumsden and Wilson suggest, but are also species whose behavior under specific fixed conditions remains constant from member to member because they lack the intelligence to acquire and manifest new behavioral responses.

Moreover, it supplies an explanation for the common tendency to describe digital machines, which we have discovered have no mentality, as "intelligent", nevertheless, because they display enormous behavioral plasticity because of their capacity to "learn" or "acquire" a wide range of different forms of behavior, which in this case are varying computational abilities under suitable conditions of programming as opposed to learning (Fetzer 1997). Even though it would be mistaken to attribute mentality to these machines or even describe them as "thinking things", the cognitive versatility they display as modes of extension of genuine mentality possessed by their designers and their users warrants their (appropriately qualified) description as "intelligent machines".

Thus, on an approach of this kind, intelligence and mentality may be viewed as related but independent concepts. While lower species, such as bacteria, may possess mentality, their purely instinctual behavior does not reflect the capacity for acquiring or learning non-instinctual behavior. Species that are comparable in this respect—which, admittedly, may have evolved gradually, if evolution is incremental in this respect, or more dramatically, if it is not—thus possess mentality but not intelligence. Digital machines, including contemporary computers, moreover, which are readily adapted to multiple uses through programming, can be described (metaphorically, if not literally) as possessing intelligence but not mentality, when they are understood to be symbol systems lacking the ability for the use of signs distinguishing minds.

Arthur Jensen (1998) has remarked upon the difficulties in establishing scientifically acceptable criteria and definitions for "intelligence". But the separation of intelligence from mentality promotes this objective. When Dawkins (1993), for example, receives reconsideration from this point of view, it becomes evident that her criteria of consciousness— (CC-1) complexity of behavior; (CC-2) adapting behavior to variable conditions; (CC-3) learning from others; (CC-4) behavior involving choice; and (CC-5) behavior involving cooperation—appear to capture properties that demarcate levels of intelligence of various species rather than specific properties of minds. But that does not preclude their utility for drawing distinctions between species, which would reflect differences between minds of different kinds.

Even though Gould may be entirely correct in his depiction of evolution as "a copiously branching bush" rather than "a unilinear progressive sequence", where modern earthworms and modern crabs, for example, are not inferior to vertebrates, including human beings, as adaptations, it certainly does not follow that they are not inferior to vertebrates, including human beings, as intelligent things! The range and variation of different species with respect to their semiotic abilities appears to be among their most important features, where some species have considerably greater range and variation in mentality in this sense than do other species. Even though earthworms, crabs, fishes, turtles, pigeons, rats, and monkeys may be on-a-par as evolved adaptations, that does not preclude a certain ordering with respect to their mental ability!

These considerations strongly suggest that intelligence itself may have an objective foundation as a property of organisms that varies between species and between the members of the same species. Indeed, as a property that appears to differ from species to species, it must have evolutionary origins and require evolutionary explanation. The adaptive benefits of intelligence under this interpretation, of course, are not difficult to discern. But differences between species with respect to evolved predispositions, in the case of the higher species, and with respect to evolved dispositions, in the case of the lower species, do not yet establish that the highest species might be differentiated on the basis of evolved predispositions that differ by races.

Were there no races, of course, there could be no racially-based differences in intelligence. The existence of races has occasionally been called into question, especially out of sincere but misguided attempts to promote the concept of equality, which turns out to be amenable to a wide variety of alternative interpretations, as Philip Fetzer (1997) has observed. But the general conception appears to have some basis in biological theory. In <u>Sociobiology</u> (1975), for example, E. O. Wilson defines "races" as <u>subspecies</u>:

(DSS) Subspecies =df a population or series of populations occupying a discrete range and differing genetically from other geographical races of the same species (Wilson 1975, p. 323);

where the barriers that inhibit genetic exchanges with other individuals are those of distance and geography as opposed to those "intrinsic isolating barriers" that inhibit the free interbreeding between members under natural conditions typifying the species of which they are subpopulations.

Wilson emphasizes the variation that can occur between races as subspecies, where "Subspecies, insofar as they can be distinguished with any objectivity at all, show every conceivable degree of differentiation from other subspecies" (Wilson 1975, p. 8), on which he elaborates as follows:

> At one extreme are the populations that fall along a cline—a simple gradient in the geographic variation of a given character. In other words, a character that varies in a clinal pattern is one that changes gradually over a substantial portion of the entire range of the species. At the other extreme are subspecies consisting of easily distinguished populations that are differentiated from one another by numerous genetic traits and exchange genes across a narrow zone of intergradation.

Thus, if there is no cluster of traits that distinguish one race from another, then there would be no foundation for supposing that races—human races, in particular—could differ with respect to their intelligence, mentality, or g.

Perhaps the most comprehensive synthesis of studies of differences between human races can be found in J. Philippe Rushton, <u>Race, Evolution, and Behavior</u> (1995a). Rushton reports that hundreds of studies support the conclusion that Orientals, Whites, and Blacks differ on a wide spectrum of traits:

<u>Table XVIII. Relative Ranking of Races on Diverse Variables</u>.

[Table XVIII is taken from Rushton (1995b), p. 23; cf., Rushton (1995a), p. 5.]

Thus, Rushton's findings—for which massive citations are provided—appear to support the conclusion that "racial differences in intelligence are observed worldwide, in Africa and in Asia as well as in Europe and North America, and that they are paralleled by differences in brain size, speed of dental maturation, reproductive physiology, and numerous other variables" (Rushton 1995a, p. 4).

Whether or not such an inference follows from the evidence that Rushton has accumulated obviously depends upon several crucial considerations. The first is whether he has accurately summarized the data at his disposal. The second is whether the data at his disposal encompasses all the available data that might make a difference to his findings. The third is whether there are any alternatives that might provide a better explanation of the evidence than the existence of (at least) these subpopulations and their related differences. Indeed, if these attributes are not permanent properties of phenotypes underlying these racial groupings or if these racial groupings are not manifestations of underlying genotypes, then findings such as these may have to be rejected, discounted, or otherwise revised. The question becomes, Do these races exist?

2. Race and Evolution.

An important dimension of research that has emerged from the merge of molecular genetics with evolutionary theory has been the study of relations between phenotypes of various species and underlying genotypes or, in the case of earlier studies, similarities between their blood chemistry as a measure of their evolutionary proximity. Vince Sarich and Allan Wilson (1967), for example, discovered that immunological resemblance between the serum albumins of apes and man support the conjecture that evolution has "slowed down" since the divergence of man and ape and suggest that, if humans and

Old World monkeys last shared a common ancestor 30 million years ago, then humans and African apes may have shared an ancestor as recently as 3 mya.

The most important studies of the existence or non-existence of races have DNA as their focus, where DNA is the fundamental constituent of genes. Thus, in a study that has been called "the mitochondiral Eve paper", Rebeca L. Cann, Mark Stoneking, and Allan Wilson (1987) maintain that DNA analysis offers evidence that Homo sapiens originated in Africa and subsequently migrated from there to other regions of the globe. This study focuses on mitochondrial DNA (mtDNA) for three reasons: first, because mutations accumulate in DNA of this type several times faster than in the nucleus; second, because mtDNA is inherited maternally and does not recombine, making it ideal for relating people to each other; and, third, because there are about 10^{16} mtDNA molecules in each person, which are usually identical (Cann et al. 1987, p.p. 31-32).

Their tentative interpretation of the comparative data based upon samples of 134 types of human mtDNA drawn from Africa, Asia, Australia, Europe, and New Guinea also appears to be consistent with the fossil record, namely, "that the transformation of archaic to anatomically modern forms of Homo sapiens first occurred in Africa, about 100,000-140,000 years ago, and that all present-day humans are descendants of that African population" (Cann et al. 1987, p. 35). They recommend caution in uncritical acceptance of the convergence between their molecular findings and those of paleoanthropology because there is much uncertainty about the age of the fossil remains and because their age-dating does not imply that anatomically modern Homo sapiens appeared at that time, since mtDNA transformations need not reflect other genetic or cultural changes.

More recent studies by Masatoshi Nei and Gregory Livshits (1989) and by Masatoshi Nei and Arun K. Roychoudhury (1993) display the sophistication of studies undertaken on the basis of such comparsions. The first explores the evolutionary relationships of the three major groups of humans, Europeans, Africans, and Asians. The genetic distances between them were computed on the basis of four sets of genetic locators (including protein markers, blood group markers, and DNA markers). The results show the genetic distance between Europeans and Asians, .040%, is less than that between Europeans and Africans, .063%, or that between Asians and Africans, .078%, which supports an African origin for the species. It also shows Asians and Europeans to be more closely related than Asians and Africans (Nei and Livshits 1989, p. 280).

This result, which supports later branching of Asians and Europeans after an earlier branching out of Africa, has now been reinforced by gene-frequency studies that make the out-of-Africa model all but certain as a scientific finding. Nei and Roychoudhury (1993) studied 26 representative populations, including 4 from Africa, 5 from Europe, 10 from Asia, 4 from Australia and Oceania, and 3 from America (North American indians, South American indians, and Eskimos). The results of their study are consistent with those of classic anthropological findings, where the human population can be subdivided into five major subpopulations: (A) Negroid (African), (B) Caucasoid (European), (C) Mongoloid (East Asian and Pacific Islanders), (D) American Indian (including Eskimos), and (E) Australoid (Australians and Papuans). Their relations are as follows:

Figure 28. Phylogenetic Tree for 26 Representative Populations.

where the numbers indicate the "tightness of fit" of the clusters of groups in each grouping under variations of relevant variables during statistical tests.

These results are fascinating for many different reasons. Since they offer empirical evidence on the basis of gene frequencies for the existence of subpopulations of the human species, they reflect the existence of what appear to be at least five major races. Their geographical distribution, moreover, tends to confirm the genetic/geographical definition of "race" that Wilson has advanced, including the potential for variation within those subpopulations. These findings thus appear to be consistent with Rushton's results, on the assumption that the attributes he has identified are permanent and not merely transient properties of the subpopulations he has specified. The history of evolution that Nei and Roychoudbury (1993) advance, moreover, appears to be consistent with the evolution of the races in Rushton's account.

Figure 29. Scenario of the Origins of Major Groups of Human Populations.

In particular, Rushton suggests that the dispersal of an originally African population less than 200,000 years ago, where these subpopulations of the originally more genetically homogeneous population became successively less and less homogeneous due to pressures of natural selection and the operation of genetic drift, whereby geographically isolated subpopulations of a population tend to increase in their genetic diversity across time. Among the new niches which some of these subpopulations inhabited included the problems of survival in colder northern latitudes. These difficulties led to increased adaptive benefits from those members of the subpopulation able to cope with these selective pressures, which placed a premium upon skills and abilities that may have been less in demand on the African savannah.

Thus, for example, unlike the topics and subtropics, plant food was now less abundant and no longer constantly available, varying with the seasons, which placed emphasis upon the adaptive ability to hunt game and gather food from the environment. Rushton believes these differences mattered:

> Even among near-contemporary hunter-gatherers, the proportions of foods obtained by hunting and by gathering varies according to latitude. Peoples in tropical and subtropical latitudes were largely gatherers, while peoples in temperate environments relied more on hunting .... Another set of problems in the northern latitudes would have centered on keeping warm. People had to solve the problems of making fires, clothes, and shelters. (Rushton 1995a, pp. 228-229)

Thus, the cognitive demands of creating tools and making fire and clothing selected for higher average levels of intelligence than did the relatively less cognitively-demanding and resource-rich environment of sub-Sahara Africa.

The diverse demands of different environments also promoted adoption of different reproductive strategies, where more challenging environments tended to promote high parental investment for small numbers of children, while less challenging environments tended to promote low parental investment for large numbers of children, known as "K-selection" and "r-selection" (Rushton 1995a, p. 274). Thus, a variety of causal mechanisms of evolution operating across time in diverse environments may have produced exactly the differences between subpopulations that seem to distinguish the races. As Herrnstein and Murray (1994, Appendix 5) have remarked, Rushton is hardly alone in searching for an evolutionary explanation for observable differences among the races. They expect that time will tell if he is right.

Time is not the arbiter of truth. But it may take time—perhaps even a considerable interval thereof—to consider the full range of alternative explanations. If the individual members of the various subpopulations have been subject to widespread and systematic differences with respect to the (internal and external) environmental conditions of their development, for example, it would be unsurprising that these differences might be manifest in average differences of this kind. Such an outcome can even be a predictable consequence of norms of reaction, whether applied to species or to individuals. It is therefore possible that even properties that are prevalent within a population are not among their permanent properties. The difficult problem is to ascertain the nature of the genetically-based predispositions which are permanent, as Vincent Sarich has explained (Sarich 1995).

Whether or not this has occurred in the case of the hundreds of studies that are cited by Herrnstein and Murray (1994) and by Rushton (1995a), for example, has been subjected to extensive debate (Jacoby and Glauberman 1995). If there are (internal or external) environmental factors that make a difference to the level of intelligence of different racial groups that have yet to receive adequate consideration, then the impressive evidence that Rushton has collated can be faulted on that ground, as many have done. But because the results of these studies are robust and widespread, it may be worthwhile to consider other alternatives on the hypothesis that level of intelligence is among the permanent properties of these groups' members.

Even if level of intelligence, in particular, is a permanent property of each individual member of these groups, <u>the variation between members exceeds the average differences between these groups</u>, as everyone who studies intelligence—including Rushton, Gould, and Herrnstein and Murray—has acknowledged. A comparison would be the average weight of members of a football team in relation to the average weight of their opposing teams. A team that averages 200 lbs., for example, might actually have no member who weighs 200 lbs., but some who weigh more—possibly much more—and others who weigh less—possibly much less. The differences between their weights might exceed the average differences between teams.

Since weight is a property that players could gain or lose while remaining members of their team, weight clearly qualifies as a transient rather than a permanent property of member of a team. But it should also be observed that properties that vary from member to member of a group—where membership in that group is specified intensionally by their possession of specific reference properties—cannot qualify as permanent in relation to those reference properties. Permanent properties are attributes that no member of a reference class could be without. So if the same level of intelligence is not possessed by every member of the group—in this case, the subpopulations identified as races—this attribute cannot be one of its permanent properties.

Moreover, the range of variation in each group represents a potential for evolution that might raise the average values within each race by increases in the level of this attribute by their individual members—perhaps in large numbers—under suitable conditions. According to Fisher's theorem (Fisher 1930), sometimes called "the fundamental theorem of natural selection", the rate at which evolution by natural selection can proceed is a function of the variance available within the present population. As Mayr has observed, "Fisher's most important conclusion was that much of continuous variation, at least in man, is due to multiple Mendelian factors rather than to environmental influences" (Mayr 1982, p. 554). Fisher stressed the importance of genes with small phenotypic effects that appear widespread in our species.

The kind of variance that matters to natural selection, however, must be "additive" in the sense that its influence can accumulate (either increase or decrease) across time. The evolutionary changes that take place in specific populations are affected by many different factors, including the number of organisms that are competing for natural resources, which is known as "frequency-dependent selection" (Sober 1984, Chapter 6). What is most important for our purposes, however, is that the existence of differences in levels of intelligence within these populations appears to supply the kind of material required for evolution to occur, which lends support to the potential for the future evolution of this property. These values as group averages can represent no more than a transient stage in the evolution of the races.

Even more importantly, when minds are understood as semiotic systems, different kinds of intelligence surely accompany different kinds of minds. Relative to iconic, indexical, and symbolic modes of mentality, for example, there must be higher and lower varieties of iconic, indexical, and symbolic mentality, as a function of the range and variations in signs of those kinds that a system can acquire, under various (internal and external) conditions. This undermines reliance upon a single measure of intelligence by implying the existence of intelligence of several kinds. The suggestion that g ought to be identified with mentality of a special kind is appropriate, yet also implies that g serves as an average of mental abilities even for specific individuals.

Suppose, for example, that there are at least five kinds of minds when logical reasoning and rational criticism are taken into account, corresponding to iconical, indexical, symbolical, transformational, and metamentality modes thereof. Then (presumably) someone could be high in one and low in another, where reliance upon a single number is only an average value. If these underlying attributes are permanent, however, then any averages based upon them would also be constant from person to person. While, as a property of groups, g functions as an average of averages and cannot be a permanent property, as a property of individuals, g can be a permanent property, even though it functions as an average. But Gould may be right to deny that a single number can adequately represent human intelligence.

3. Is IQ Variable?

A distinction can still be drawn between "intelligence" envisioned as a genetically-based predisposition to acquire behavioral tendencies involving the use of signs under various conditions and "IQ" as a numerical measure of intelligence thus understood. Even though the evidence reviewed in this chapter strongly suggests that, when g is properly envisioned as a predisposition to acquire other dispositions involving the use of signs, the identification of g with intelligence, on the one hand, and of intelligence with epigenetic rules, on the other, appears to be well-founded, where g, by hypothesis, turns out to represent the strength of epigenetic rules distinguishing various members of different species without which gene-culture co-evolution would be impossible. The identification of g with IQ, however, remains problematic.

The old saw has it that "IQ is what IQ tests test". But if IQ were nothing more than what IQ tests measure, it would not be worth measuring. IQ tests are important, if they are important, because they measure g, which (presumably) affects successful performance across a broad range of cognitive tasks. If they are not suitable instruments for measuring g, then their role is moot. When Gould objects to Herrnstein and Murray's conclusions by focusing upon their conception of levels of intelligence, where "intelligence" must be measured by a single number, capable of generating a ranking in a linear order, that is genetically based and effectively immutable, he may be interpreted as conceding the existence of genetically based, even effectively immutable, predispositions, but rejecting the use of IQ tests as measures of their value.

Moreover, Gould intends to be challenging their central conclusion, even though, as we have found, he acknowledges the existence of a fifteen point average difference in IQ between blacks and whites in America, which has substantial family-line heritability within each group. Yet he persistently maintains that this finding, no matter how well-documented, "permits no automatic conclusion that truly equal opportunity might not raise the black average enough to equal or surpass the white mean" (Gould 1994). Thus, (presumably) either (1) these differences are phenotypic rather than genotypic or (2) behavioral rather than phenotypical, because of which (3) these measured differences are correlational rather than nomological in character.

A defense of the possibility that (1) these differences may be phenotypic rather than genotypic may be derived from the notion of "norms of reaction", which Wilson has explained in application to phenotype/genotype relations:

> Consider a species of organism, whether animal, plant, or microorganism. Select either one gene or a group of genes that act together to affect a particular trait. Then list all the environments in which the species can survive. The different environments may or may not cause variation in the trait prescribed by the selected gene or group of genes. The total variation in the trait in all the survivable environments is the norm of reaction of that gene or group of genes in that species. (Wilson 1999, p. 149).

Norms of reaction thus represent the range of variation in phenotype traits that can occur as a causal consequence of the influence of different environmental factors when specific genes or groups of genes are kept constant and thereby display the causal influence of various sets of environmenal factors.

In Chapter 9, consideration was given to the formalization of various laws for the development of different phenotypes from various genotypes, where different sets of environmental causes bring about various phenotype effects. Thus, when deterministic relations obtain, the following law schemata obtain:

(L1-DA) (x)(t)[G1xt ==> (EF1xt =u=> P1xt*)];

(L1-DB) (x)(t)[G1xt ==> (EF2xt =u=> P2xt*)];

. . .

which implies that the differences in environmental factors that distinguish EF1 from EF2 are causally relevant to phenotype outcome P1, P2, and so on, given the same genotype G1, since they would be causally relevant to such an outcome if and only if their presence makes a difference to that outcome.

Gould clearly endorses this possibility, which he illustrates in relation to the property of body height, where measurements of the heights of adult males in poor villages in India afflicted with acute nutritional deprivation. It would not be surprising should there be a high correlation between short fathers and short sons, a trait thereby displaying high familial heritability; yet it would be a mistake to conclude that this tendency toward low height was not amenable to variation under conditions of nutritional enrichment (Gould 1994, p. 5). Suitable comparisons between races would presuppose common prenatal and intrauterine environments for developing offspring.

A defense of the possibility that (2) these differences may be behavioral rather than phenotypic, moreover, can similarly be derived from the application of the concept of norms of reaction to behavioral/phenotypical relations, which also complicates the problem. As Elliott Sober has observed,

> The idea of a particular human being's having a "natural" level of intelligence makes no more sense than the idea of a particular corn plant's hav-

ing a natural height [which is affected by its environment as a function of how much water or nutrition or sunlight it receives] (Sober 1984, p. 161)

Yet its political consequences can be profound. If differences in behavioral performance may be affected by educational opportunities, including especially mentally stimulating experiences in early life, then providing them can appear to be morally imperative. But if they are supposed to have a "natural" level of intelligence that thereby limits their behavioral capacities, providing those educational opportunities "may seem less pressing" (Sober 1984, p. 161).

The acquisition of different behavioral tendencies by phenotypes under different sets of environmental factors appears to have a nomological foundation.

Thus, when deterministic relations obtain, laws of the following forms obtain:

(L2-DA) (x)(t)[P1xt ==> (EF3xt =u=> BT1xt*)];

(L2-DB) (x)(t)[P1xt ==> (EF4xt =u=> BT2xt*)];

. . .

which implies that the differences in environmental factors that distinguish EF3 from EF4 are causally relevant to the acquisition of different dispositions as behavioral tendencies for the same phenotype P1, which occur, of course, as an effect of the influence of environmental factors upon epigenetic rules.

The causal sequence implies a temporal development that progresses via stages, beginning with the development of phenotypes P from genotypes G:

(L1-DA) (x)(t)[G1xt ==> (EF1xt =u=> P1xt*)];

progressing to the acquisition of behavioral tendencies BT by phenotypes P:

(L3-DA) (x)(t)[P1xt ==> (EF3xt =u=> BT3xt*)];

reflecting the relationship between phenotypes Pi and epigenetic rules ERi:

(L2-1) (x)(t)(P1xt ==> ER1xt);

where epigenetic rules are predispositions to acquire behavioral tendencies:

(D1-D1) (x)(t)[ER1xt ==> (EF3xt =u=> BT3xt*)];

(D1-D1) (x)(t)[ER1xt ==> (EF4xt =u=> BT4xt*)];

. . .

and the conclusion that different genotypes G1, G2, . . . , that might be based on race give rise to different phenotypes P1, P2, . . . that possess different epigenetic rules ERi follows only if the differences in ERi are not effects of environmental factors EFi that affect the emergence of various phenotypes from those genotypes or of environmental factors EFj that affect the acquisition of various behavioral tendencies by those phenotypes as their effects.

The character of predispositions as dispositions to acquire other dispositions as outcome effects under different conditions displays itself several ways. Since intelligence g is now being identified with semiotic epigenetic rules ERi as properties of phenotypes, where those phenotypes Pi are outcome effects of causal interactions between genotypes Gi and environmental factors EFi, the question is whether, if these different genotypes were or had been subject to similar environmental factors EFi, would those factors bring about or have brought about the development of phenotypes Pi that would have or would have had the same epigenetic rules ERi or levels of in-intelligence g as predispositions to acquire dispositions under conditions EFj?

Clearly, differences in racially-based genotypes Gi make a difference to the acquisition of behavioral tendencies BTi that are due to those genotypes only if they are not due to other differences, which may perhaps be drawn more conspicuously by assuming that the difference is probabilistic, where G1, G2, . . . , are causally relevant to the possession of ERi only provided that

(MD-1) (x)(t)[(G1xt & EF1xt) =n=> ER1xt*]; and,

(MD-2) (x)(t)[(G2xt & EF1xt) =1-n=> ~ER1xt*];

when n does not equal 1-n (that is, their values are not both equal to 0.5); or, more elaborately, in relation to the acquisition of behavioral tendencies:

(MD-3) (x)(t)[(G1xt & EF1xt & EF3xt) =n=> BT1xt*]; and,

(MD-4) (x)(t)[(G2xt & EF1xt & EF3xt) =1-n=> ~BT1xt*];

where the differences in the acquisition of specific dispositions (including semiotic abilities) are not due to pre- or post-natal environmental factors.

Conducting empirical tests to ascertain whether hypotheses of the kind (MD-1) through (MD-4) would not only require random sampling of large numbers of people of kinds G1 and G2 but insuring that they were subject to similar pre- and post-natal environments of kinds, EF1 and EF3, respectively, controlled for every factor that was known to make a difference to the outcome of interest, namely, the acquisition or non-acquisition of specific dispositions in the form of behavioral tendency BT1, for example. Yet even then a statistically significant difference in the relative frequencies for BT1 outcomes would remain fallible and uncertain, insofar as heretofore unrecognized environmental factors might have affected the results.

Indeed, arguments for the tentative and inconclusive character of the findings that relate race and intelligence are compounded by the absence of direct tests for general intelligence or g. Even properly constructed IQ tests have to be suitably administered under appropriate test conditions for their results to be valid. Even when there are no relevant genotypic, phenotypic, or environmental differences affecting the acquisition of the kinds of dispositions for which IQ tests test, which generally emphasize reasoning abilities that are rooted in semiotic abilities, performance on an IQ test manifests the causal interaction of motives, beliefs and ethics as well as abilities and capabilities. Their results require interpretation.

A suitable conception of intelligence in relation to its measurement by means of IQ tests, therefore, has to accommodate the full range of factors F1, F2, . . . , Fn whose presence or absence may make a difference to IQ test results under suitable conditions C1, C2, . . . , Cn. Thus, the meaning of different IQ categories tends to be formalized along the following lines,

(IQ-D1) IQzt = very high =df (TTzt & F1zt & F2zt & . . . & Fnzt)
=u=> TSzt* = 125 or above;

(IQ-D2) IQzt = high =df (TTzt & F1zt & F2zt & . . . & Fnzt)
=u=> TSzt* = 110 to 125;

(IQ-D3) IQzt = normal =df (TTzt & F1zt & F2zt & . . . & Fnzt)
=u=> TSzt* = 90 to 110;

for example, where low IQs measure between 75 and 90 and very low below 75. Interpreting the test scores TS as indicative of the IQs of the test takers TT thus presupposes they have not been up too late the night before, have not had an automobile accident en route to the test site, or otherwise incur disturbing factors that would invalidate their test score results.

Even given the multiple ways in which the results of IQ tests might be invalid, empirical findings support the hypothesis that there are racially based differences in intelligence that are measurable by means of IQ tests. In particular, the results of the kinds of studies Herrnstein and Murray (19-94) and Rushton (1995a) have summarized reflect a normal distribution of IQs on the basis of a normal distribution of IQ test scores. This means that 68% of those scores fall within one standard deviation of the mean (of IQ = 100), where another 27% fall within two standard deviations, another 4% falls within three standard deviations, and 1% falls beyond three standard deviations, which Herrnstein and Murray (1994, p. 121) diagram as follows:

Figure 30. The Distribution of IQ Scores.

As Alex Michalos (1962, p. 290), explains, a wide variety of properties are distributed normally, including heights and weights of various species, lengths of seashells of the same species, lengths of tobacco leaves, number of kernels on ears of corn, weights of hens' eggs, and number of piglets per litter. The existence of normal distributions counts as evidence that some persistent and enduring attributes have been uncovered and supports the conclusion that sufficient evidence has become available to justify accepting the best supported among the available hypotheses (Fetzer 1981, Ch. 9). Indeed, not only IQ scores but also SAT and ACT scores are also normally distributed and support similar inferences regarding the distribution of IQs.

Although it is always logically possible to deny conclusions, even when they are strongly supported by the available evidence, precisely because empirical results based upon inductive reasoning are always tentative and fallible, the weight of the evidence available tends to support the existence of racially-based differences in intelligence. Indeed, even Gould does not dispute these differences so much as he denies that they adequately represent the underlying phenomena, endorsing instead the theory of multiple intelligences (in a form affirming seven different kinds), thereby denying the existence of general intelligence g (Gould 1994, p. 9). And, if there is no single property of intelligence, it follows that "intelligence" cannot be represented by a genetically based, effectively immutable single number.

Jensen (1998) has observed that the theory of multiple intelligences in the specific form that Gould endorses—which distinguishes between verbal, logical-mathematical, spatial, musical, kinesthetic, intrapersonal, and interpersonal—has been substantially undermined by the discovery of strong correlations between verbal, logical-mathematical, spatial, and musical, which are strongly "g loaded". The nature of intrapersonal and interpersonal "intelligences", from this point of view, has yet to be determined. But the kinesthetic does not even appear to belong in this category, because there is no incompatibility between g and the existence of neural nodes that can exert control over specific abilities of these kinds.

Even if Gould were right, in some contexts, the use of a single number might be appropriate, provided its meaning is not misunderstood. These values cannot be permanent properties of these groups, because they vary among their members. As properties of their members, they can vary by kind of intelligence and are affected by norms of reaction. Rushton's findings thus appear to contribute substantially to our understanding, but, like all other empirical correlations, still require cautious interpretation. Gould himself, for example, has ridiculed 19th century attempts to establish connections between cranial size and intelligence (Gould 1981, Ch. 3), yet new studies Rushton has brought together, including some employing magnetic resonance imaging (MRI), indicate that a substantial correlation still obtains when adjusted for body size (Rushton and Ankney 1996; cf. Rushton 1997).

Jensen (1998) has also observed that g should not be viewed narrowly as a special cognitive process or as an operating principle of the mind but broadly as a biologically based, highest order, common factor that has an important role in understanding individual differences in cognitive ability. What is so appealing about the generalization of g to epigenetic rules of the semiotic variety is that it then represents genetically-based, species specific yet individually variable, properties of minds that combine cognitive flexibility with behavioral plasticity. This conjecture has to be appraised by the extent to which it clarifies and illuminates the phenomena at hand, but it does appear to have the right properties to warrant consideration as a conception that promises to broaden and deepen our comprehension of g.

The theory of minds as semiotic systems, as I have previously observed, lends some plausibility to the possible existence of multiple kinds of intelligences (iconic, indexical, symbolic, and so forth), which is reinforced by the identification of intelligence with various semiotic kinds of epigenetic rules. This approach is different than the one Gould endorses, and the arguments that apply to intelligence as a single property necessarily apply to multiple intelligences, mutatis mutandis. This account not only implies the existence of minds of different kinds (distributed between the varied species) but also implies different members may have different mental abilities (distributed within the same species). The capacity to successfully solve problems, however, is obviously a function of successful learning throughout a life history.

No matter how sound the science or how extensive the evidence, there are social forces that are unwilling to confront it and will actively suppress it. A striking example of recent vintage occurred when James D. Watson, a Nobel Prize winner for his research in uncovering the double-helix structure of DNA molecules with Sir Francis Crick, which he memorialized in his celebrated book, The Double Helix (1968), was forced to retract his observation that, “All our social policies are based on the fact that [African] intelligence is the same as ours—whereas all the testing says not really” (Dean 2007). While this was hardly the first such remark by a Nobel Prize winner, as august an institution as The Science Museum of London cancelled a speech Watson was to have given on the ground that his statements on race and intelligence are “beyond the point of acceptable debate”. Yet the evidence supports him.

The alteration of a single gene, for example, has been sufficient to change the sexual behavior of fruit flies from hetero to homosexual in character, which appears to be the first occasion where a single gene has been shown to control complex behaviors (Rosenthal 2005). Since female mammals possess two copies of the X chromosome, while males possess one X and one Y chromosome, while the X chromosome contains 1,098 genes and the Y only 78, it should be unsurprising if women display traits that are different than those of men across a broad spectrum of behavior. It may even turn out that Lawrence Summers, Harvard's past President, was not actually mistaken in suggesting that there might be differences in aptitudes for science and mathematics between the sexes but was targeted ideologically for advancing opinions regarded as being “politically incorrect” because his critics knew no better (Rimer and Healy 2005). And for that he was forced to resign.

Indeed, a recent study has suggested that an unusual pattern of genetic diseases that occurs among Jews of central or northern European origin, called "Ashkenazim", may be an effect that accompanies natural selection for intellectual ability. While praising the scholarly qualities of the authors' research, Stephen Pinker has remarked that "It would be hard to overstate how politically incorrect this paper is" (Wade 2005). But surely empirical truths are properly appraised on the basis of logic and evidence, not by their capacity to conform to political preferences. On the basis of an investigation of ten categories of research, the latest review concludes racial differences in IQ are as much as 80% genetic in character (Rushton and Jensen 2005). Political correctness, alas, can also exert a powerful negative influence upon the integrity of science, which may be more subtle than but still has parallels with that of religious fundamentalism.

The ultimate limitation on the importance of generalizations concerning intelligence, however, as Gould and others have surmised, is that variation within races exceed average differences between them. There are smarter and dumber of every race. Each individual ought to be judged on the basis of his own ethics, abilities, and capabilities, regardless of his race, except in those circumstances where race makes a relevant difference (such as working undercover in crime-laden neighborhoods). The problems that attend racial differences are not those differences themselves but our tendency to think and act on the basis of stereotypes. No one is surprised when individuals differ in their dispositions and predispositions. In a better society, we will be as tolerant of group differences in dispositions and predispositions as we are of individual differences. It is not a matter of science but of morality.

CHAPTER 11. EVOLUTION AND RATIONALITY

Mentality requires the ability to utilize and manipulate representations, where "representations" (or "signs") are things that stand for other things in some respect or another for a sign-using system. Minds as semiotic systems, in turn, are predisposed toward the acquisition or manifestation of specific mental states as behavioral dispositions that involve the use of signs under suitable internal and external conditions. The relationship between bodies and minds thus appears to be that minds as (semiotic) predispositions are permanent properties of brains of specific kinds, mental states as (semiotic) behavioral dispositions are permanent properties of specific brain states, yet specific brain states and mind states can be among the transient ("acquired") properties of those brains and minds. Rather unexpectedly, the difference between permanent and transient mental states permits the evolution of culture.

The relationship between minds and mind states and between brains and brain states, moreover, can readily be diagrammed along the following lines:

	PREDISPOSITIONS	DISPOSITIONS
OF COGNITIVE FUNCTION	Minds	Mind States
OF NEUROLOGICAL STRUCTURE	Brains	Brain States

Figure 31. Brains and Minds.

Thus, when "phenotypes" are properly understood as including specific neurological structures among their properties, then when specific behavioral dispositions are permanent properties of those neurological structures, then every instance of that phenotype has to possess those same behavioral dispositions.

It is only when behavioral dispositions are transient properties of phenotypes—whether or not they happen to be possessed by every conspecific with that phenotype—that the prospect for culture emerges distinct from the possession of innate, genetic, and species-specific dispositions, as we are about to discover.

This framework both illuminates and contravenes influential work on the nature of language and mentality, including that of Noam Chomsky (1959) on the nature of language, Jerry Fodor (1975) on the nature of thought, and Steven Pinker (1995) on language as an instinct. All three maintain that fundamental properties of language are innate, genetic, and species-specific. However, in evaluating their significance, at least three different positions must be distinguished, as William Ramsey and Stephen Stich (1991) have observed, namely: minimal nativism, which maintains there are in-born biases for certain languages and against others; anti-empiricism, which maintains that innate learning mechanisms are not enough to learn a language; and rationalism, which maintains that learning a language requires a language-learning module.

Minimal nativism appears to be too weak to support any interesting form of rationalism, since it is compatible with species-specific epigenetic rules with innate biases for learning. Similarly, anti-empiricism seems to be inadequate on its face, since there appear to be no good reasons for thinking that innate learning mechanisms that would enable us to learn a language do not or cannot exist. And the thesis that learning a language requires a language-learning module as a functional capacity that serves no other purpose appears to be a fantasy. The conception of minds as semiotic systems undermines theses focused on language learning specifically, since the use of symbols is but one form of the use of signs. But views of this kind have been widely held for a large number of bad reasons.

Chomsky (1959, 1988), for example, appears to defend a position rooted in the fallacy of assuming that there is exists a unique correct grammar to learn, which ignores the possibility that we may communicate successfully because we share similar (overlapping) instead of the same (identical) grammars and vocabularies (Fetzer 1994b, pp. 345-346). His influential "poverty of the stimulus" argument, for example, depends upon the hypothesized existence of an assumed learning mechanism consisting of a competent scientist fortified by whatever methods of inquiry he desires. According to Chomsky, a learning mechanism of this kind might "think up" the right grammar, yet the evidence would not permit him to identify it to the exclusion of every other alternative. But Chomsky's argument simply assumes that such a unique grammar exists!

The methodological foundation for Chomsky's position, moreover, reflects a blunder in presupposing that a learning mechanism of this kind should be able to uniquely identify such a grammar. Anyone familiar with inference to the best explanation would tend to assume that there may be multiple alternative possible explanations for any phenomenon, where they are inductively supported but to differing degrees because they are simply not equally likely. Unless the evidence entails the hypothesis under consideration, it cannot be the case that evidence conclusively establishes unique conclusions! So unless Chomsky is begging the question by assuming the existence of a unique grammar, his argument—which is intended to prove that, no matter what the available evidence, the right grammar would not invariably be discovered by any learning mechanism and must therefore be known without learning—does not follow. But if Chomsky is begging the question, his conclusion still does not follow because his argument is fallacious. Evidently, therefore, it does not follow.

Fodor (1975) defends the existence of an innate language of thought in the form of a set of innate concepts relative to which learning an ordinary language is merely a process of "pairing up" the words in that language with those that belong to the innate mental language. This mental language is supposed to be complete in the sense that it has the conceptual resources to accommodate any future discovery in art, science, or technology—such as polio vaccine, jet propulsion, and color television—no matter how novel or unexpected that might be. But since the innate mental language is in-born and species-specific, the mental language of early Homo sapiens was presumably just as rich as that of modern Homo sapiens, which rather strongly suggests that Fodor, like Chomsky, has made a mistake in reasoning and that his conclusion results from a blunder.

Indeed, the language of thought hypothesis cannot be sustained (Fetzer 1989).

Fodor assumes that learning a language (learning what "Px" means when "Px" means G) could only occur for an organism that already understood G (Fodor 1975, p. 80). Fodor takes for granted that the kind of understanding involved in understanding the G-phenomenon for which "Px" stands must also be linguistic! Thus, in order to forestall an infinite regress of languages that must be understood in order to understand another language, he posits a base language, the language of thought. Fodor overlooks that prior understanding may be rooted in the acquisition of habits of mind and of habits of action as dispositions that are non-linguisitic! Having prior understanding of what it is to suck a nipple, bounce a ball, or draw with crayons, it does not take a rocket scientist to discover that specific words stand for specific meanings related to these habits!

Other consequences follow from Fodor's position, such as that unsuccessful translations between ordinary languages are theoretically impossible (because they are all understood by means of the same species-specific base language) and that incommensurable theories in the sense of T. S. Kuhn can never occur (Fetzer 1993, p. 163). Indeed, a language of thought of this kind must be full-blown from scratch in order to be complete, which implies that it cannot have been the product of an evolutionary process, after all (cf. Fetzer 1996, p. 148). The thesis of an innate, species-specific, autonomous module, even in the form Pinker (1995) advocates, poses a feeble alternative to the explanation of grammar as an evolving adaptation to explosive growth in semantic complexity during early hominid evolution when the use of symbols began to abound, as Thomas Schoenemann and William Wang recommend (Schoenemann and Wang 1996).

The evolution of genes for speech, therefore, does not support Chomsky or Fodor or Pinker's conceptions. Recent research suggests that even Neanderthals may have possessed a crucial gene that underlies speech (Wade 2007). Having the neuro-physiological capacity for speech is a necessary condition for speech, of course. But being able to make sounds (phonemes) to which meanings can be assigned (morphemes) does not imply the existence of an innate syntax or of an innate semantics, much less that language is an instinct. Those who adhere to the theory that thought presupposes language might be inclined to advance arguments to that effect, but what we have already established in the course of this inquiry in relation to animal minds, primate minds, and human minds has demonstrated—conclusively, in my view—that that view is without foundation.

1. Adaptations as Knowledge.

Plotkin has astutely remarked that science aims at explaining "more and more by less and less", in the sense of subsuming increasingly broader ranges of phenomena by means of successively fewer general principles having the character of laws of nature (Plotkin 1994, p. 78). His work aims at providing a framework for understanding successively broader ranges of biological phenomena by subsuming them within the principles of evolution by selection, where the mechanisms thereby invoked include variation, differential fitness and heritability, the transmission of selected variants and their (re-)combination with new variants. These mechanisms define "universal Darwinism", and the organisms and groups of organisms to which they apply are "Darwin machines" (Plotkin 1994, p. 86).

Indeed, Plotkin maintains that this framework subsumes not only biological organisms but mental states and cultural practices, thus including "memes" as well as "genes" within its scope, where memes are understood to be the units of cultural evolution by contrast to genes as the units of biological evolution (Plotkin 1994, p. 215). In many respects, the author follows the lead of Richard Dawkins. In other respects, however, he goes beyond him. Viewing the ordinary notion of knowledge as a relation involving a suitable "fit" between mental states and physical states, Plotkin extends the notion to biological and cultural adaptations on the ground that they too involve counterpart relations of "fit" between internal organization and external order (Plotkin 1994, p. 152).

He suggests that, if phenotypic adaptations qualify as forms of knowledge, then adaptive behaviors also qualify as forms of knowledge, including behaviors that result from (possibly complex) developmental processes based upon genetic programs that have the character of instincts. Instincts, however, may or may not be good enough for organisms to survive and for species to evolve:

> Instincts are efficient and economical forms of adaptive behavior, and most animals get by with instincts alone. Instincts, however, like all adaptations, have one potentially grave drawback: they are constructed on the basis of instructions built up in the past. Because nature is never prescient, this is all that they can ever be built on. But in a world that is always changing,

> such instructions may not be entirely appropriate for living in the world as it is now. (Plotkin 1994, p. 153).

Consequently, organisms that confront environments where change may occur more rapidly than genetic change can cope with it require additional resources.

Plotkin thus maintains that special kinds of adaptations have evolved that are intended to compensate for the limitations of ordinary biological evolution, one of which relates to rapid changes within organisms themselves in the form of their immune systems, the other to rapid changes within their environments in the form of their intelligence (Plotkin 1994, pp. 154-155). By "intelligence", Plotkin initially encompasses learning and memory in many animals and thinking and reasoning in some, which are properties of organisms individually. He later expands his approach to include culture, understood as the ability to share knowledge, which is a property of groups of organisms collectively. Organisms with abilities such as these thus acquire considerable evolutionary advantages.

Drawing several distinctions, Plotkin refers to the process of genetic-developmental change through natural selection as the primary heruristic, where the immune system and intelligence function to compensate for its shortcomings in dealing with rapid chemical and physical changes as the secondary heuristic (Plotkin 1994, pp. 153-154). And he subsequently suggests that the function of culture is to compensate for even more rapid forms of change than individual intelligence can handle, which qualifies as the tertiary heuristic (Plotkin 1994, p. 206). While Plotkin concedes to being unable to explain "the functional origins" of language, moreover, he supports his conception of the adaptive significance of culture using Chomsky's arguments about language, Cosmides' conception of social exchange, and his own account of "emotional knowledge" as illustrations.

Plotkin's rationale for the evolution of intelligence is fascinating and highly persuasive, provided that intelligence is understood normatively rather than descriptively (roughly, as synonymous with rationality rather than with mentality, a matter that is pursued below). His attempts to encompass the evolution of culture, however, seem to be unavailing. The principles that distinguish cultural from genetic evolution are far more extensive than Plotkin allows. They not only operate at different rates but by means of different mechanisms: cultural evolution permits the inheritance of acquired characteristics and is therefore more Lamarckian than Darwinian (Bonner 1980, Fetzer 1985). Even apart from the demerits of some of the studies that Plotkin cites (Davies et al. 1995), therefore, Darwinism would appear to be less "universal" than Plotkin claims.

John T. Bonner (1980), for example, has emphasized the importance of the capacities for teaching and learning in the evolution of culture. In fact, there appear to be high and low kinds of intelligence, where the (lower) capacities for classical and operant conditioning provide ways in which experience can directly shape behavior, while the (higher) capacities for organisms to teach and learn from one another reflect ways in which behavior can be affected indirectly. Teaching and learning are greatly facilitated by the use of symbols, which are merely habitually associated with those things for which they stand, as in the case of language (Fetzer 1991/96). Yet processes of both these kinds appear to exemplify Lamarckian instruction rather than Darwinian selection.

The evolutionary pressure for the emergence of the secondary heuristic is (what he calls) the uncertain futures problem (Plotkin 1994, Ch. 5). Genetic instructions that originate at time t1 may be expected to yield appropriate phenotypical adaptations at time t2 only if there have been no significant changes in the environment in the meanwhile. Some changes, of course, can be so vast in their effects as to be catastrophic, where minor modifications in behavior would make no difference between life and death. Others, however, might be dealt with successfully on the basis of behavioral adaptations that do not require physiological alterations. They may be able to cope with (what he calls) predicable unpredictability, a kind of "wobble" around the center of the genetically-expected environment rather like standard deviations about means.

According to Plotkin, the connections between evolution and knowledge are strong and straightforward. Knowledge is taken to be a form of adaptation, and adaptations are taken to be forms of knowledge: "The connection I am arguing for", Plotkin writes, "is that all adaptations are instances of knowledge, and human knowledge is a special kind of adaptation" (Plotkin 1994, p. 117). This is a very appealing conception, which appears to simultaneously recast and transform our understanding of evolution and of epistemology into a new and more powerful form of evolutionary epistemology, where evolution itself becomes a process for the production of knowledge. Adaptations work because they are "in-formed" by features of that world through evolution (Plotkin 1994, p. 118).

Plotkin defines "evolutionary epistemology" as the biological study of knowledge, but this conception harbors an equivocation. Some philosophers, such as Karl Popper and Donald Campbell, both of whom Plotkin cites, contend that the nature of knowledge can be illuminated by viewing it from the perspective of evolutionary theory. These authors perceive the growth of knowledge as a process of epistemic acquisition that is analogous to biological evolution. Ploktin, by contrast, perceives the growth of knowledge as a process of epistemic acquisition that is an instance of biological evolution. The former position allows for the possibility that the comparison may be imperfect, since there could still be some important differences between them. The latter permits far less latitude.

Popper, for example, views science as a process of conjectures and attempted refutations, where conjectures that survive repeated and serious attempts to refute them endure (at least, for the time being), just as organisms that survive repeated and serious attempts to extinguish them endure (at least, for the time being). Popper's "conjectures", however, have the ontological status of theories or hypotheses that can be true or false, while "organisms" have the ontological status of forms of life that can live or die. Moreover, they appear to represent different kinds of knowledge: theoretical conjectures concern knowing that something is the case, whereas biological conjectures concern knowing how to act or to behave (Fetzer and Almeder 1993, "Knowing that vs. knowing how"). They thus differ in their ontological character and their epistemological status.

Plotkin wants to maintain that, whatever their differences, biological evolution and knowledge acquisition are governed by the same general principles, namely: the g-t-r or "generate-test-regenerate" heuristic Campbell advocates, which Plotkin labels "Campbell's blind-variation—selective retention scheme" (Plotkin 1994, p. 84). At this level of analysis, even Popper's method of conjectures and attempted refutations can be viewed as a special case of what can be most simply expressed as a "trial and error" process in which we learn from our mistakes (Popper 1968). But while g-t-r plausibly applies to biological evolution (Plotkin 1994, p. 138), the conclusion that knowledge acquisition should therefore be envisioned as an instance of biological evolution does not follow.

The reasons for denying this are various. If knowledge acquisition is a Lamarckian process of acquiring knowledge-that, while biological evolution is a Darwinian process of acquiring knowledge-how, then they cannot be properly subsumed as instances of "knowledge" in the same sense. In evolution, for example, does nature learn from its mistakes? Now and then Plotkin seems to be aware of the risks inherent in his position, even suggesting that he ought to be read as meaning "adaptations are biological knowledge, and knowledge as we commonly understand the term is a special case of biological knowledge" (Plotkin 1994, p. xv). Even when thus qualified, however, the question remains of whether the underlying comparison is more illuminating than it is misleading.

For example, if some adaptations are innate, but other adaptations are not, then it may be especially important to distinguish between them. Biological knowledge in the form of (complex) genetic-developmental programs, which cannot be changed and cannot be violated by individual organisms during the course of their lifetimes, may be very different from acquired behavior in the form of conditioned responses to specific kinds of stimulation, on the one hand, or from rational beliefs in the form of the acceptance and rejection of specific theories or hypotheses, on the other, where the occurrence of additional conditioning or the discovery of new evidence may lead to changing our behavior or our minds. It would be unwise to conflate knowledge of such different kinds.

Within epistemology, moreover, the term "knowledge" ordinarily stands for beliefs which are both justified and true, whether approached historically (Ackermann 1965) or analytically (Scheffler 1965). The differences between most philosophers who study the subject is a matter of how the components of belief, truth and justification can be best understood (Kirkham 1992, Goodman and Snyder 1993). Thus, different authors give different answers to questions such as, "What is a belief?" and "What is truth?" Within the context of theories of "scientific knowledge" specifically, however, some philosophers contend that a more illuminating conception results from following Popper and entertaining scientific knowledge as justified beliefs that may be false (Fetzer 1981, Ch. 1).

2. Evolutionary Epistemology.

If Plotkin were talking about knowledge when he talks about "adaptations", therefore, we would expect him to make connections between his concepts and the properties of belief, truth and justification as they occur within the context of the theory of knowledge. What we find when we study his work, however, is not at all reassuring. The closest he comes to defining "beliefs", for example, occurs during his discussion of memes, where he suggests that "meme" might best be defined in terms of "belief", understood in turn as "a relatively fixed core meaning, tolerant to minor changes about a fuzzy edge" (Plotkin 1994, p. 217). This conception, however, does not begin to capture the notion of belief as a mental state in which some such meaning is accepted by someone as true.

In fact, Plotkin tends to avoid the notions of minds and of mental states altogether. Although he occasionally talks about mental states (Plotkin 1994, p. 4, for example), his discussions of knowledge are expressed either in terms of its character as an adaptation or as a relation between brain states and the world (Plotkin 1994, p. 52). Since brain states (such as the state of activation of a specific arrangement of neurons and synapses) are not the sort of thing that can properly be described as being true or false, it would be appropriate for him to say something about the relationship between mental states and brain states; but when the occasion finally arises, he simply says that we do not know how mental states are related to brain states (Plotkin 1994, p. 217).

The situation with respect to justification appears to be even worse. In the final chapter of his book, Plotkin "bites the bullet" at last. While maintaining that (biological) adaptations generated by the primary heuristic are "usually well justified" through their evolution by selection, he mistakenly presumes that the (epistemic) adaptations with which philosophers are concerned have to do with "how you or I can be certain . . . that it is or is not raining today" (Plotkin 1994, p. 232). He suggests this may be an unsolvable non-problem:

> Only if survival and reproduction are absolutely correlated with knowledge could they be an infallible guide to true belief. But since this is not the case, evolutionary epistemology has nothing to say about the knowledge justification problem. This, however, does not mean the end of the epistemological world ....(T)he justification problem may simply be unsolvable—in effect, a non-problem that philosophers have worried at for thousands of years to no avail. (Plotkin 1994, p. 234).

This passage and others, alas, suggest that Plotkin has not only misunderstood the nature of the problem but its solution within an evolutionary epistemology.

Evolution by selection, which involves the generation of variation, selective retention and regeneration through reproduction, is a causal process. The outcome of a causal process may be <u>explained</u> by citing those causal mechanisms and antecedent conditions that brought about that result. The outcome of that same causal process can be <u>justified</u> by citing the available evidence and normative principles relative to which such a result was appropriate. Explanations typically are not justifications. When causal systems, such as human minds, adhere (even unconsciously) to suitable normative principles of reasoning, there is a convergence between the principles on which a system ought to be operating and those on which it is operating. Such minds are rational (Fetzer 1991/96).

The (epistemic) problem of justification is to identify (what might be called) <u>criteria of credibility</u> such that, when a belief satisfies those criteria, then it has qualified for acceptance (Fetzer and Almeder 1993, "Criteria, the problem of"). It is important because we have no direct access to the truth or the falsity of any beliefs. Consequently, we must arbitrate between them on the basis of the available relevant evidence. This is a normative process of discovering inductive, deductive and perceptual standards relative to which beliefs may be acceptable as true. Since the evidence on the basis of which we evaluate beliefs remains fallible, we can still make mistakes and sometimes accept false beliefs. Those that satisfy appropriate criteria are nonetheless rational beliefs.

Ultimately, distinctions must be drawn between at least two kinds of rationality (Fetzer 1990, 1991/96). Actions (as intentional forms of behavior) are said to be rational when they are appropriate as means to attain specific goals. Beliefs (as specific kinds of mental states) are said to be rational when they receive appropriate support from the available relevant evidence. These properties appear to be logically independent in the sense that different individuals could be high in rationality of action and low in rationality of belief, or vice versa. In extended senses, with respect to lower species of organisms largely if not exclusively controlled by their instincts, it would not be overly misleading to describe their behavior as "rational" when it promotes their survival and reproduction, even if they do not possess the capacity to subject their beliefs to rational criticism.

Rationality of belief becomes especially important to higher species of organisms in permitting them to subject potential actions to rational criticism before they undertake them. In this sense, we are able to formulate hypotheses and theories on the basis of which we might act and kill them instead of ourselves, as Popper often emphasized (Popper 1978). And when we want to change the behavior of the members of specific species, we can benefit greatly from knowing if their behavior is completely instinctual or amenable to classical or operant conditioning or to teaching and learning through the use of symbols, such as language. Rational beliefs ("knowledge") of this kind can enable us to undertake far more effective and efficient actions than would otherwise be possible.

In the last few pages, Plotkin attempts to come to grips with at least some of the problems that undermine his conception of adaptations as knowledge. He asserts that knowledge (in his sense) is fallible and claims that products of the primary heuristic are no less fallible than are those of the secondary heuristic and that products of the tertiary heuristic are even more fallible than are they:

> (J)ust as the adaptations generated by the primary heuristic are of varying degrees of truth and may even be untrue (though in the fullness of time they will tend toward the truth), so it is too with the knowledge that results from the operation of culture and individual intelligence........ (A)nd however full of self-correcting mechanisms intelligence might be, the secondary heuristic does make errors........ The tertiary heuristic, even if nested under the primary and secondary heuristics, is subject to even less control by the more-often-than-not-true-belief-generating primary heuristic and the quite-often-untrue-belief-generating secondary heuristic. (Plotkin 1994, p. 233)

The very idea that "adaptations" may be of "varying degrees of truth" and may even be "untrue" raises an important question for a theory of this kind, namely: how are we to distinguish the "adaptive" from the "non-adaptive" adaptations?

The problem for Plotkin is serious. Suppose, for example, we were to identify "fitness" with truth ("varying degrees of fitness" with varying degrees of truth), which captures the spirit of the enterprise. Then evolution by selection may not be infallible, but nevertheless tends toward successful adaptation "in the fullness of time". Yet such a conception is not easy to reconcile with Plotkin's own admission that more than 98% of all species that have ever existed are extinct (Plotkin 1994, p. 144). Moreover, if the primary heuristic actually leads to extinction in the vast majority of cases "in the fullness of time", while the secondary heuristic is less dependable in securing truth than the primary heuristic and the tertiary even less dependable than the secondary, then even when they make marginal contributions to "fitness" enhancement, the prospects for survival remain dim.

When Plotkin asserts that "evolutionary epistemology has nothing to say about the knowledge justification problem", therefore, he is implicitly conceding that his conception is seriously flawed. When properly understood, the knowledge justification problem is the central problem of epistemology: without a solution to this problem, there is no (remotely plausible) theory of knowledge. The position he should be defending is that the Popperian methodology of conjectures and attempted refutations provides "an evolutionary justification" for accepting some beliefs as true and rejecting other beliefs as false, even though we cannot do so with certainty, just as its biological counterpart of evolution by natural selection provides "an evolutionary justification" for regarding some organisms as having greater fitness than do other organisms, even though we cannot do so with certainty. In both cases, "knowledge" is uncertain and fallible.

Ultimately, Plotkin adopts a Kantian conception of knowledge, according to which minds are predisposed to acquire some kinds of information and to not acquire other kinds as a causal consequence of evolution by selection. He thus endorses an evolutionary variation on Kant's account—a species of Evolutionary Rationalism, as it might be called—which, in general, appears to be the correct approach as long as the distinction between dispositions and predispositions is observed (Fetzer 1991/96). Ironically, the condition of certainty, which misled Plotkin about the nature of justification, was imposed by Rationalists, such as Plato and Descartes, rather than by Empiricists, including Locke and Hume. This suggests that the Empiricists may have understood the nature of knowledge better than the Rationalists, who better understood the nature of mind.

It should be observed that some philosophers endorse conceptions of truth that harmonize with particular aspects of Plotkin's approach. According to the pragmatic formulation, a convergence of opinion should emerge between the members of the community of inquirers, were they to continue their inquiries forever, where the opinion that they are destined to agree on ("in the fullness of time") is true (Fetzer and Almeder 1993, "Truth, Peircean theory of"). This conception, moreover, can function as an epistemic criterion, where an alternative definition maintains that our beliefs are true when they are appropriate to guide our behavior (Fetzer 1990, p. 125). Combining these two conceptions, it follows that the opinion that the community of inquirers is destined to agree upon ("in the fullness of time") ought to be appropriate to guide our behavior.

What we need to know, if possible, of course, is how to behave now in order to avoid death or extinction later. With respect to other species, we may want to know which properties of those organisms that were beneficial in the past are likely to be beneficial in the future. We might want to shape their genes or their memes to make them more or less successful in the future by changing them or by changing their environments. Alternatively, we may want to shape our own genes or our own memes (presumably) to make us more successful in the future. Among our most promising avenues toward that end thus appears to be enhancing our capacity for rational criticism of hypotheses and theories.

The conception that beliefs are true when they are appropriate to guide our behavior is the right definition of truth within this context, but the criterion of truth as the opinion destined to be agreed on ("in the fullness of time") is wrong. We need to be able to separate adaptive from non-adaptive adaptations now. To explain and to predict the behavior of organisms, we need to know the laws that relate genes to behavior (in the case of instincts), experience to behavior (in the case of conditioning), and beliefs to behavior (in the case of rationality). Knowledge of nature is the key to our success. We need epistemology to understand biology even more than we need biology to understand epistemology.

3. Is Rationality Adaptive?

In his splendid book, The Evolution of Culture in Animals (1980), John T. Bonner has isolated several factors that differentiate between genetic and cultural (or gene-culture) evolution. In the language of genes and memes, he suggests three basic differences, namely, that genes can exist independently of memes, but memes cannot exist independently of genes; that genetic information is transmitted exactly once during the lifetime of an organism, while memetic information can be transmitted repeatedly thoughout an organism's lifetime; and that the rate of transmission of genetic information is very slow, while that of memetic information can be very fast. These are indeed important differences, no doubt, but they do not seem to be exhaustive.

GENETIC EVOLUTION	**vs.**	**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 roughly by speed of light)

Table XIX. Genetic vs. Cultural Evolution (Bonner).

Consider, for example, that the properties that are transmitted by genes are permanent properties of organisms, ones that they cannot lose without also losing their identity as organisms of that kind, while the properties that are transmitted by memes are merely transient properties that an organism could lose while remaining an organism of that kind; that the transmission of genetic properties does not permit the inheritance of acquired characteristics (and is therefore Darwinian), while the transmission of memetic properties allows the inheritance of acquired characteristics (and is therefore Lamarckian), where Lamarckian processes allow an organism to benefit from changes in its cultural environment that occur during its lifetime without altering its genes:

GENETIC EVOLUTION	**vs.**	**CULTURAL EVOLUTION**
(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		classic conditioning
natural selection		operant conditioning
sexual reproduction		imitating others
. . .		. . .
artificial selection		logical reasoning
genetic engineering		rational criticism

Table XX. Genetic vs. Cultural Evolution (Fetzer).

The differences between genetic and cultural evolution are therefore profound and reflect the importance of predispositions for understanding higher species. The phrase, "higher species", in this case designates any species for which the behavior of its members is not completely determined by genetically-based dispositions as specific patterns of behavior. The E. coli bacteria appears to be an appropriate example, because its survival and reproduction appears to be completely under the control of Darwinian causal mechanisms. Chimpanzees, by comparison, appear to be strongly affected by classical and instrumental conditioning and by teaching and learning from others. Their behavior thus appears to be strongly affected by Lamarckian mechanisms. But is the alleged distinction between mechanisms of these kinds justifiable?

No doubt, in purely biological contexts, the difference between Darwinian and Lamarckian evolution has a firm foundation, since there is no inheritance of acquired characteristics when transmitted genetically. If there is a difference of the kind alleged, as I maintain, then it must be the case because there is inheritance of acquired characteristics when transmitted culturally. Perhaps the clearest illustration of this difference was advanced by Karl Popper (1972) in thought experiments comparing our species's prospects under two scenarios:

Experiment 1: All our machines and tools are destroyed, and all of our subjective learning, including our subjective knowledge of machines and tools, and how to use them. But libraries and our capacity to learn from them survive. Clearly, after much suffering, our world may get going again.

Experiment 2. As before, machines and tools are destroyed, and our subjective learning, including our subjective knowledge of machines and tools, and

> how to use them. But this time, all libraries are destroyed also, so that our capacity to learn from books becomes useless. (Popper 1972, pp. 107-108)

This thought comparison suggests the benefits that are derivable under most, though not all, situations encountered during the course of (non-catastrophic) cultural evolution. The contrast between these scenarios exemplifies the importance of the inheritance of acquired cultural characteristics, assuming that we retain the semiotic ability to read and learn from books (Popper 1972, p. 116). The causal potency of our cultural legacy reflects the reality of this distinction.

What then of rationality for a species even defined as "the rational animal"? The connection between causality and rationality assumes an acute form from the perspective of evolution, since natural selection seems to be a completely causal process that functions independently of considerations of rationality. Once distinctions are drawn between rationality of belief and rationality of action—neither of which need be conscious to organism or agent—it becomes obvious that rationality of both kinds promotes the attainment of goals, which is significant to evolution when they include survival and reproduction. When evidence is inaccurate or incomplete, however, or non-biological goals override biological ones, even actions that are rational in both senses can be non-adaptive or maladaptive as they influence prospects for survival and reproduction.

Somewhat more formal and complete definitions of these notions might be helpful in facilitating discussion of the adaptive benefits rationality can afford, beginning with a more precise definition of the nature of rationality of belief:

(D1) **rationality of belief** =df believing in proportion to the evidence: when the evidence is sufficient to accept h, accepting h as true; when the evidence is sufficient to reject h, rejecting h as false; and when the evidence is not sufficient, neither accepting nor rejecting h.

The potential adaptive benefits of rationality in this sense should be apparent, since the acceptance of beliefs that are true and the rejection of beliefs that are false promotes not only the (pure) theoretical goal of understanding the world but the (impure) practical goal of attaining our aims, objectives, and goals. For there is scant room to doubt that true beliefs promote the attainment of goals.

The connection between beliefs and goals arises by way of action, which are characteristically undertaken to attain our goals on the basis of our beliefs. Consider, for example, a more precise definition of the nature of rationality of action:

(D2) **rationality of action** =df acting on the basis of motives and beliefs beliefs by adopting means appropriate (efficient, effective, or reliable) to attain those ends, independently of consideration for the rationality of those beliefs themselves.

This is the kind of rationality often called "instrumental" (or "means/ends") rationality, involving as it does the selection of appropriate means to attain specific ends. But it ought to be obvious that, when actions are undertaken on the basis of false or mistaken beliefs, even the adoption of the most efficient, effective, or reliable

—not to mention, expensive—means may be unlikely to attain an action's goals.

Thus, the most important reason for favoring true beliefs over false, from the standpoint of practical action is that, when beliefs are true, the guidance they provide for action will be appropriate, but when they are false, their guidance will be inappropriate. Indeed, a pragmatic conception of truth itself would be that beliefs are true when they provide "appropriate guidance for action" (Fetzer 1990, pp. 125-127). And it may be worth observing that beliefs do not have to be "exactly true" to provide guidance for action that is "appropriate enough". There are occasions, for example, when you set a date and time to meet, it may not matter if you both arrive at just the same time, provided you are in the right place; other occasions, it may not matter if you both in just the right place, provided you are there at the right time. On special occasions, you may need to be in the right place and on time.

Thus, satisficing strategies appear to make a difference in life. You may set off with one plan in mind, such as catching the next showing of your favorite movie, perhaps "Titanic", yet discover that the line was too long to make the start of the film and adopt an alternative plan. There is an important role in life for what is often called "flexibility", which has something to do with adapting to the things as they are rather than resisting them. The importance of "adapting" can vary from case to case, however: flexibility about catching a flick may be one thing, but flexibility in resistance to Nazi oppression may be another. Just as there appear to be grades of approximation to the truth that are "good enough" to accomplish, there are degrees of goal satisfaction that are similarly "good enough". Our actions are affected by our abilities, capabilities, and ethics as well as our motives and beliefs.

Adaptations that have proven to be adaptive in the past, we know, may or may not continue to be adaptive in the future as a function of changing circumstances, which encompass the environmental resources and conspecific competition. They can be described as "rational" relative to one complete set of conditions and also be described as "irrational" relative to another complete set of conditions. What makes adaptations adaptive, from a biological point of view, is that the promote the survival and reproduction of the organism, in the first instance, and of the species, in the second. But that conception takes for granted that the biological goals of survival and reproduction are among our personal aims, objectives, or goals; otherwise, behaviors might be rational in attaining our own aims, objectives, and goals, even though they do not promote our survival and reproduction.

The very idea of aims, objectives, or goals that may not promote survival and and reproduction runs against the grain of "Hamilton's rule", according to which the adaptive value of an action can be measured by the product of the fitness benefits it confers b and the degree of relatedness between the organism performing the action r minus its genetic costs c, or [(r • b) - c] (Hamilton 1964). This conception underlies the notion of inclusive fitness, where the importance of behaviors is measured by its fitness values for genetic relatives, reflected by the biologist's witticism that he would "gladly die for two brothers, four cousins, or eight second cousins" (Angler 2000). And Hamilton's rule has proven to provide a robust framework for subsuming many kinds of behavior across many different species as manifestations of this fundamental "biological imperative".

When [(r • b) - c] > 0, then the behavior confers an adaptive advantage and tends to be favored by natural selection. But when [(r • b) - c] = 0, it is adaptively neutral, and when [(r • b) - c] < 0, it is actually maladaptive and disfavored by natural selection. Behaviors that are neutral, such as preferring to play bridge over canasta, for example, or actually maladaptive, such as taking risks in the pursuit of scientific knowledge, do not promote genetic fitness and therefore pose problems for evolutionary explanations. There are many non-biological kinds of values, including financial, aesthetic, theoretical, and moral, whose influence may explain non-adaptive behavior. An adequate science of human behavior must make room for non-biological as well as biological values. They may bring about behaviors that biological values cannot adequately explain. That evolution can explain many forms of behavior does not imply it can explain them all.

Indeed, actions that are "rational" in both rationality of belief and rationality of action can be non-adaptive or even maladaptive from a biological point of view, when non-biological motives—such as might arise from religious obligations, ego defenses, peer pressure or self-esteem—override biological ones. Certain kinds of actions that tend to contravene reproduction or survival or both may nevertheless qualify as "rational": consider, for example, monks and nuns who take vows of chastity (perhaps enhancing longevity at the expense of reproductive potential); consider suicide as a defense against the acute loss of self-esteem (thereby avoiding the outcome of personal humiliation by self-sacrifice). The case of monks and nuns defeats reproduction while possibly promoting survival, while ego defenses may defeat both. Some psychological motives do override biological imperatives.

Notice the differences between cases of these kinds and those of ordinary false beliefs. Young people who smoke in order to "be cool" (perhaps thereby enhancing their short-term sex appeal at the potential expense of long-term impairment) may or may not be making mistakes, depending upon the relative weight that they assign to their short-term as opposed to their long-term aims, objectives, and goals. It could always be argued that those who commit suicide to avoid humiliation are allowing short-term motives to override long-term motives, yet there exist human beings whose sense of honor and integrity would require them to sacrifice themselves under certain kinds of conditions, not as an act of moral weakness but as an act of moral courage that is deeply rooted in their character. And the reproductive sacrifice made by monks and nuns does not appear affected by such arguments.

The benefits of rationality do not derive from the promotion of biological aims, objectives, and goals, therefore, even though most human beings want to survive and reproduce. The benefits of rationality have more to do with autonomy than with adaptation, where autonomy represents the capacity to decide for ourselves what life we are going to lead or whether we are going to lead any life at all. As in the case of truth and satisfaction, there are degrees of autonomy, where actions tend to be autonomous to the extent to which they are voluntarily made free from compulsion and constraint. For when persons are compelled to do things that they would otherwise have preferred not to do or are constrained from doing things that they otherwise would have preferred to do, their lives are compromised by being unable to live them as they would prefer in the boundaries of their circumstances.

But this conception presupposes the presence of suitable degrees of rationality of action and of rationality of belief; otherwise, the absence of compulsion and of constraint does not allow a person to live their own lives. Consider, for example, the incapacity imposed by the impairment of rationality of belief represented by psychoses such as paranoid delusions, because of which rational actions may be highly inappropriate, even though they are efficient, effective, or reliable means for attaining specific aims, objectives, or goals. Consider, for example, the incapacity imposed by the impairment of rationality of action represented by neuroses, such as an approach/avoidance complex, because of which actions may be highly inefficient, ineffective, or unreliable means to attain specific aims, objectives, or goals—no matter how worthy the goals or how true and complete a set of beliefs.

The reason why "knowledge" matters to our practical lives as well as to theoretical understanding thus becomes increasingly clear. The standard conception, according to which a person z knows that p if and only if (a) z believes that p, (b) z is warranted in believing that p, and (c) p is true means not only (a) that z sincerely and honestly accepts that p and (b) that z possesses appropriate evidence in support of the belief that p and (c) that p is the case. The importance of warrants thus becomes apparent, because having "good reasons" for believing that p means there are "good reasons" for believing that p is true, which implies in turn that there are "good reasons" for believing that p provides appropriate guidance for actions. Thus, every rational agent has an interest in knowledge, which is relative to the seriousness of the consequences of taking actions based on false beliefs.

The cases of suicide and celibacy, I presume, demonstrate that rationality (in the strongest sense) does not necessarily promote the biological aims, objectives, or goals of survival and reproduction. When actions are said to be "adaptive" only when they promote survival and reproduction, therefore, then rationality is not invariably adaptive. Moreover, adaptations are not always rational. Consider, for example, that there can be cases in which the failure to draw obvious conclusions may be adaptive and where violations of rationality of belief, in particular, might promote survivial or reproduction. A criminal's mother, sisters, and older children may have benefited from not drawing inferences about his guilt or innocence that are well-supported by the available evidence. Even he might benefit from failing to acknowledge his own conduct to himself—even as a matter of self-preservation!

The benefits of education, especially higher education, are therefore profound. Persons who have the opportunity to learn more about the world and themselves —and who learn more about the world and themselves—have greater options in life than do those who know less. The exercise of autonomy can be advanced by placing oneself in a situation in which learning will take place, your mind will be developed, and you will become a more efficient, effective, and reliable thinking thing and human being. Entering a college or a university involves becoming a part of a complex causal process intended impart knowledge, to be sure, but one that also instills appropriate habits of mind and habits of action, namely: those characteristic of persons who are not only able to learn from and to teach others but who are able to learn for themselves. Rationality thus promotes autonomy.

That this should be the case emerges with great clarity from the distinctions between kinds of minds that are aspects of the semiotic conception. Minds can employ signs that are iconic, indexical, or symbolic, but they can also be transformational or critical in kind (Fetzer 1990, 1991/96, and 2000) . Transformational mentality involves the exercise of logical reasoning, whether deductive (in being able to ascertain what else must be true if something happens to be true) or inductive (in being able to ascertain what else may be true if something happens to be true). When the exercise of appropriate principles of deduction and of induction become habits of mind, those who incorporate them among their mental dispositions enhance the rationality of their beliefs and their rationality of action.

And those who become critical thinking things in using signs to stand for other signs in order to make them more effective, efficient, and reliable for their own purposes become more effective, efficient, and reliable, in turn, at least in their habits of mind if not in their habits of action. Rationality of belief and rationality of action are independent properties, to be sure, yet strengthening rationality of belief tends to strengthen rationality of action—by providing it with a more firm foundation. Rationality and autonomy do not necessarily promote biology and, as I have elsewhere explained, they do not entail morality. When Willie Sutton said that he robbed banks, "Because that's where the money is!", therefore, he was displaying neither a lack of rationality of action nor of rationality of belief.

Indeed, individuals who are unafflicted by serious neurotic or psychotic symptoms and who are relatively free from compulsion and constraint imposed upon them by others are not only more or less autonomous but also capable of acting on the basis of their own motives, beliefs, and ethics, by virtue of which they can be described as exercising freedom of the will (Fetzer 1991/96, Ch. 9). Freedom of the will should therefore be understood as amenable to degrees with respect to the extent to which a person's actions are both autonomous and under the control of their rationality. This conception does not entail any absence of causation, but rather reflects a conception of action where agents are exercising "free will" when they are competent and acting on the basis of their preferences. Free acts reflect our preferences for acting under various conditions and thus are self-determined.

Plotkin overlooks that our rationality allows us to transcend our biology. But perhaps this is a difficult point. Dennett goes further than Plotkin in his Kinds of Minds (1996) by drawing distinctions between Darwinian creatures, which are the products of natural selection, Skinnerian creatures, which are capable of operant conditioning, Popperian creatures, which are capable of preselection among possible behaviors, and Gregorian creatures, which are capable of the evolution of of culture. As in the case of his previous discussion of things of these same kinds (Dennett 1996), he insists that human beings are not only Skinnerian creatures who are capable of conditioning but also Darwinian creatures who benefit from inherited hardwiring and Popperian creatures who can represent their options.

What appears to be most intriguing about Popperian creatures, I believe, is is they are capable of representing their environments and their choices before they act, a capacity that Dennett ascribes to many different kinds of animals:

> We do not differ from all other species in being Popperian creatures then. Far from it: mammals and birds, reptiles, amphibians, fish, and even many invertebrates exhibit the capacity to use general information they obtain from their environments to presort their behavioral options before striking out. (pp. 92-93)

Dennett thus diverges strongly from the dominant preoccupation of other students of mentality and cognition, who suppose that the distinctive ability of minds is <u>the capacity to utilize and manipulate representations</u>. (Compare: minds are <u>systems that are capable of utilizing and manipulating signs</u>.) Those who approach the problem from this perspective are likely to take Popperian creatures as thinking things.

If Popperian creatures are thinking things, human mentality has evolutionary origins. Dennett, however, contends that only Gregorian creatures can be thinking things, because they are capable of the use of tools, including language, especially (pp. 99-101). The conception of human beings as distinctive tool-makers and tool-users is an early anthropological conception that has been superseded by research in cognitive ethology. No one familiar with the state of current research ought to be drawn to such a view, which ignores or distorts the evolution of communication and the nature of animal mind (see, for example, Beckoff and Jamieson, eds. 1996). Gorillas in the Congo have recently been observed using tools, too (Verrengia 2005).

The possibility that Dennett has no coherent conception of mentality, moreover, receives support from several directions. Beyond his inconsistent commitments to Cartesian conceptions, he reports that it has seemed obvious to many, including him,

> that what minds do is <u>process information</u>: minds are the control systems of bodies, and in order to execute their appointed duties they need to gather, discriminate, store, transform, and otherwise process information about the control tasks they perform. (p. 69)

But if Popperian creatures, by his own admission, gather, discriminate, store, transform, and otherwise process information about the control tasks they perform, is it not equally obvious that they also qualify among the possessors of minds and that some level of complexity suitable for the emergence of mentality has been attained? In fact, we already knew that creatures of all of "Dennett's kinds" can have minds. Now we know that human beings are vastly more than mere Darwinian machines.

CHAPTER 12. ETHICS AND EVOLUTION

Rationality, we have found, promotes autonomy, but neither rationality nor autonomy necessarily promote survival and evolution, when biological motives are overridden by non-biological motives. This might come as a surprise to anyone committed to biological determinism, because it does not look like a predictable consequence of evolutionary biology. (Whether evolution can explain morality is something that we will pursue.) Moreover, rationality does not guarantee morality. This result contradicts a powerful tradition in moral philosophy, according to which morality and rationality are inextricably intertwined. Not only was Willie Sutton not irrational in his beliefs when he explained why he robbed banks, but if money is your object, one way to try to get a lot of it is by robbing banks. Though it would not be moral, bank robbing could be an exercise in the rationality of action.

Consider the following payoff matrix, a familiar device within decision-theory contexts, where various action options and their possible outcomes are compared in order to establish the possible results in making decisions:

	State of Nature	
Action Options	He/She is wonderful	He/She is Not
Accept date	Great time! * * * *	Awful time *
Reject date	Kick yourself * *	Relief * * *

Table XXI. A Payoff Matrix

Thus, confronted with a the offer of a "blind date", you have two choices: accept the date or reject it. Your prospect, let us assume, is either wonderful or not. If you accept the date and s/he is wonderful, then you'll have a great time; if you accept the date and s/he is not, then you'll have an awful time. If you reject the date and s/he is wonderful, then you'll kick yourself; but if you reject the date and s/he is not, then you will at least be relieved.

In order to arrive at a "rational decision", you must rank order the outcomes in terms of your preferences (say, having a wonderful over feeling relieved over kicking yourself over having an awful time, as the asterisks reflect). If the probabilities of the outcomes are not known (and you are in conditions of uncertainty), then at least two principles might apply, namely: (R1) The Minimax Loss Principle, which tells you to prefer the alternatives that would minimize possible losses; and, (R2) The Maximax Gain Principle, which tells you to prefer alternatives that permit the greatest gain. Thus, in this situation, (R1) would recommend that you reject the blind date, but (R2) would recommend that you accept it. Neither is more rational than the other, but (R1) ought to appeal to pessimists, while (R2) should appeal to optimists.

An alternative approach applies when the probabilities for the outcomes happen to be known, in which case the decision is said to be made under conditions of risk. In that case, you must make some (often rather complicated) calculations of the probabilities for each outcome multiplied by the utilities for each outcome (quantifying the value that you would assign to them) and summing their values across each action-option to secure what are known as the expected utilities thereof. Then (R3) The Principle of Maximizing Expected Utility should be applied, which tells you that you should adopt an alternative that provides at least as much expected utility as any other. This decision rule is widely recommended and even regarded as obvious (Michalos 1969, Ch. 8).

There is a whole industry devoted to subtle variations on rules like these, but the point I want to make is simple. Suppose, for example, that you wanted to make money. Then among your alternatives (your "action options") might be robbing banks, counterfeiting credit cards, and getting a job. If you calculated that robbing banks had the highest expected utility among your alternatives—on the basis of careful consideration and thoughtful analysis—then that would be the rational alternative! Of course, you would have to take into account the possibility that you might be caught, convicted, and sent to jail; but if, after all the outcomes were weighed and balanced, this remained the alternative with the highest expected utility, it would be the rational choice. Yet it ought to be apparent that it is not a moral choice. So rationality does not entail morality.

1. <u>Evolution and Morality.</u>

In a fascinating book, Robert Richards (1987) has suggested that the development of evolutionary theories of mind and behavior confronts at least three fundamental problems, which involve "heritable habits", rationality, and morality, respectively. The solution to the problem of heritable habits thus turns out to be the theory of natural selection, which operates at the level of behavior through a process of selection to yield changes in the frequency of genes across time, whereby combinations of genes which predispose various phenotypes toward adaptive behavior tend to be perpetuated.

The problems of rationality and morality have proven somewhat more difficult to resolve. Lumsden and Wilson (1981, 1983) have advanced their conception of mentality as susceptibility to social learning, which might, in turn, provide at least a partial solution to the problem of rationality. And the conception of an ethics based upon evolution has been widely supposed to supply the basis for a resolution of the problem of morality, as a lengthening succession of contemporary authors—from Wilson (1975, 1978), Ruse and Wilson (1985, 1986) to Richards (1987), Alexander (1987), and, more recently, Ruse (1998) and Wilson (1999), independently—have maintained.

While these authors advance somewhat different views, the basic ideas they advance can be cast into a coherent position, which accents the nature of human beings in light of their biological origins. Ruse and Wilson (1985) for example, observe that humans are animals and that "the social behavior of animals is firmly under the control of the genes, and has been shaped into forms that give reproductive advantages". Ruse and Wilson (1986) reject the is/ought distinction as "debilitating", while suggesting that kin selection and reciprocal altruism afford the foundation for a biologically-based ethics.

Richards (1987) and Alexander (1987), by contrast, accept the is/ought distinction but believe that it can be overcome. Alexander (1987), for example, contends that "those who have tried to analyze morality have failed to treat the human traits that underlie moral behavior as outcomes of evolution", on the one hand, while he "explicitly reject[s] the attitude that whatever biology tells us is so is also what ought to be", on the other. Richards (1987) claims that the distinction succumbs to arguments relating empirical premises about "what is" to normative conclusions about "what ought to be".

Insofar as ethics concerns how we should behave and evolution concerns how we do behave, they might very well stand in direct opposition. If we sometimes do not behave the way we ought to behave toward one another, ethics as a domain of inquiry might transcend the resources that evolution can provide. Ethics could require more than science can supply. But if we always behave the way we ought to behave, then perhaps evolution could provide everything we need to know about moral behavior. Ethics might then require no more than science can provide. That is an open possibility.

The existence of crime, of course, makes this position a rather difficult one to seriously defend. Human beings all too frequently commit murder, robbery, and rape, among their varied offenses against their fellow human. The occurrence of murder, robbery and rape supports the conclusion that we do not always behave the way we ought to behave, however, only provided we have access to normative premises concerning how we ought to behave. In the absence of access to such standards, it does not follow that the existence of crime counts as behavior that humans should not display.

Moreover, similar considerations apply to evolutionary conceptions of ethics. The existence of kin selection, reciprocal altruism and other forms of social cooperation supports the conclusion that kin selection, reciprocal altruism and other forms of social cooperation are moral behavior only if we have access to normative standards concerning our behavior. In their absence, it might turn out to be the case that kin selection, reciprocal altruism and social cooperation are not behaviors that humans ought to display. They could be evolved forms of behavior that might not qualify as moral.

Consider, for example, favoritism and corruption in businesses and corporations. When marginally qualified applicants are shown preference in hiring over others who are far better qualified because they are close relatives, kin selection may be displayed, but it is not therefore ethical. When close friends are given inside information that enable them to make fantastic profits on the market in the expectation that they will return the favor, reciprocal altruism may be involved, but it is not for that reason any less immoral. Kin selection and reciprocal altruism are not inevitably ethical.

Richards (1987) "bites the bullet" by arguing that evolved behavior is directed toward "the community good". His position is that human beings have evolved to act for the community good and that acts for the community good are "moral acts", as a matter of definition. It presumably follows that human beings are moral beings who act as they ought to act. But the kinds of behavior that he has in mind are kin selection, reciprocal altruism and other forms of social cooperation. We have already discovered forms of kin selection and reciprocal altruism that appear to qualify as immoral.

Moreover, the phrase, "the community good", harbors ambiguity. The good of the community can vary with the interests of the community and may or may not be morally praiseworthy. The existence of communities of Nazis suggests that various activities, such as book burning, forcible detention, military invasions or systematic genocide, which require social cooperation, may be for the community good but are not therefore moral. If humans had evolved to act for the community good, that would not be enough to establish the morality of their acts. Cooperation is not morality.

Thus, it is a mistake to assume that behaviors which have evolved are always moral, as Alexander (1987) seems to understand. In denying the contention that whatever biology tells us is so is what ought to be, he implies the possibility that evolved traits may or may not be moral. Insofar as the adaptations that evolution has produced are not invariably moral, however, the problem remains of establishing which traits and behaviors are moral and why. Richards has not supplied the missing premise that would provide the foundation for a theory of ethics based upon evolution.

Other evolutionary thinkers have also emphasized that behaviors that have evolved are not therefore moral. George Williams, for example, in a recent review of Richards (1987), quotes Thomas Huxley (with approval) when he observes that the immoral sentiments have evolved no less than the moral sentiments, which means that "there is, so far, as much natural sanction for the one as the other" (Williams 1989a, p. 387). This, in turn, hints that descriptive solutions to ethical problems are unlikely to be availing, unless we already know which traits and behavior are moral and why.

If we already know which traits and behavior are moral and why, however, then descriptive solutions to ethical problems are no longer required. This recognition may be more subtle than it appears, since Richards (1987) also finds it seductive to suppose that societies might be positioned to overcome the is/ought distinction by appealing to metaethical inference principles, such as, "Conclude as sound ethical injunctions what moral leaders preach" (Richards 1987, p. 616). These principles are supposed to enable normative conclusions to be drawn from factual premises.

What Richards apparently overlooks, however, is an ancient question raised about God and His moral laws, namely: are the moral laws right because God commands them, or does God command them because they are right? Surely we cannot know that the ethical injunctions preached by moral leaders are right merely because they preach them. But that means we are still confronted by the necessity of discovering precisely which ethical injunctions are right, whether or not moral leaders preach them. The gap between the descriptive and the normative cannot be resolved by "metaethical inference principles" of the kind he recommends.

Indeed, appeals to religious texts encounter comparable difficulties in every case in which the "moral maxims" they present appear problematic. The Old Testament, for example, provides a valuable source of illustrations drawn from an important religious document. According to Leviticus 20:10, (MM1) If a man commits adultery with another man's wife—with the wife of his neighbor—both the adulterer and the adulteress must be put to death.

That may appear a high price for adultery. Compare it with Leviticus 20:27:

(MM2) A man or a woman who is a medium or a spiritualist among you must be put to death.

The "Psychic Hot Lines" so popular today take a heavy hit. Or Leviticus 20:9:

(MM3) If anyone curses his father or mother, he must be put to death.

This does not appear to be a child-rearing practice of which Dr. Spock would approve. Among my personal favorites, however, is Deuteronomy 25:11-12:

(MM4) If two men are fighting and the wife of one of them comes to rescue her husband from his assailant, and the reaches out and seizes him by his private parts, you shall cut off her hand. Show her no mercy.

Personally, if my wife were to come to my assistance under such conditions, I would want to shake her hand, not cut it off! The point, of course, is not that theologians and other students of religion are unable to present some defense of maxims such as these, but rather that they are not obviously moral. The suggestion that ethical injunctions should be considered to be sound because moral leaders or religious texts advance them appears to be without merit.

Similar considerations apply to other positions as well. When Ruse and Wilson (1985) suggest that the social behavior of animals is firmly under the control of the genes, the conclusion that kin selection, reciprocal altruism and other forms of cooperation are moral depends on other premises, such as that social behavior that is firmly under the control of the genes is always moral. If kin selection, reciprocal altruism and other forms of social cooperation can promote behavior that is immoral, however, then even behavior that is firmly under the control of the genes is not always moral.

The "firmness" of "the control of the genes", moreover, requires further contemplation. If human behavior were completely "under the control of the genes", the question of morality might not even arise. Our behavior, like that of many lower species, then would be instinctual and non-moral, where the same kinds of social behavior would be displayed across every similar environment. Human behavior is not completely "under the con-control of the genes", since it would be a blunder to overlook the influence of other causal factors, such as social learning, in shaping human behavior.

The position that comes the closest to endorsing the idea of ethics as instinctual behavior, no doubt, is known as psychological egoism. According to its tenets, every human being invariably acts in his or her own personal interest, because it is impossible for humans to do otherwise. This is simply part of our nature as humans. Since psychological egoism advances a descriptive hypothesis about human nature, it has to be sharply distinguished from ethical egoism, which asserts the normative thesis that every human ought to act in his or her own personal interest, which is a different thing.

Indeed, as ordinarily understood, if psychological egoism is true, then ethical egoism is not merely false but actually meaningless. Such a consequence appears to follow because, if acting in our own personal interest is something that we have to do as a matter of human nature, then it makes no more sense to suggest that we ought to do it than it does in the case of eating, breathing, and sleeping. Ethical egoism would be meaningless and not merely false if psychological egoism were true, therefore, because it is normally assumed that the truth of an ought-statement presupposes that we might or might not behave that way, an issue to which we shall return.

Neither psychological nor ethical egoism, however, should be confused with the position that we always act selfishly because we always act from motives that move us. Such an attitude completely obscures fundamental moral differences between selfish and unselfish behavior. Indeed, psychological egoism turns out to be false (as a descriptive theory) if humans ever act from a sense of duty, out of friendship, for the welfare of society, for the sake of justice or to promote the well-being of others, just as ethical egoism turns out to be false (as a normative theory) if humans ever ought to act from a sense of duty, out of friendship, and so forth--assuming that these are motives that can move us (Facione, Scherer, and Attig 1991, pp. 96-98).

A weaker but more defensible version of the connection between ethics and evolution, therefore, would maintain that the trait which evolution has produced is not <u>moral behavior</u> as such but the <u>capacity for moral behavior</u> instead. Thus, if moral behavior has benefits for reproduction and survival, then when the presence and absence of moral behavior separates different human beings or different human groups, the adaptive benefits that moral behavior provides might afford a selective advantage. Every human could have the same adaptive capacity, even if only some of us ever exercise it.

There are cases, however, where ethics and morality would not appear to provide a selective advantage. Consider the Mafia hitman, for example. His success depends upon his ability to perform such acts as murder and mayhem. These seem to be immoral acts, if any acts are immoral. As a consequence, he may lead a comfortable lifestyle, with plenty of money, women, and respect. Yet consider his prospects were he to lose his talent for performing immoral acts. His potential for survival and reproduction appears to depend on his immorality. Similarly for con-artists and pimps.

If humans do not always behave morally, if kin selection and reciprocal altruism are not invariably ethical, and if social cooperation is not enough for morality, then what prospects remain for evolutionary ethics? Traditional theories of morality, which include consequentialist accounts, such as ethical egoism, limited utilitarianism and classic utilitarianism, are based upon the conception of something as intrisically desirable ("the good"), where actions are proper (or "right") whenever they maximize the good. An evolutionary ethic should be based upon a similar value commitment.

The considerations that arose during the discussion of whether or not evolution is an optimizing process, however, apply here as well. If acts are only right when they maximize the good, then any acts that do not afford as much good as the maximum are not right acts. That implies a very high standard, even for the mundane decisions of practical life, such whether to go out to dinner, where to dine, or which movie you ought to take in. The minute calculations that would be required for acts to be right acts by maximizing standards, as Michalos (1973) has explained, would make decision making in ordinary life a practical impossibility. Here, as elsewhere, survival depends on finding solutions that are not the best but good enough.

An appropriate foundation for a theory of evolutionary ethics initially, at least, would seem to be a commitment to the intrinsic value of the reproduction and survival of the human species. The appropriate stance to adopt, I think, for those who want to elaborate an evolution-based morality, is to maintain that the survival and reproduction of the human species is intrinsically valuable, if anything is. Indeed, even if the existence of intrinsic values might be disputed on various grounds, a commitment of this kind appears to compare favorably with the value commitments that other theories have embraced, which include pleasure, happiness, knowledge, and even power.

Among the authors under consideration here, perhaps Alexander (19-87) comes the closest to adopting this conception. His emphasis upon reproductive success parallels widely-held theories about inclusive fitness as the basic value that human behavior should be expected to maximize. The distinction between "somatic" altruism, which can be adaptive, and "genetic" altruism, which is never adaptive, thus supports the inference that kin selection and reciprocal altruism can be expected to occur more frequently than behavior that sacrifices a person's genetic self-interest.

Alexander's position, however, like those of the others under consideration here, appears to reflect an impoverished conception of morality. When he contends that "moral issues can only be resolved by the collective opinions and decisions of the populace" and that "otherwise what occurs is not a resolution or by definition is not moral" (Alexander 1987, p. 255), he seems to confound the nature of <u>ethics</u> with that of <u>politics</u>. Collective opinions and decisions of a population may be indispensable to a functional democracy, for example, but they do not define morality.

The debates over the morality of abortion, for example, do not hinge on collective opinions, voting preferences, or even the judicial decisions that determine the law of the land. Traditional moral theories arise instead as a consequence of rational deliberation over general principles as they apply to specific cases in an effort to arrive at recommendations or proposals concerning how human beings ought to act toward each other.

They result from <u>explication</u> as an activity aimed at clarifying and illuminating language that is vague and imprecise (Hempel 1952, Fetzer 1984).

Consider, for example, classic utilitarianism, which adopts happiness as the nature of the good and happiness maximization as the measure of the right. When everyone is viewed as of equal moral worth, utilitarianism is commonly described by means of the maxim of the greatest happiness for the greatest number. But a theory of this kind can be subject to criticism on various grounds. The acute unhappiness of a minority within a population may be compatible with the greatest happiness of that population as a whole, where a slave-based society might thereby be morally justifiable.

But we do not have to go to such extremes. Suppose that the government were to periodically round up 100 smokers at random, put them on television and shoot them. It would not be too surprising if the number of smokers were to drop drastically, the health of the population were to increase, and the cost of medical care to diminish. It might turn out that, by every measure, the greatest happiness for the greatest number increased by more than would have occurred by any available alternative measure. The dead smokers might not be happy about it, but they would be in no position to complain. It might maximize happiness but it would be wrong.

If a morally justifiable slave-based society appears to you to be an unacceptable consequence, then you should argue for revision or rejection of any theory that implies it. Thus, ethical egoism, which makes each person the arbiter of his own morality, and limited utilitarianism, which makes each group the determiner of its own morality, appear to be untenable. Ethical egoism would justify the conduct of a Ted Bundy, a John Gacy, or a Jeffrey Dahmer. And the Nazis, the Mafia, and even General Motors are counterexamples to the defensibility of limited utilitarianism. Indeed, my discussion here of kin selection, reciprocal altruism and social cooperation illustrates the kind of reasoning characteristic of theorizing in philosophy.

One of the most persuasive reasons for taking <u>deontological theories</u> of morality—such as the categorical imperative of always treating persons as ends and never merely as means—seriously is that they provide an alternative to consequentialist approaches. Murder, robbery and rape, as well as slavery and genocide, are immoral on deontological grounds precisely because they involve treating other humans merely as means. Employers and employees, of course, may still treat one another as means as long as they regard each other with respect, which appears to be the right result.

2. <u>Morality and Biology</u>.

This does not mean that persons can never treat other persons as means, which usually happens without thereby generating immorality. The relationship between employers and employees is clearly one in which employers use their employees as a means to conduct a business and make profits, while employees use their employment as a means to make income and earn a living. Within a context of mutual respect, this can still qualify as moral conduct. It is a matter of not treating other persons, not as means, but <u>merely</u> as means.

When employers subject their employees to unsafe working conditions, to excessive hours, or to poor wages, however, the relationship becomes exploitative and immoral, which can equally obviously occur when employees fail to perform their duties, steal from their employers, or abuse their workplace. Similar considerations apply to doctors and patients, students and faculty, or ministers and congregations, which may explain our dismay at their betrayal. Persons in positions of trust and responsibility with respect to other persons are always acting immorally when they treat other persons merely as means.

Perhaps the most disturbing aspect of Ruse and Wilson (1986), from this point of view, is their presumption that there are just three possible sources of moral standards, namely, religious sources, especially ones derived from belief in God; genuinely objective moral axioms, which are derived from an abstract domain; and genetically based and empirically testable rules of conduct, which are derived from epigenetic rules (Ruse and Wilson 1986, p. 174 and p. 186, for example). Even I admit that, if these were our only alternatives, the prospects for genuinely prescriptive, non-religious moral theories would be rather bleak. But their alternatives appear to be non-exhaustive.

What Ruse and Wilson tend to overlook is that moral theorizing can also be pursued as a form of explication, in which notions that may be somewhat vague and ambiguous, but nevertheless important, such as right and wrong, are subjected to critical scrutiny in an effort to clarify and illuminate their meaning. This process involves assessing general principles on the basis of specific cases, and specific cases on the basis of general principles, in order to arrive at tentative recommendations as to how these notions should best be understood. This is a method that can be applied to understand morality.

It is not that theorizing about morality occurs in a descriptive vacuum. On the contrary, widely held attitudes about which specific acts are right and are wrong can supply evidence relevant for subjecting moral theories to empirical evaluation. If murder, robbery, and rape happen to be virtually universally regarded as morally wrong, while kindness, consideration, and generosity are virtually universally regarded as morally right, then any theory that has the effect of classifying pre-analytically clear cases of right conduct as "morally wrong" or of classifying pre-analytically clear cases of wrong conduct as "morally right" ought to be difficult theories to accept but easy theories to reject.

Murder, robbery, and rape, for example, would be morally right actions if they were done by persons who thereby maximized their personal happiness, if ethical egoism is true and happiness is the good. Military domination, territorial aggression, and racial genocide would be morally right actions if they were done by groups of persons who thereby maximized their group's happiness. Enslaving a certain percentage of the population would be morally right if it were the arrangement of society that produces the greatest happiness for the greatest number and that would be the effect upon the entire population.

The reason this procedure can advance our understanding of the nature of morality appears to be because there is far less disagreement among human beings generally and philosophers specifically about which kinds of actions are right and wrong than there is about which principles of morality themselves are right and wrong. By classifying these specific kinds of actions as "morally right" and as "morally wrong" pre-analytically—that is, before we commit ourselves to any specific moral theory—we establish a class of cases within the extension of the concept for which we want to specify an intension.

Theories such as ethical egoism, limited utilitarianism, and even classical utilitarianism cannot qualify as acceptable theories, because they have the consequence of classifying pre-analytically clear cases of wrong actions as if they were moral and of right actions as if they were immoral. Consider, for example, that kindness, consideration, and generosity, which virtually everyone would qualify as morally right actions, would be morally wrong from the point of view of ethical egoism, for example, were they not happiness maximizing actions for specific persons. But the adequacy of a moral theory can be tested further by the illumination it affords for pre-analytically unclear cases.

To offer an uncomplicated illustration, there appear to be no inherent reasons prostitution should not qualify as moral so long as hookers and their tricks treat each other with respect. Hookers are immoral whenever they do not provide services agreed upon, steal their trick's money, or infect them to venereal disease, while johns are immoral whenever they do not pay for services rendered, engage in physical abuse, or infect them with disease. Respect works both ways round. The difficulties that arise in relation to prostitution are generated largely by its illegality, not its immorality. Indeed, it is not obviously immoral.

In those locales where prostitution is legal, women presumably can choose this line of work without the intervention of pimps, who turn them into sexual slaves. When prostitution is illegal, of course, the consequences can be immoral for hookers and their tricks alike. Even when prostitution happens to be legal, however, immorality can enter by means of other relationships. When husbands or wives commit adultery and thereby betray their commitments to each other, they are not displaying respect for their spouses and are acting immorally. But that remains the case apart from any business aspects. Indeed, marriage itself has been described as a form of "legalized prostitution" by George Bernard Shaw.

When alternative moral theories are explored in the fashion I have described, then they cannot be adequately characterized as derived from belief in God, as derived from an abstract domain, or as derived from epigenetic rules, as Ruse and Wilson (1985) suggest. However, it does not follow that they are therefore either subjective or arbitrary. As recommendations concerning how best to understand the nature of moral phenomena, they can be subjected to systematic criticism and to empirical test in relation to specific examples that display the scope and limits of those principles, which, indeed, is the practice that I have adopted in appraising moral theories, to which I shall return in later chapters.

No doubt, not everyone will be convinced by what I have had to say here. As Ruse (1998) perceptively reports, much of Wilson's work on ethics appears to be affected by three important factors, namely, first, doubts about the substantial reality of ethical phenomena over and beyond subjective attitudes and mere opinions; second, veneration for social organization (exemplified by colonial invertebrates, by social insects, by non-human animals, and by human beings) as pinnacles of evolutionary progress; and, third, the belief that, "because the ethical capacity has evolved, evolution must reach through to the very core of the claims that we make in its name" (Ruse 1998, p. 99). Views such as these, I think, would tend to promote the identification of morality with cooperation.

More important than any misconceptions about morality and methodology, however, is Alexander's emphasis—which Ruse (1998) and Wilson (1999), of course, among others, share—on the role of evolution in determining human behavior. Most of his efforts appear to be directed toward the goal of securing a conception of morality that is at least consistent with, if not actually exhausted by, what evolutionary biology has to tell us about human nature. In this respect, therefore, his work appears to be focused less upon the is/ought distinction than it is upon the principle that "ought implies can". This emphasis accounts for much of the appeal of his and Ruse and Wilson's work on ethics.

The principle that "ought implies can" holds that no one should be held responsible for their behavior when they could not have done otherwise. What this means, however, requires interpretation. The driver who races through an intersection at 80 mph would not be exonerated on the basis of the contention that, because he entered the intersection at 80 mph, it was impossible for him to have done otherwise. A proper rebuttal would note that he could have driven more slowly, not as a matter of historical possibility, but as a matter of physical possibility. The laws of nature permit it.

If the laws of nature made genetic altruism impossible, for example, it would be morally inappropriate to hold anyone morally responsible for his failure to display it, because "ought implies can". In this sense, biology constrains morality, since a theory of morality whose satisfaction contravened the laws of biology would thereby violate this principle. Although compatibility with the laws of biology counts as a necessary condition for morality, however, it does not likewise qualify as a condition sufficient for morality.

The strongest case for supposing that adaptations are as they should be, I suspect, emerges from the adaptationist attitude that assumes "the latest is the best" (Dupre 1987). Once we recognize that evolution is not an optimizing process, we should also realize that the way things are is not always the way things ought to be, especially in relation to behavior (Fetzer1993). Once we recognize that evolution is unfinished and ongoing, we can resist the temptation to identify evolved traits with optimal traits, where there remains room to consider ways in which we and our world could be better.

Moreover, once we recognize that human behavior is not completely under the control of the genes, we must also admit that, to the extent to which our behavior is under the influence of our rationality, older forms of biological determinism must yield ground to more adequate conceptions of gene-culture co-evolution of the kind elaborated in this book, where mentality, intelligence, and rationality have a contribution to make in shaping social behavior that goes beyond our genes. The ability to consider and criticize the strengths and the weaknesses of various methods, processes, and procedures further suggests that morality may have originated with criticism.

Our capacity for criticism represents an exercise of imagination and conjecture in thinking about how things might be different (how they could be improved upon or "made better"). Our capacity for criticism—of ourselves, our theories, and our methods—indicates that human minds can contribute to improving their own culture by "bettering" their capacities for communication, cooperation and community. It hints that, by exercising our higher mental faculties, human beings might also contribute to the survival of our species (Fetzer 1996). It thereby implies ways morality transcends biology.

Before discussing Alexander's views further, it should be observed that, given the commitment to the intrinsic value of the survival of the species, there still appear to be at least two approaches to implementing an ethic based on evolution. The first is (let us say) the positive ethic of doing anything we can possibly do to advance the survival of the species. The second is (let us also say) the negative ethic of not doing anything we can possibly do to inhibit the survival of the species. Though some theoreticians might be inclined to disagree, these principles do not amount to the same thing.

The negative ethic, for example, suggests not reducing any cooperation and communication between the members of the population of human beings to avoid diminishing the well-being of the species. It also implies that global pollution and nuclear warfare are patterns of behavior that ought to be discouraged. The positive ethic, by contrast, could be offered in support of genetic engineering and even infanticide on behalf of doing everything possible to promote the survival of the species. The positive ethic might threaten individual rights. It could even justify forms of genetic fascism.

I therefore believe that theories of morality based upon evolution are ultimately destined to prove to be incomplete. It appears to me as practically inevitable that they have to be supplemented by deontological commitments to the equal worth of every human being. It appears to me as theoretically indispensible to combine the intrinsic value of the survival of the species as a collective end (for all of us together) with respect for the intrinsic value of every member of the species as a distributive end (for each of us individually). An approach of this kind appears theoretically defensible.

An approach of this kind not only embraces the necessity for a commitment to the intrinsic value of the species but also concedes the importance of the is/ought distinction. It makes no effort to dispense with the difference between the way things are and the way things should be, but rather views the way things are as a stage in the evolution of the species, where cultural innovations and improvements might yet generate enormous benefits for future generations. Ethics does require more than science can provide. It requires an exercise of rationality of a certain philosophical kind.

The apparent necessity to encompass personal rights within evolutionary ethics suggests that moral behavior may or may not possess an evolutionary advantage. The proper response, I think, is that sometimes it does and sometimes it does not. Virtue, of course, is supposed to be its own reward. While cooperation may frequently provide evolutionary advantages, there is more to morality than cooperation. And as a largely cultural rather than exclusively genetic phenomenon, there can be no "genetic explanation" for morality as a trait of every human. Morality is a normative conception.

Incorporating respect for the individual together with concern for the species does not mean that scientific discoveries and technological innovations cannot be put to work on behalf of human beings. What it means is that, when genetic engineering or other techniques are utilized on behalf of the species, it must be within a context of respecting every person's individual worth. As we confront the problem of over-population, for example, we ought to employ every available method provided that it does not violate personal rights. On this account, there is a crucial difference between forced sterilization and voluntary contraception. It is a matter of morality.

3. Is Nature Immoral?

In the final analysis, the problems of rationality and of morality turn out to be intimately intertwined. Understanding the nature of morality requires the exercise of rationality, where the difference between consequentialist and deontological theories deserves consideration. In the end, a morality based upon evolution implicitly shifts attention from the population to the species, where the long term interests of the species tend to displace the short term interests of the population. But it would be all too easy to misunderstand the nature of this exchange in points of view.

Because individuals are the agents who perform actions, it might be supposed that, since they are the actors, the rightness or wrongness of their actions must be a function of their motives. But, as in the case of other consequentialist theories, the rightness or the wrongness of acts is determined by their contribution to promoting the survival of the species, provided, of course, that personal rights are respected. Whether an action is right or wrong, therefore, is not determined by whether or not an agent recognizes that fact. Right acts can be done for wrong reasons.

Still, it would be (at least vaguely) reassuring if humans could act on the basis of appropriate motives for morality. If humans could never be motivated by appropriate moral sentiments, then it might be maintained that, even if psychological egoism happens to be false (because we sometimes act on the basis of motives that do not put our own interests first), the principle that ought-implies-can precludes the truth of another moral theory. If the most promising moral theories imply that humans should (at least sometimes) act to benefit the species or to respect the rights of others, for example, their plausibility would be drastically undermined or completely destroyed if humans never act on the basis of such motives.

I have been fascinated to learn that recent empirical studies provide strong support for the existence of moral sentiments of the kinds implied by the conception of evolutonary ethics which I have outlined (Petrinovich, O'Nell and Jorgensen 1993). These studies involved samples of college students who were presented with (hypothetical) choice situations of two kinds, namely: "trolley problems" and "lifeboat problems". In trolley problems, a decision must be made whether or not to throw a switch that would determine whether individual-or-group X or individual-or-group Y is killed. In lifeboat problems, a decision has to be made to determine which among six members of a lifeboat survive.

The examples that were employed tested the subjects' attitudes toward killing or sacrificing human beings vs. members of other species, unfamiliar persons vs. friends and relatives, ordinary persons vs. Nazis, endangered species vs. non-endangered species, and ordinary persons vs. elite members of society. The results displayed a very strong bias in favor of human beings over members of other species, a very strong bias in favor of friends and relatives, and a strong bias against persons who were Nazis. Mere numbers turned out to be moderately important, while the endangered species factor and the elitist factor were minimal.

These findings suggest that (at least some) humans have motives of the kinds that are appropriate to moral behavior in accordance with the conception of evolutionary ethics described above. Indeed, although no component directly tested the motive of respect for the rights of others, insofar as Nazis represent a group devoted to deliberate and systematic violations of the rights of others, I think it is reasonable to interpret the strong negative bias against Nazis as a strong positive bias in favor of respect for the rights of others. Moreover, since kin selection is not improper when employed as a "tie breaker" within a context of respecting the rights of others, for example, nothing here appears to undermine, much less destroy, the conception of evolutionary ethics which I have defined.

If an ultimate commitment to the intrinsic value of the survival of the human species has to be combined with respect for the intrinsic value of every member of the species, then the question arises of whether conflicts between these value commitments can arise and, if so, how they can be resolved. I believe that the influence of mere numbers ought to make more and more of a difference—both in test situations and in daily life—as other factors are balanced out. In other words, when the lives of few innocent human beings are pitted against the lives of many innocent human beings, the importance of numbers should increase proportionately.

Consider, for example, the choice between killing one innocent human being and killing the entire human species. Surely there should be little room for controversy in a case of this kind. This suggests that societies may have important (collective) evolutionary reasons for imposing severe penalties upon those who would (distributively) threaten their existence (by disclosing secrets vital to the national defense, by assassinating their political leaders, and the like). Precisely when cases of these kinds are at hand, of course, can be controversial, since "national security" may at least sometimes be advanced as a rationalization for political purposes.

Another kind of ultimate value conflict, however, may not be resolved quite so easily. It follows from our ultimate commitment to the instrinsic value of the species that the members of other species are equally entitled to an ultimate commitment to the intrinsic value of their species. This consequence has sometimes been labeled "speciesism", precisely because an organism's ultimate values depend upon the species to which it belongs. Nothing about speciesism appears to defeat the prospects for evolutionary ethics, provided that we acknowledge that other species possess the same moral rights to defend themselves against humans as we do against them.

Nothing about an approach of this kind necessarily has to contradict the genetic interest of members of societies in relation to their offspring. Assuming that each parent contributes 50% of their genes to the genetic composition of their children, that their children in turn contribute 50% of their genes to the genetic composition of their offspring, and so forth, each parent would seem to have a genetic representation equal to $(1/2)^n$ per offspring in each successive generation, where _n_ is the number of that generation. The consequences of this conception for evolutionary theory itself, of course, were introduced by Hamilton (Hamilton 1964).

As Williams has observed, Hamilton's theory of _inclusive fitness_ elaborates the conception that "the survival and reproduction of a relative are partly equivalent, in evolutionary effect, to one's own survival and reproduction" (Williams 1989b, p. 184). When we know who our relatives are and how closely they are related to us, therefore, we can be in an appropriate position to act toward them as manifestations of our own genetic legacy. Even when we have no offspring of our own, we can still retain an interest in the survival and reproduction of the culture of our species, especially if we have made contributions (books, tools, etc.) of our own.

The most difficult case appears to be when we do not know who our relatives are or how closely they are related to us and when we have no cultural contributions of our own. Even then we may still be motivated to act to benefit the survival and reproduction of the species, especially when we have offspring who might have other offspring of their own in unknown and unpredictable numbers across successive generations. The perpetuation of our own personal genetic or cultural representation thus appears to be compatible with an evolutionary ethics of the above kind, because it reinforces our impersonal motives to perpetuate the species.

The position that I have advanced appears to be "moderate" relative to those advanced by other thinkers. While Ruse and Wilson, Richards, and Alexander tend to assume that natural selection operates in favor of morality (when <u>morality</u> is properly understood), Williams contends that natural selection operates against morality (when <u>natural selection</u> is properly understood). Thus, he maintains that the biological effects of natural selection display "gross immorality" in a sense which goes far beyond mere selfishness of the kind attributed to human beings by psychological or by ethical egoism (Williams 1989b, pp. 180-181). For Williams, the conception of an "evolutionary ethics" is virtually a self-contradiction.

The basis of Williams' attitude appears to be that nothing in nature exemplifies conformity to traditional maxims of morality: "Nothing resembling the Golden Rule or other widely preached ethical principles seems to be operating in living nature. It could scarcely be otherwise, when evolution is guided by a force that maximizes genetic selfishness" (Williams 1989b, p. 195). Yet here and elsewhere Williams appears to confound the difference between behavior that is <u>instinctual</u> and behavior that is <u>voluntary</u>, where it makes no sense to describe instinctual behavior as "moral" or "immoral". He even attacks speciesism by comparing the triumph of one population over another to a form of "systematic genocide" (Williams 1989b, p. 196).

If nature operates on the basis of laws of nature that it cannot violate and it cannot change, however, then it appears to make no more sense to hold nature responsible for its conduct than it would to hold humans responsible for theirs. If the appropriate standard for moral responsibility among humans turns out to be that no laws of nature inhibited us from acting otherwise, then the same standard should apply with respect to nature. The principle that ought-implies-can also holds <u>between</u> different species. There is no good reason here for describing nature as "immoral" or for believing that an evolutionary ethics cannot be consistent.

The ultimate import of the ought-implies-can connection with which Alexander, especially, has been concerned, therefore, is that, as Scoccia (1990) has observed, we must clearly distinguish <u>our motives for being moral</u> from <u>what makes our actions right</u>. Acts that were motivated by reciprocal altruism, by kin selection or simply by self-interest may still turn out to be morally proper acts, provided that they maximize the survival of the species without violating personal rights. The existence of a defensible evolutionary ethics in this sense is no longer in doubt. While biology constrains morality, morality cannot be reduced to biology alone.

The existence of a defensible evolutionary ethics, however, does not by itself afford any guarantees that human beings will be smart enough or courageous enough or (even) moral enough <u>to do the right thing</u> from an evolutionary point of view. Even if the positive evolutionary ethic advises us to do anything we possibly can do to advance the survival of the species and the negative evolutionary ethic advises us to not do anything we can possibly do that might inhibit the survival of the species (where acts of both kinds are compatible with acknowledging the intrinsic value of every human being), our actions still may or may not qualify as moral.

Indeed, the increasing potential for cloning human beings, for genetic engineering, for harvesting organs, and for tissue engineering are going to challenge our most basic conceptions of ourselves as a species. The case for genetic engineering, moreover, exemplifies a tension latent in distinguishing negative ethics from positive ethics (where letting someone die need not be equated with killing them). The replacement of genes that would otherwise give rise to birth defects (such as cleft lips and palates) may not be morally problematical, but replacing genes in order to bring about other traits (such as greater intellectual and athletic ability), which will occur, is already generating concern (Goldberg 1999, Stolberg 2000).

At least three questions might be raised about the position developed in this chapter. The first is that the combination of a commitment to the intrinsic worth of each individual with a commitment to the survival and reproduction of the human species appears to mix together deontological and utilitarian conceptions of morality in a fashion that some theoreticians may find unsatisfactory. Even deontological commitments, however, must take consequences into account, since it follows that treating persons with respect is morally appropriate, while not doing so is morally inappropriate. Actions that have these consequences are moral or immoral, respectively, apart from any utilitarian framework. I thus maintain that the position I defend here is essentially deontological both distributively and collectively.

The second question concerns how thinking about populations is meant to differ from thinking about species. I envision populations as collections of individuals who exist at one time, while a species includes the ancestors and the offspring of a population. The underlying conception, therefore, is that a population is a temporal stage in the evolution of a species. Thus, a proper conception of the connection between ethics and evolution dictates that consideration be given to future generations of existing populations in arriving at decisions that may affect their prospects for reproduction and survival. This is the sense in which we owe it to our offspring to provide them with the resources that are essential to their well-being, at least in the sense of the negative ethic, if not also in the sense of the positive ethic.

The third question concerns what may appear to be tacit commitments to group selection as a mechanism that affects the course of evolution. As many readers are no doubt aware, there is a very strong aversion to group selection among evolutionary thinkers today. But "group selection" seems to occur whenever any arrangement, organization, or cooperation between various conspecifics makes a difference to their prospects for survival and reproduction. Insofar as specific arrangements between conspecifics may influence their evolutionary prospects, therefore, group selection appears to make a difference to the course of evolution (Fetzer 1997). This is one of the more important issues that will be explored in the chapter to follow.

If the conception of evolutionary ethics I have proposed amounts to an adequate theory of morality (however preliminary), then we have general normative premises in relation to which the morality of actions ought to be assessed. Biology and morality, however, are no more always allied than are biology and psychology. Non-moral motives, such as greed and profit-maximization, can override moral ones, just as non-biological motives can override biological ones. Rationality does not entail morality, and morality does not guarantee survival. We can continue to pollute the world and we can continue to run the risk of nuclear war. We have to learn to act in ways that nurture and sustain the species. Even when we understand both biology and morality, therefore, our survival ultimately depends upon our rationality.

CHAPTER 13. BIOLOGY AND SOCIETY.

Another contentious aspect of evolutionary theory shifts attention from the species and the subspecies to smaller groups, where strenuous debate rages over the existence of group selection. Wilson has defined a "group":

(DG) a group =df a set of organisms belonging to the same species that remain together for any period of time while interacting with one another to a much greater degree than with other conspecifics. (Wilson 1975, p. 8)

As he observes, the expression has special utility in describing arrangements of populations in which there exists "a hierarchy of levels of organization constructed of nested subsets of individuals" belonging to that specific population.

Ongoing debates over group selection have generated considerable disparity in point of view over the existence and potential influence of causal mechanisms of this kind in relation to evolutionary phenomena. Given a distinction between <u>units of selection</u> and <u>levels of selection</u>, where the units are what is transmitted from one generation to another, while the levels are the types of causal mechanisms that determine what will be transmitted, the issue revolves about whether there is a "group level" of selection that makes a difference to which units (non-controversially envisioned as <u>genes</u>) are perpetuated from generation to generation and which are not (Brandon 1982 and Brandon and Burian 1984, Part II).

Among the principal contributors to the discussion have been G. C. Williams (1966/96, 1992) and David S. Wilson (1980, 1983). Wilson has advocated the existence of <u>trait group selection</u>, where the members of a group benefit (have their fitness enhanced) by the emergence of a group trait for which there is an underlying gene. Williams, by contrast, considers the fitness benefits of group membership to be adequately captured by "selection based on the success and failure of individuals as influenced by membership in trait groups" (Williams 1992, p. 46). He also suggests that, if trait groups were effective at the level of selection, then they ought to optimize the properties of those trait groups.

Group selection tends to be regarded as an alternative to the mechanisms of selfish genes, kin selection, and reciprocal altruism as kinds of factors that influence the course of evolution. Howard Bloom, for example, has observed, "The goal of the 'group selection squad' is simple: to assure that group selection is accepted as a legitimate phenomenon on a par with individual selection, kin selection, and reciprocal altruism" (Bloom on HBES-L,12 November 1995). Depending upon how group selection should be defined, however, it might be the case that kin selection and reciprocal altruism both qualify as particular kinds of group selection that simply involve relatives, coworkers, or friends.

Others, however, place their greatest emphasis upon altruism. Peter Frost, for example, envisions the crucial feature of group selection as a willingness to make personal sacrificies for the benefit of other members of a group, namely:

> As I understand it, group selection tries to explain altruistic behavior without reference to kin selection, i.e., individuals will do what is best for the survival of the group, even to the detriment of their own survival. (Frost on HBES-L 13 November 1995)

Since the sacrifice that is required might merely consume time, effort, or money, other students of the biology of morality, such as Richard Alexander, regard the sacrifice of genetic self-interest as deserving special attention (Alexander 1987).

1. <u>Group Selection</u>.

Perhaps the most important recent development involving group selection has been the emergence of what are sometimes called new group selectionists, among whom David Sloan Wilson has been prominent. According to D. S. Wilson,

> Whenever an evolving population is subdivided into various groups, the "new group selectionist" examines the relative fitness of individuals within groups and the relative fitness of groups in the metapopulation. If the trait that evolves is neutral or selectively disadvantageous within groups but increases the relative fitness of groups, it is said to evolve by group selection and to be a group-level adaptation. (Wilson on HBES-L,14 November 1995)

Wilson's emphasis upon traits that are neutral or even negative for individuals within groups, but that nevertheless enhance the fitness of those groups with respect to other groups, thus appears to harmonize with Alexander's emphasis.

It might be a mistake, however, to take for granted that group selection has to involve genetic self-sacrifice, when genetic self-sacrifice appears to be rather special from an evolutionary point of view. Some traits that benefit the group could also evolve even though they do not entail genetic self-sacrifice and thus do not qualify as "moral" in that specific sense. Moreover, the use of the phrase, "traits that evolve", harbors an equivocation, because certain traits that evolve may be dispositions to display specific behavior under specific conditions, while other traits that evolve might be predispositions to learn one or another among alternative dispositions to display various behaviors under various conditions.

The difference is whether the same behavior would be displayed by every member of the group (subgroup, or subpopulation) under the same conditions due to a genetic disposition or must be acquired, given a genetic predisposition. Group behavior, in general, appears to involve elements of communication, co-ordination, and cooperation, but those tendencies might be innate or acquired. The hunting behavior of packs of wild dogs in Africa, for example, appears to be an adaptation that qualifies as a genetically-based disposition, whereas team membership in the NBA as a player for the Chicago Bulls, for another, appears to be an adaptation that qualifies as a genetically-based predisposition instead.

These suggestions are closely related to kinds of fallacies group selectionists have sometimes been supposed to be committing. Mario Heilman, for example, has argued that genetically self-sacrificing behaviors are destined for extinction:

> Assume an individual that has a (heritable) propensity to help others at the expense of his/her own reproductive success. This gene will confer less reproductive success compared with those without the gene. Hence, the relative frequency of this gene will decrease with each generation and probably even vanish........ (Heilman on HBES-L,13 November 1995)

In response, however, it could be argued that the extinction of genes for genetic self-sacrifice appears to be a frequency-dependent outcome that would not invariably occur if such a gene were common in the population (as a disposition) or if it were relatively easily acquired and then activated (as a predisposition).

To the extent to which Heilman wants to divorce concern for self-sacrificing behavior from the study of group selection, however, his argument implies that it is mistaken to focus on altruism as its defining property. This contention has been echoed by D. S. Wilson, who makes the point in an explicit fashion, namely:

> A trait can evolve by group selection without being altruistic Regardless of whether altruism is involved, group selection turns groups into adaptive units, just as individual selection turns individuals into adaptive units. Group-level functional organization should be the focus of group selection, not altruism. (Wilson on HBES-L,13 November 1995)

Group-level functional organization, moreover, appears to be affected whenever members of a group fulfill different roles within the group, whether those roles are innate or acquired. The same eleven men, for example, might be organized into a rifle team or a rifle squad, where the latter might have the capacity for kinds of behavior (such as laying down a field of fire) the former would lack.

If group selection crucially depends on altruistic behavior and if behavior is altruistic only when it is self-sacrificing, then the functional difference between the same eleven men organized as a rifle team and organized as a rifle squad is only going to matter insofar as it affects propensities for genetic self-sacrifice. If group selection crucially depends upon functional organization, however, then the functional difference between the same eleven men organized as a rifle team and as a rifle squad may have multiple manifestations. The narrow focus of the altruistic perspective appears to lose sight of broader concern for the adaptive contribution that may depend upon different modes of functional organization.

A latent tension appears to remain in D. S. Wilson's position, however, since differences between various modes of functional organization may increase or decrease the relative fitness of various groups without concern for whether or not those traits (as specific modes of functional organization) are neural or disadvantageous within those groups. If altruism should not be considered to be the defining property of group selection, then it is difficult to understand why propensities for various modes of functional organization should count as bona fide instances of group selection only when they are neutral or disadvantageous within the group. These neutral or disadvantageous properties, after all, would be at the level of the individual and appear irrelevant at the level of the group.

This suggests that several different conceptions of group selection have been run together that require careful disentanglement. The strongest would define "group selection" as entailing innate propensities for genetically self-sacrificing behavior when it is neutral or disadvantageous to the individual but beneficial to the group (Alexander). A more moderate position would define "group selection" as entailing innate propensities for behavior that is neutral or disadvantageous to the individual but beneficial to the group (D. S. Wilson, strong). An even more moderate position would define "group selection" as entailing innate propensities for behavior which is beneficial to the group (D. S. Wilson, weak).

Thus, the more moderate definition of "group selection" does not entail the occurrence of genetic self-sacrifice, while the even more moderate definition does not entail the occurrence of behavior that is neutral or disadvantageous to the individual while benefiting the group. Forms of non-genetic sacrifice at the level of the individual would qualify on the more moderate definition, but no sacrifice at the level of the individual would be required by the weakest thereof. All three definitions, however, retain the conception that group selection presupposes the existence of underlying genes, which makes them all instances of trait group selection in the sense that was introduced above.

When altruism and other forms of self-sacrifice are removed from group selection, it potentially becomes a more robust concept that might apply to a far broader range of behavior than has heretofore been supposed. Williams, however, would remain largely unmoved, insofar as his objections to group selection are mainly based on the lack of permanence of group arrangements. Thus, for example, he has argued that the natural selection of phenotypes cannot produce the kind of differential bias presupposed by evolutionary theory, because phenotypes are extremely temporary individuals formed by interaction between genotypes and the environment. Nor can genotypes themselves, since they too are extremely temporary things (Williams 1966/96, pp. 23-24).

While Williams' arguments appear forceful in support of genes as the units of selection, they do not logically preclude the possibility that groups might be among the levels of selection. Indeed, insofar as mating behavior among the members of sexually reproducing species occurs as a behavioral phenomenon that is not determined phenotypically or genotypically (that is, which individuals engage in mating behavior depends upon environmental factors that are not exhausted by phenotype and genotype), it should be apparent that sexual reproduction contributes to genetic diversity as a function of sexual behavior. Sexual behavior, like other kinds of behavior, is also a transient phenomenon.

If mating behavior is a causal mechanism that contributes genes to future pools in spite of its transient character, however, then that would appear to raise the prospect that other causal mechanisms might have similar effects in spite of their transient character. The competition for material resources that defines natural selection and the competition for sexual resources that defines sexual selection, for example, are transient behavioral phenomena whose consequences for survival and reproduction are nonetheless significant. (A sexual encounter, however brief its duration, may transmit genes.) But in that case, it becomes obscure why the transient status of group arrangements should matter.

Williams' concerns would be well-taken, if the kinds of group arrangements that make a difference to survival and reproduction invariably qualified as innate properties of every member of the group, such as the hunting behavior of packs of wild dogs in Africa. This adaptation appears to be a genetically-based disposition in the sense that both Wilson and Williams require. Membership in the NBA as a player for the Chicago Bulls, however, appears to be an adaptation that qualifies as a genetic-based predisposition instead. It is a transient status that can come and go where it would be at least faintly ridiculous to conjecture the existence of specific genes for membership in the NBA playing for the Bulls.

Membership in the NBA playing for the Bulls, however, no doubt confers a differential fitness benefit that might otherwise be difficult to acquire. (Other high-status positions within society that confer comparable fitness benefits include being movie stars, powerful politicians, or--most similarly--members of popular bands. The status must be something that could but usually does not persist and endure, where these attendant benefits accompany that standing.) In such cases, the presumption that there must be an underlying gene for the group trait may or may not be satisfied: in the case of the wild African dogs, there may be an innate disposition, but not in the case of playing for the Bulls.

If these considerations are well-founded, however, then something appears to be wrong with both Wilson's and Williams' positions. The most that ought to be required for trait selection (in Wilson's sense) to take place would appear to be genes, not for specific dispositions, but for suitable predispositions. Membership in the NBA, after all, presupposes certain rather general athletic capacities that are genetically based, which can be developed into rather specific abilities. And the adaptive benefits accruing from membership in group arrangements do not require that those arrangements have to be persistent and enduring (in William's sense) to promote the survival and reproduction of group members.

If these considerations are well-founded, then it is a mistake to require the existence of genes for group-level adaptations as dispositions rather than predispositions. It is also essential to separate genes for phenotypes from genes for behavior, since genes for phenotypes only determine behavior when that behavior is genetically determined by innate dispositions. In the case of behavioral variability combined with phenotypic similarity, group arrangements can be adaptive and benefit the members of the group by promoting the survival and reproduction of the members of that group as individuals, even if there is no gene for those group arrangements other than as a predisposition.

The difference can be explained relative to the (now familiar) distinction underlying the difference between laws of nature and accidental generalizations. When similar phenotypes display uniform behavior as a function of genetically-based dispositions, then those properties should be described as <u>permanent properties</u> of those genes (at least, under normal environmental conditions). When similar phenotypes display uniform behavior as a result of genetically-based predispositions, however, then those properties should be described as <u>transient properties</u> of those genes. Pack-hunting behavior by wild dogs appears to be permanent, while Bulls' membership is transient.

The crucial difference is that permanent properties are properties which cannot be taken away from the members of a corresponding reference class (defined by a reference property) without taking them out of that class (or denying them that property), while transient properties can be taken away from the members of that reference class without depriving them of underlying reference properties. Pack-hunting behavior by wild dogs would be a permanent property of corresponding genes only if that behavior could only be taken away from wild dogs by changing their genes. Membership in the Chicago Bulls would be a permanent property of corresponding genes if that behavior could only be taken away from members by changing their genes.

The crucial property of group selection thus does not appear to revolve about the existence of genes for specific group traits, as Wilson and Williams mistakenly suppose, because those traits may be rooted in genes that merely predispose individuals for membership in those groups. In cases of this kind, there are no underlying genes for those specific traits as dispositions but only as predispositions, where those specific traits are learned or acquired rather than genetic and innate. It would be absurd to deny that the predispositions themselves are genetic and innate, but the distinction hinges on whether the members of groups can only benefit (have their fitness enhanced) when there is an underlying gene for the group trait that enhances these members fitness.

Once it becomes apparent that genetically-based dispositions are possible but not required and that genetically-based predispositions are sufficient for those group traits to emerge (under appropriate environmental conditions), it also becomes apparent that, for group traits to become effective at the level of selection, those group arrangements need not persist and endure as properties of the members of those groups. Membership in these groups can be beneficial even though it may be a temporary and non-permanent standing which is not rooted in genetically-based dispositions. From this perspective, therefore, the underlying conception embraced by Wilson and Williams seems to be wrong.

The consequences of this misconception are widespread. Richard Dawkins (1976, 1982), for example, has suggested that, for a group trait to evolve, it must be possible for each member who possesses the trait to recognize the presence or absence of other members who possess that same trait. Thus, if pleiotropic genes for a group behavioral trait had easily recognized phenotypic manifestations (such as a green beard), presumably it would be relatively easy for one member of the group to recognize other members of the group, which has come to be known as "the green beard effect". The same function, however, could be fulfilled by transient practices, such as wearing red shirts, where fitness benefits are conferred in spite of the absence of specific genes.

What seems to be crucial to group selection, therefore, is not the existence of an underlying gene for specific group traits, but instead the emergence of properties that make a difference to the prospects for survival and reproduction of the members of the group that would not exist apart from those group arrangements. These group arrangements may be rooted in genes for specific dispositions, as in the case of pack hunting by wild dogs, or in genes for predispositions, as in the case of membership in the Chicago Bulls. Wild dogs could not bring down antelope and other game, were they consigned to hunting one-by-one. And Michael Jordan, Scottie Pippen, Dennis Rodman, Ron Harper, and Tony Kukoc could not play basketball apart from being organized into a team.

Communication, coordination, and cooperation thus tend to distinguish the interactions between group members, yet they are not the key to understanding the nature of group selection. The members of a rifle team, for example, contribute scores to the team's total, where communication, coordination and cooperation are important to their success (such as being in the right place at the right time, firing in the proper sequence at the right target, and conveying your score to officials as required). Yet each shooter fulfills the same role as a member of that team. Apart from their cumulative scores, which are added together to sum the team's score, none performs a different role than the others.

The members of a rifle squad, by contrast, fulfill different roles (as point men, machine gunners, radio operators and squad leaders) making it possible for them to bring about specific effects (such as laying down an ambush, for example) that would not occur absent those arrangements. Unlike membership in a rifle team, where the same effects are brought about by each member of the team, the effects that are brought about by membership in a rifle squad are brought about though causal interaction between the effects that are brought about by each member of the squad. These properties appear to be different in kind from those that would otherwise exist (Fetzer 1986).

The crucial features of group selection thus appear to include: (a) the existence of arrangements of two or more conspecifics, where these may be either transient or permanent in relation to underlying genes, for example:

families	**towns**
gangs	**states**
tribes	**religions**
bands	**cultures**
. . .	. . .

(b) these arrangements must bring about "emergent properties" that differ in kind from those that the members of any such groups could have brought about absent those arrangements; where (c) these emergent properties sometimes but not always promote the survival and reproduction of the members of these groups, where selection favoring the group need not invariably occur.

Thus, consider, for example, the Shaker Cult, which was a religious group that believed sexual relations were an evil thing. Whenever they felt sexual urges overcoming them, the Shakers would get together and "shake off" the temptations of the flesh. This behavior appears to be most unlikely absent membership in such a group but, equally clearly, it does not promote the survial and reproduction of the members of the group. Illustrations such as this suggest (d) group selection by virtue of emergent properties brought about by transient arrangements of members of groups are crucial to cultural evolution in species, such as humans, at least some of whose behavior is non-instinctual.

Instinctual behavior thus should be understood to be behavior for which there are underlying genes making similar behavior under similar conditions a permanent property of every similar phenotype within the species. Sometimes, therefore, there may be evolved genes for group-level arrangements:

ants	**wasps**	**termites**

And yet other times there may be no corresponding gene for group properties:

English **German** **French**

Some species, such as humans, may have capacities for complex social arrangements even in the absence of underlying genes for those specific arrangements:

Red Cross **Marines** **Mafia**

Of course, some group-level arrangements may have few genetic consequences:

chess clubs **quilting groups** **orchestras**

Thus, group selection appears to be simply one more causal mechanism affecting which genes are perpetuated from pool to pool across time, which does not presuppose the existence of corresponding genes for those specific group traits.

2. <u>Non-Reductionism</u>,

Taking for granted that genes are the units of evolution and that changes in gene pools across time appropriately defines the course of evolution, the kinds of causal mechanisms that affect this process appear to fall into two categories, namely: causal mechanisms that affect <u>genetic diversity</u> (including genetic mutation, sexual reproduction, genetic drift, and genetic engineering), on one hand, and causal mechanisms that affect <u>genetic endurance</u> (such as natural selection, sexual selection, and artificial selection), on the other. The question that finally arises at this point thus appears to be, "Does group selection belong on this list?", where the answer depends, at least in part, upon pragmatic objectives and goals.

The first point to be made within this context is that the phrase, "natural selection", seems to be ambiguous, sometimes subsuming every mode or mechanism that contributes to the evolution of species, including all of the above. In a narrower sense, "natural selection" applies specifically to competition between conspecifics for material resources, such as food and shelter, where other forms of competition, such as sexual selection, are separated from natural selection as such. The second is that whether group selection should be "accepted as a legitimate phenomenon on a par with individual selection, kin selection, and reciprocal altruism" depends (at least, in part) upon precisely how those modes or mechanisms are envisioned as fitting into the broader scheme of evolution.

Individual selection for material resources, after all, is part and parcel of natural selection, where kin selection and reciprocal altruism seem to qualify as special varieties of group selection. Both involve arrangements of two or more conspecifics in permanent or transient relationships or arrangements, which bring about emergent properties (differential treatment) with fitness benefits that would not occur absent those relationships or arrangements. It thus appears to be appropriate to conclude that, when properly understood, group selection not only exists on a par with kin selection or reciprocal altruism but actually subsumes them, which indicates the importance of its role.

The human species appears to be well-positioned to take advantage of the benefits afforded by membership in groups, where group membership may be regarded as an evolutionary strategy. As Harmon Holcomb has observed,

> Humans are uniquely intelligent among species, permitting a novel kind of selection, one that does not require genetic differences of the kind that underlie ratios between within-group and between-group fitness effects (as does D. S. Wilson's theory, Wilson and Sober 1994). Instead, any number of us could get together, identify ourselves as a group, and think up a strategy to outcompete other groups by regulating behavior toward in-group and out-group members ....There is no theoretical reason to rule out evolutionary strategies as conscious choices among human beings that bypass the usual restrictions on genetic group selection. (Holcomb 1996, p. 15)

Holcomb thus appears to understand clearly that the existence of group traits does not presuppose the existence of underlying genes for those group traits, where group selection nevertheless can occur by benefiting group members.

Other examples can be drawn from the lowest species to the highest. Consider Howard Bloom and Mike Waller's observations about Bacillus subtilis:

> If a prolonged food shortage stimulates the Bacillus subtilis to emit a signal of repulsion that impels approximately 10,000 groups of cells to start foraging, which is not a random procedure but rather activates an inbuilt search pattern that ensures each group explores a different piece of territory, thereby maximizing that chances that the colony as a whole will discover what it needs, then this group adaptation would appear to be one which has evolved into a gene for a specific group-level adaptation. (Bloom and Waller hbe-l, 30 June 1996)

This appears to be an example that would satisfy even the strict constraints of Wilson's narrow notion of group trait selection based on underlying genes.

Equally fascinating illustrations can be derived from the history of religion among the Homo sapiens. Consider, for example, John Hartung's observations:

> Rules against murder, theft, and lying codified by the Ten Commandments were intended to apply only within a cooperating group for the purpose of enabling that group to compete successfully against other groups. In addition, this in-group morality has functions, both historically and by express intent, to create adverse circumstances between groups by actively promoting murder, theft, and lying as tools of competition. Contemporary efforts to present Judeo-Christian in-group morality as universal morality defy the meaning of the texts upon which Judaism and Christianity are based. (Hartung 1995, p. 86)

Examples such as these suggest that group selection—possibly in forms that also appear to exemplify limited utilitarianism—is not only important to the evolution of species, but that its existence is crucial to the evolution of culture.

When arrangements of individuals into different groups brings about the existence of abilities and capabilities that otherwise would not exist, then the occurrence of "emergent properties" has taken place. Because the differences between these groups may involve the very same individuals and vary only in the ways in which they are arranged, these properties cannot possibly be reducible to those of lower levels, whether in the case of cultures to groups (of anthropology to sociology) or of groups to individuals (of sociology to psychology), no less than of behavior to phenotype and of phenotype to genotype. The existence of emergent properties at each higher level ultimately undermines reductionism as an impoverished program of scientific investigation and as an unworkable framework for understanding the sciences of society.

Thus, as a "rule of thumb" that serves as a usually reliable but not therefore infallible indicator of the presence or absence of a property, attributes are "emergent" when their existence arises as a consequence of a division of labor in the absence of which such effects would not occur (Fetzer 1998b). At the level of groups, these divisions of labor occur between conspecifics and are displayed in virtually every aspect of human society--from reproduction and child-rearing itself to hunting and gathering to group arrangements for social, economic, and political purposes on to organizing for scientific, educational, and creative purposes. Effects, such as the music of a symphony, that could not occur but for a division of labor between the members of the group that bring it about, are emergent and non-reducible properties.

In Consilence (1999), E. O. Wilson endorses "reductionism" in two different senses, namely: as a process of analysis and synthesis, of taking things apart and putting them back together again; and, as a process of reducing laws at one level to those at a lower level, thereby acquiring broader and deeper understanding (Wilson 1999, pp. 59-60). In the first sense, "reductionism" typifies research. But, if many of the phenomena of chemistry are emergent relative to those of physics, of biology emergent relative to those of chemistry, and of psychology, sociology, and anthropology emergent relative to those of biology—which, in general, appears to be the case—then "reductionism" in the second sense cannot be sustained. In the first sense, "reductionism" is true but trivial, while in the second, it is significant but false.

It does not follow that reductions in the second sense never occur. Even in the context of evolutionary biology, although selection operates at the level of behavior for all organisms, higher and lower, for the lower species, where every member having the same phenotype displays the same behavior, it is convenient to consider selection as operating at the level of the phenotype. Moreover, a reduction of the number and variety of regularities that require independent explanation has been offered as a driving force behind science. Michael Friedman, for example, has remarked, "science increases our understanding by reducing the total number of independent phenomena that we have to accept as ultimate or given" (Friedman 1974, p. 15), which is a very appealing conception that appears to capture the spirit of Wilson's attitude.

From the perspective of inference to the best explanation, indeed, Friedman appears to be correct, but not for the reason he suggests. Just as the requirement of maximal specificity asserts that a lawlike sentence cannot be true when it is not maximally specific, the requirement of strict maximal specificity denies that an explanation can be adequate when the antecedents of the laws that occur in their premises include predicates describing properties that are nomically (or causally) irrelevant relative to their explanandum outcomes. This implies, as Wilson suggests, that theoretical unification occurs whenever diverse phenomena can be subsumed as explananda for the same explanans, where "theoretical unification" occurs as a manifestation of lawful reduction.

As properties that were previously believed to be relevant to the occurrence of an attribute are discovered to be irrelevant, therefore, the outcome will tend to be laws of potentially broader scope that ordinarily reduce the number and variety of independent phenomena in Friedman's sense (Fetzer 1993, p. 146). The conception of science as aiming at the discovery of laws of nature to secure the benefits of testable explanatory theories by means of abductive procedures based upon inference to the best explanation thereby promotes unification as well. But, even though reduction in this sense may sometimes occur, the existence of laws and the adequacy of explanations do not depend upon it. The proper approach, therefore, appears to be to adopt the non-reductionist attitude of accepting science with or without reduction.

The most striking ramifications of Wilson's conception of epigenetic rules, no doubt, become important in contemplating those arrangements of groups that constitute societies. He has enumerated some of (what he takes to be) the most important evolutionary findings that impact on society, where the following brief paragraphs summarize his summaries (1999, pp. 183-186):

(1) kin selection, according to which human beings have the tendency to help others in relation to their genetic proximity, where the greater the genetic similarity, the stronger the tendency to help, with consequences for understanding altruism, patriotism, ethnicity, inheritance, adoption, and such;

(2) parental investment, according to which parents tend to adopt family procreation and rearing practices, such as the r-selection (having numerous offspring, but investing little in each) and K-selection (having few offspring, but investing a great deal in each), with consequences of understanding sex ratios, marriage contracts, parent-offspring conflicts, child-abuse, infanticide;

(3) mating strategies, according to which the differential contributions of male and female partners to sexual reproduction promotes understanding of mate choice and courtship, relative degrees of sexual permissiveness, paternal anxiety, exploitation of women, polygamy and polygyny, and adultery;

(4) status seeking, according to which, whether by rank, class, or wealth, humans tend to pursue different roles and positions within society, which have consequences for their propensities to survive and reproduce, where high status in males is also correlated with greater sexual access to women;

(5) territoriality, according to which bands, tribes, cities, states, and other social groups tend to defend and expand their domination and control over geographical regions, which appears to be a "density-dependent" phenomenon as a function of carrying capacity in relation to a variable population;

(6) contractual agreements, according to which all mammals, including especially humans, form societies for selfish reasons, including enhanced personal survival and reproductive success, unlike worker ants and other social insects, who are willing to sacrifice themselves for the common good.

Active research programs within the general domain of gene-culture coevolution are exploring each of these areas, some with considerable success, an exemplar of which may be found in L. Betzig, M. B. Mulder, and P. Turke, eds., Human Reproductive Behavior: A Darwinian Perspective (1988). What makes these approaches distinctive in kind from more traditional research in the areas of psychology, sociology, and anthropology, of course, is the adoption of an evolutionary perspective on the phenomena, by appeals either to Darwinian algorithms or to epigenetic rules, where the effects of evolution operating across substantial intervals of time affect present human behavior.

The properties of algorithms as effective decision procedures are such that they can always be relied upon to provide a correct solution to a problem in the classes of problems to which they apply. As causal processes, therefore, they must be deterministic and yield the same outcome under the same conditions, unless every outcome is equally satisfactory, as in some cases with flipping a coin. Otherwise they sometime succeed but sometimes fail. As probabilistic processes, they might have any value for success and failure between 0 and 1, with propensities for success equal to n and for failure equal to 1 - n. They are clearly not the same. If the tendencies alluded to in (1) through (6) are of universal strength, for example, they can have no exceptions; but if they are probabilistic, then they can. Processes that are probabilistic cannot be algorithmic.

This makes an enormous potential difference to the empirical testability of epigenetic hypotheses and therefore to the scientific standing of gene-culture co-evolutionary theory. Consider, for example, potential conflicts between (1) kin selection and (2) parental investment. According to (1) human beings are disposed to help others in relation to their genetic proximity, while according to (2) parents tend to adopt family procreation and rearing practices, such as r-selection and K-selection. Few relatives stand in as close genetic proximity as offspring to their parents. If (1) were interpreted deterministically, therefore, it would be falsified by a single instance of a parent killing a child or conversely. And if (2) implies that some parents are predisposed to have numerous offspring but invest little in each, while others are predisposed to have few offspring but invest a great deal in each, how can (2) be reconciled with (1)?

The ease with which apparent inconsistencies can be generated when these rules are interpreted deterministically can induce skepticism and dismay. But many factors influencing human behavior are subtle and complex. They may plausibly be interpreted probabilistically as contributing and as counteracting factors that, in totality, have to satisfy the requirement of maximal specificity. With his customary candor—a display of the honesty that typifies great men of science—Wilson openly admits that our state of knowledge is not complete:

> The epigenetic rules that guide behavioral development are also largely unexplored, and as a result the exact nature of gene-culture co-evolution can, in most cases only be guessed. It makes all the difference in the world whether epigenetic rules are rigid, specialized functions of the brain, and thus resemble animal instinct, or whether they are more generalized rational algorithms that function across a wide range of behavioral categories. The evidence to date shows that both kinds of epigenetic rules, broad and narrow, exist. (Wilson 1999, p. 187)

Analogously, of course, it could be the case that most epigenetic rules happen to be probabilistic, but that some, such as "cheater detection mechanisms", are not.

Indeed, the strongest case for the existence of Darwinian algorithms as rigid, specialized functions of the brain that resemble "animal instincts" has been that advanced by Cosmides and Tooby (1992, p. 206), who offer the following claims:

1. The algorithms governing reasoning about social contracts include inference procedures specialized for cheater detection.
2. Their cheater detection procedures cannot detect violations that do not correspond to cheating (such as mistakes).
3. The algorithms governing reasoning about social contracts operate even in

unfamiliar situations.

4. The definition of cheating that they embody depends on one's perspective.
5. They are just as good at computing the cost-benefit representations of a social contract from the perspective of one party as from the perspective of another.
6. They cannot operate so as to detect cheaters unless the rule has been assigned the cost-benefit representation of a social contract.
7. They embody implicational procedures specified by the computation theory (e.g., "If you take the benefit then you are obligated to pay the cost" implies "If you paid the cost, then you are entitled to take the benefit").

These are rather strong claims, of course. They imply a capacity for the adoption of multiple perspectives and for formal cost-benefit reasoning that appears to go far beyond ordinary abilities; they do not explain how we discriminate between deliberate "cheating" and accidental "mistakes"; they contradict the obvious risks of dealing with unfamiliar parties in unusual conditions; and they commit logical blunders regarding the logic of duties and obligations that undermine their theory.

Wilson praises Cosmides and Tooby for their work on cheater detection, according to which "domain-specific" as opposed to "general purpose" reasoning modules have developed during the course of evolution, where "one capacity, the detection of cheating, [has] developed to exceptional levels of sharpness and rapid calculation" (Wilson 1999, p. 186). Anyone who really believes this, however, must be unaware of the prevalence of deceitful politicians, wayward spouses, and used-car salesmen, whose cheating often goes undetected, yet Cosmides and Tooby's research on cheater detection mechanisms is considered the foundation of "evolutionary psychology". It is supposed to provide the strongest and most convincing evidence in support of "evolutionary psychology" in those versions dominated by "Darwinian algorithms".

Moreover, the ability to detect cheating appears to depend upon special kinds of knowledge that both parties may not share. Focusing on specific cases that are governed by written contracts, such as the purchase of a used car, for example, the detection of cheating presupposes knowledge about the actual value of the vehicle, about a fair mark-up (or profit margin), and about prevailing market conditions. Unless you have done considerable homework and possess knowledge that is not common, you will be ill-positioned to make reliable judgments regarding cheating. Indeed, unless you also know the salesman's state of mind, you will be unable to ascertain whether an inflated sales price is deliberate or merely mistaken. Thus, there are reasons to doubt that a mechanism of the kind they describe even exists.

Since mechanisms of the kind they define have no basis for discriminating between deliberate cheating and accidental mistakes, it should be obvious that they cannot guarantee success in detecting cheating. Cheater detection is therefore not deterministic and cannot possibly qualify as algorithmic. But my concern is less for the shortcomings of this research program (Davies, Fetzer, and Foster 1995) than it is for gene-culture co-evolutionary theory and especially the notion of epigenetic rules. In one place, Wilson describes these rules as encompassing:

> the full range of inherited regularities of development in anatomy, physiology, cognition, and behavior. They are the algorithms of growth and differentiation that create fully functioning organisms. (Wilson 1999, p. 163)

In another place, however, he portrays them instead as only "rules of thumb":

> They are rules of thumb that allow organisms to find rapid solutions to problems encountered in the environment. They predispose individuals to view the world in a particular innate way and automatically to make certain choices [in mating, etc.] as opposed to others (Wilson 1999, p. 210)

Even if cheater detection mechanisms are not deterministic, they could still be probabilistic without reducing to "rules of thumb" that have arbitrary exceptions.

The general situation is evident. (a) Most mental processes, including dreams, daydreams, perception, memory, and even ordinary thinking—are non-algorithmic, as earlier chapters have explained. But the possibility remains that other thought processes might still be algorithmic. (b) The specific cheater detection mechanism Cosmides and Tooby propose, however, is not an algorithm for detecting cheating, since it is unable to differentiate deliberate "cheating" from accidental "mistakes" and depends upon special kinds of knowledge. (c) And even if such an algorithm had evolved during more primitive times, it could be highly unreliable today due to changes in the conditions of social exchange, just at the things we tend to fear today not highly correlated with risk conditions to which we are exposed (Vendatum 1996).

Darwinian algorithms may or may not exist, but the arguments that Cosmides and Tooby have advanced in their support based upon "cheater detection mechanisms" are theoretically flawed and empirically suspect. In the absence of stronger arguments for the existence of Darwinian algorithms, Lumsden and Wilson's conception of epigenetic rules should be preferred, especially because they are not envisioned as algorithms that produce a correct solution to a problem in every case in a finite sequence of steps. They are lawful processes that operate under variable conditions to produce outcomes within particular norms of reaction. They are consistent with negative outcomes as well as positive ones and may be interpreted probabilistically. They are causal laws that govern events that occur as effects during the world's history. They can be easily confused with algorithms. But these norms are descriptive, not prescriptive, and afford a more adequate foundation for the sciences of behavior.

3. <u>The Moral Society</u>.

There should also be no doubt that societies as collections of members of the human species have to be arranged in ways consistent with the natural laws of human beings. This has been a traditional conception of cultural anthropology, notable, for example, in Bronislaw Malinowski, <u>A Scientific Theory of Culture</u> (1960). Malinowski advanced two axioms, first, that every culture must satisfy the biological system needs, including those dictated by metabolism, reproduction, and physiology; and, second, that every cultural achievement involving the use of artifacts and symbolism is an instrumental extension of human anatomy (Malinowski 1960, p. 171). Here the first of these axioms matters and not the second. Indeed, it is fascinating to compare Malinowski's inventory of types of biologically-required social institutions and biologically-evolved epigenetic rules.

Malinowski suggested that every human culture must include certain rather general types of institutions as structures that fulfill specific biological functions. He differentiated the institutional types from the functions they were to fulfill, where the FUNCTIONS appear capitalized: REPRODUCTION (family, courtship, marriage contracts, extended families, other relations); TERRITORIAL (nomadic hordes, roaming bands, villages, towns); PHYSIOLOGICAL (primitive sex totemic groups, groups based on age, sex, health); VOLUNTARY ASSOCIATIONS (primitive secret societies, clubs, athletic teams); OCCUPATIONAL AND PROFESSIONAL (economic teams, schools, courts, police, army); RANK AND STATUS (caste systems, racial and cultural stratification into groups); COMPREHENSIVE (tribes, enclaves of minorities, political units, parties, states, nations) (Malinowski 1960, pp. 62-65).

With respect to REPRODUCTION, for example, epigenetic rules concerning kin selection, parental investment, and mating strategies would potentially impact upon an adequate understanding of how specific institutions within a society contribute to fulfilling this biological need. From this perspective, gene-culture co-evolutionary theory appears to effect an internalization of social arrangements that are biologically required so that, instead of being properties of collections of members of the group collectively, they become properties of individuals for for participating in those social arrangements as dispositions (in the case of the lower species) or as predispositions (in the case of the higher species). In order for genes to exert their influence upon behavior, they must produce phenotypes that are disposed or predisposed to engage in behavior of the appropriate kind.

The group arrangements that makes the greatest difference to most members of a population, no doubt, are those that control the distribution of economic resources within that society, understood as a group of individuals who belong to the same species and are organized to promote cooperation (Wilson 1975, p. 7). Among the most important properties of such a society are those that facilitate communication, which includes the creation, transmission, and perpetuation of linguistic and other conventions by means of institutions. A

society in which its members cannot communicate is a society that is going to encounter difficult—potentially insuperable—problems in attaining its objectives. Communication is important because communication facilitates cooperation, and cooperation is indispensable to the attainment of community goals.

That societies can be fractured along religious, racial, or economic lines is not news. What matters is how that society responds to the divisions that it confronts, which are pragmatically dependent upon its aims, objectives, and goals. The political alternatives range from anarchy and communalism on to democracy and plutocracy to aristocracy and monarchy to fascism and totalitarianism (Facione et al. 1978, Ch. 7). The underlying questions of value in organizing a society to attain its objectives include the adoption of particular conceptions of distributive justice (for allocating benefits and burdens, especially economic), including of retributive justice (for undeserved benefits) and of compensatory justice (for undeserved burdens), matters characteristically governed by the laws of each society as forms of public commitment.

The United States, for example, was founded on the basis of The Declaration of Independence, which asserts that all men are created equal and that they are "Endowed by their Creator" with certain inalienable rights, including Life, Liberty, and the Pursuit of Happiness. The notion "all men are created equal" is obviously <u>not</u> a descriptive assertion about the relative abilities of various members that society, because they differ not only in their genetic or innate physical and mental capacities but also in their learned or acquired educations and attainments. The notion has to be understood as intended to have a normative dimension. It has something to do with their equal standing before the law <u>in spite of</u> their differences in relation to any innate or acquired abilities.

Laws of societies, unlike laws of nature, of course, can be violated and can be changed. They are transient, rather than permanent, properties of a population, which may or may not be subject to revision by reform as opposed to alteration by revolution. It depends upon historical conditions, including the customs, traditions, and practices of that society. Thus, the proclamation that all men are endowed with certain <u>inalienable rights</u> represents a conception of how a society ought to be organized as a normative ideal. It reflects a commitment to conduct that society (though the adoption of suitable policies, procedures, and laws) in such a fashion as to promote those aims for the members of that society, not just for <u>some</u> of its members, moreover, but for <u>all</u> of them—although at the time slaves were not citizens and women not allowed to vote!

The adoption of such a conception, from a biological perspective, represents the adoption of an evolutionary strategy, which indicates the commitment of that society to a distinctive approach toward promoting the survival and reproduction of its members. A moral society presumably would maintain that each member of its group should be treated as an end—as endowed with inalienable rights—and never merely as a means. Not all societies are moral, but any that are committed to treating their members with respect. The question that arises at this juncture thus becomes how to translate that attitude into practice by adopting specific policies and procedures intended to insure that those members are treated with respect. The right to life, liberty, and the pursuit of happiness are meaningless if society cannot afford the conditions of their fulfillment.

The term "afford", within this context, exudes ambiguity. What a society can or cannot pay may or may not coincide with what a society should or should not provide with respect to the financial burden of supporting the conditions for the fulfillment of these rights. Inequalities of distribution of wealth in this society, for example, are extreme (Wolff 1996). Even newspaper accounts report that, "The gap between the rich and the poor has grown into an economic chasm so wide that this year the richest 2.7 million Americans, the top 1 percent, will have as many after-tax dollars to spend as the bottom 100 million" (Johnston 1999). Current changes in tax policy continue to benefit the rich, even though the adverse consequences of economic disparities of this order are well known, including effects upon health, longevity, and social cohesion (Wilkinson 1996).

It appears painfully obvious that appropriate tax policies, including the taxation of wealth rather than of income, can provide benefits for society that regressive taxation cannot provide. (To paraphrase Sutton, we should tax the rich because that's where the money is!) But the proper role of government, which is to raise revenues through taxation and make expenditures through spending on behalf of the public interest, requires clarification. (Those who attack "taxing and spending", therefore, are attacking the very rationale for which government exists, perhaps because they are ethical egoists and their conception of their own personal interest conflicts with the public interest.) But precisely what is "in the public interest" is a matter that invites debate.

For a society committed to certain inalienable rights, including life, liberty, and the pursuit of happiness, it would appear contradictory to deny that society thereby assumes certain obligations to its members by providing (what might be described as) the preconditions for the attainment of society's goals. A distinction, however, might well be drawn between their biological needs and their psychological wants. The desire for food, shelter, and health seem to be biological, while the desire for fame, fortune, and happiness are not. Food, shelter, and health are or appear to be necessary conditions for survival and reproduction, while fame, fortune, and happiness are not. Indeed, the vast majority of the world's population survives and reproduces in spite of living a rather miserable life. Happiness is not necessary for procreation.

Nevertheless, we are inclined to think that fame, fortune, and happiness are important as values of a different kind. Biological motives as needs—as needs of individual organisms to survive and of groups to reproduce—entail rights and obligations. (More precisely, they entail rights and obligations for intrinsically valuable species.) Biological needs clearly seem to be more fundamental than psychological wants. Consider, for example, the phrase "need to be wealthy" versus the phrase "need to be healthy". While it makes sense to say of an individual that he needs to be healthy, it sounds odd to say that someone needs to be wealthy. This is so notwithstanding that a person may become accustomed to a certain "quality of life" and to affluence and wealth.

Psychological desires, by contrast, presume opportunities for their fulfillment. Compare, for example, the opportunity to be healthy versus the opportunity to be wealthy. We think that we are entitled to something far stronger than merely the opportunity to be healthy. Perhaps we are entitled to have fulfillment of our need to be healthy combined with—to whatever extent it can be accommodated—opportunities to be wealthy, to be famous, to pursue happiness. But it still seems to be the case that biological needs come before psychological wants. If this line of reasoning is correct, however, then one way to envision the rationale for the organization of society that would harmonize with deontological conceptions is that society should strive to coherently fulfill unfulfilled needs and promote opportunities for the populations they represent.

Promoting opportunities for the members of the population no doubt entails other rights and obligations. The "pursuit of happiness" becomes no more than an insignificant phrase or an empty promise if society cannot provide the most basic ingredients required for undertaking that objective. They include a level of education appropriate to social expectations with respect to the use of language and mathematics for commerce and communication and a suitable background with respect to science and technology, on the one hand, and history and current events, on the other. Public education is not enough for citizens to pursue happiness unless discrimination is discouraged and suitable wages are available. No one is promised happiness, but opportunity should abound.

The most important and least understood dimension of freedom, moreover, is that each of us is unfree to do things for which we lack suitable resources, including economic. The operable concept here is effective freedom, namely: possessing the means necessary to accomplish one's aim, no matter what that might be (Facione, Schere, Attig 1978, p. 119). Among the policies a society might adopt to increase effective freedom, for example, are the formation of labor unions, unemployment insurance, retirement insurance, equal employment opportunity, equal educational opportunity, progressive taxation with graduated rates, inheritance taxes, corporation taxation, and other measures.

The choices that societies confront with respect to their core values, which ultimately motivate their economic policies and political actions, are for that reason also ideological and obviously subject to debate. Because our basic ideological commitments are reflected by The Declaration of Independence and the Constitution of the United States, few of us tend to reflect upon the most basic ideological choices that we confront (Goodin and Pettit 1993; Funderburk and Thobaben 1997). Occasionally, however, circumstances confront us in ways that we might prefer to avoid but then have no choice. Such appears to be the case with respect to the publication of Herrnstein and Murray's The Bell Curve (1994).

The debate over its methods and findings has been intense, but an important distinction needs to be drawn between two different questions implicitly at stake:

(Q1) What cognitive properties, if any, might distinguish the various races?

and, should scientific inquiries substantiate the conclusion such differences exist,

(Q2) What should society do in response to the discovery of such differences?

There has been a tendency, alas, to assume that the policy options Herrnstein and Murray (1994, Part IV) propose are our only alternatives. As Clark Glymour (1998) has observed, there are at least three alternative responses to these findings:

(A1) the custodial state, in which the cognitive elite promotes an expanded welfare state for the cognitive underclass "in which the rich and competent support the many more who are poor and incompetent" but are regarded as "valued members";

(A2) the adoption of "nationalized, serious, educational standards, tax-supported day and night care, minimal universal health care, a living minimum wage, capital invested in systems enabling almost anyone with reasonable training to do a job well";

(A3) government withdraws its support and "does not promise children safety, or nutrition, or education, and does not guarantee adults a living wage, minimal health services, or security against the hazards of industry" (Glymour 1998, pp. 30-31).

The name, "the custodial state", is their designation for the alternative that they predict, not the one that they consider to be the most virtuous, which I presume would be (A2).

Many problems that societies confront, including the quality of the air we breathe, the purity of the water we drink, and the quality of the food we eat, are biological problems, but their solutions—which involve the allocation and reallocation of scarce resources within the community—are clearly political. It would be at least faintly absurd, no doubt, to suggest that society has a duty to promote the reproduction of each of its members distributively. But it is not so obviously absurd to suggest that society has a duty to promote the reproduction of its members collectively, or else suffer the consequence of its own demise. Finding coherent solutions to these problems requires political decisions, moreover, since political decision-making is the procedure that we employ in dealing with the allocation and the reallocation of public resources.

A moral society, from this point of view, might appear to conflict with our knowledge of evolution. If human beings were nothing more than Darwin machines, for example, it might be appropriate to consider competition between human beings as a struggle for survival in which the fittest—and only the fittest—should prevail. But we have already found that even evolution does not strictly adhere to this conception, in part because of the influence of random and of accidental factors, in part because of the probabilistic character of its causal mechanisms. Our capacity for rationality provides the opportunity for us to go beyond our biology and treat other members of our species as we ourselves would like to be treated in times of need—with mercy and compassion.

Examples of the kinds of benefits that might be derived from the study of racial differences are gradually making their way into the public domain. A review of the effectiveness of protein-specific antigen (PSA) tests, for example, mentions in passing, "Blacks tend to develop more aggressive prostate cancers and at a younger age" (Kolata 2005). The ramifications for a good society are obvious, since it follows that Blacks should be given earlier and more frequent tests to enhance their potential to cope with prostate cancers, in accordance with deontological principles. The apparent discovery that a new heart drug, "BiDil", has benefits for Blacks not equalled by its benefits for other races even made the front page of *The New York Times* (Saul 2005). As knowledge of race-based differences increases, it should become more and more common to utilize the most effective treatments across a broad spectrum of problems for specific races as solutions that are morally-appropriate, cost-effective, and in the public interest.

Indeed, as George C. Williams (1989b) has observed, the attitude known as "Social Darwinism", according to which every individual should sink or swim on their own without support from their community, cannot be justified even on evolutionary grounds. He remarks on the views of George Bernard Shaw:

> As Shaw saw so clearly, there is no level of inclusiveness of selected entities at which the survival of the fittest is morally acceptable. The morally acceptable goal in relation to survival has to be "the fitting of as many as

> possible to survive". . . So I conclude that natural selection really is as bad as it seems and that, as [Thomas] Huxley maintained, it should be neither run from nor emulated, but rather combated. (Williams 1989b, p. 196)

Thus, as Chapter 12 explained, the biological mechanisms of selfish genes, kin selection, reciprocal altruism, and even social cooperation are unable to satisfy sufficient conditions for morality, which, indeed, transcends biology.

Democracy, as many have observed, is not the most efficient, effective, or reliable method for arriving at political decisions. Benevolent dictatorships, for example, have been extolled as comparatively more virtuous in this sense. But when it comes to arriving at political decisions that affect the allocation and reallocation of public resources, democracy can claim a rationale that no other form of government provides, namely, that, in making decisions that have consequences for every member of society, every member of society has a right of participation. The coherent political reconciliation of our biological needs with our psychological wants may pose challenges that we would prefer not to confront but also offers opportunities to demonstrate to ourselves that we are not only products of our evolutionary past but capable of contributing to our future in securing the blessings of freedom and liberty for ourselves and our posterity.

CHAPTER 14. THE ETHICS OF BELIEF

We act on our beliefs. When our beliefs are true, our actions are, in those respects, appropriately guided. Whey they are false, they are, in those respects, inappropriate and misguided. A pragmatic conception of truth maintains that beliefs are true to the extent to which they provide appropriate guidance for action (Fetzer 1990). Truth, like directions themselves, is therefore amenable to degrees, where, relative to our objectives and goals, the more appropriate the guidance beliefs provide, the greater their truth. Truth may also be identified with correspondence to reality or, more broadly, with the way things are, a far more traditional conception, which explains why truths, which correspond with reality, provide appropriate guidance for actions.

Because we act on our beliefs, beliefs have causal consequences in the world that go beyond their merely logical implications. If we believe that abortion is murder, for example, and that doctors who perform them are "baby killers", we may even be disposed to take matters into our own hands and kill the killers of the innocent unborn—all in the name of "life". Just as our actions must be moral to be worthy of praise rather than of condemnation, however, so too must our beliefs be worthy of acceptance rather than of rejection or—which for many may be far more difficult—suspension of belief. According to a principle known as *the ethics of belief* (Clifford 1879), we are morally entitled to hold a belief only when we are logically entitled to hold that belief. This principle sounds simple, but its effects can be profound.

An alternative approach known as *the will to believe* (James 1897) holds that in some cases a belief may be worthy of acceptance even if there is no empirical evidence in its support, especially when the causal consequences of adopting that belief are beneficial. Belief in God might be said to be justified because it makes a contribution to morality. The enormous differences in beliefs represented by the world's religions, however, not to mention the diverse sects and creeds of varied faiths, suggests that "the will to believe" can take many and varied forms. It does not appear promising for resolving conflicts between members of diverse faiths. This essay, by contrast, has the aim of providing an outline of ramifications that would attend adopting the ethics of belief as a principle that promotes democracy.

The things we believe are things we take to be true. We take our beliefs to be true, no matter whether they are true or false or they are justified or not. Those we believe without evidence or contrary to evidence are *articles of faith*. Some of the beliefs upon which we act, moreover, may affect our behavior in a manner that exceeds normal expectations for human interaction. Many of our beliefs are supportable on the basis of the available evidence, but others go far beyond what could be established on the basis of observations, measurements, or experiments. And that includes most of our religious beliefs. Consider the following examples:

(E1) Suicide bombers are recruited from Palestinian youth by Hamas partly by appealing to the promise, based upon the Koran, that, in return for "martyrdom", not only will their families be financially compensated but they personally will have "unlimited sex with 72 virgins in heaven". According to one young Muslim, Bassim Khalifi, 16, it has a powerful effect: "The boys can't stop thinking about the virgins" ("Devotion, desire spur youths to martyrdom", USA TODAY 26 June 2001);

(E2) Three men in Sungai Siput, 130 miles north of Kuala Lumpur, Malaysia, were recently charged with capital murder in the killing of a Duluth, MN, woman during the course of "an alleged ritual sacrifice to obtain lottery numbers from the spirits. The body of the woman, Carolyn Janis Noriani Ahmad, was discovered in a shallow grave at an oil palm plantation last month. She had been missing for 19 months" ("3 accused of ritual murder", Duluth News Tribune 28 July 2001); and,

(E3) According to a very recent survey of religious opinions, 36% of Americans believe that the Book of Revelation contains "true prophecy"; 55% believe that the faithful will be taken up to heaven in the Rapture; 74% believe that Satan exists, where among Evangelicals the number increases to 93%; and 17% believe the end of the world will occur in their lifetime ("The Pop Prophets", NEWSWEEK 24 May 2004).

From the perspective of the theory of knowledge, these cases are not precisely the same. The belief in 72 virgins appears to be a classic example of an empirically untestable belief since, even though there may be an elaborate theological rationale for the number 72, if there were 71 or 73 or none at all, no one living is ever going to know. The ritual sacrifice to obtain lottery numbers at least potentially could be subjected to empirical test to ascertain the relative frequency with which winning numbers are obtained by this method, which presumably tends toward zero as its value. The popularity of religious beliefs does not itself imply specific actions based upon them, until you consider that those who believe them include persons, such as George W. Bush, who are in powerful positions to make decisions affecting us all.

1. Is Morality without Religion Possible?

It will generate little controversy to suggest that religious beliefs can be loosely classified into the broad general categories of *religious beliefs about God* (or gods), which are theological in kind, and *religious beliefs about morality*, which are social/political in kind. That virtually every theological belief qualifies as an article of faith would not be widely contested. Most theologians and philosophers concede that the existence of God (in anything approximating traditional conceptions) can neither be proven nor disproven, that the existence of multiple gods—such as one for each of the seasons or for the four elements, say—can neither be proven nor disproven, and that every true believer can rest assured that, at the very least, their theological beliefs cannot be shown to be false. By the same token, they cannot be shown to be true.

According to the principle of the ethics of belief, we are morally entitled to hold a belief only if we are logically entitled to hold it. If we grant that we are logically entitled to hold beliefs about the world only when they are appropriately related by suitable inductive and deductive logical relations to available evidence on the basis of observations, measurements, and experiments, then the only conceptions of God that appear to be empirically testable are those that identify God with nature, as in the case of pantheism. We interact with the natural world in space/time, after all, unlike a transcendent world beyond space/time to which we have no access. Beliefs about God as an omniscient, omnipotent, and omnibenevolent entity existing beyond space/time, therefore, are beliefs about the world which we are not entitled to hold.

That most theological beliefs about God (or gods) are not beliefs we are logically entitled to hold does not mean that alternative conceptions of God (or gods) are, on that account, beyond debate. The conception of God as the creator suggests that it makes more sense to envision God as a woman than as a man. Women, after all, can give birth, which is something no man can do. But we are no more logically entitled to believe in God as a woman than we are to believe in God as a man. What may be even more intriguing than the status of religious beliefs about God is the status of religious beliefs about morality. The principle of the ethics of belief entails we are likewise not morally entitled to hold beliefs about morality unless we are logically entitled to hold them. This implies that many religious beliefs about morality may also be immoral unless they qualify as beliefs that we are logically entitled to hold.

Speaking generally, we are logically entitled to hold beliefs about the world only when they satisfy appropriate logical standards. We tend to assume that beliefs we can justify on the basis of direct experience are therefore justifiable, which—in the case of those who are not color blind, tone deaf, and the like—tends to suffice in our practical lives. We can characterize this as "ordinary knowledge". For the purpose of this essay and to exemplify the kinds of standards that matter here, I shall assume that a more exact conception would be codified by the most defensible account of the logical structure of scientific reasoning, which is known as *abductivism* and which incorporates *inference to the best explanation*, as readers of this book discovered in Chapter 1. The products of this process properly qualify as "scientific knowledge".

Thus, when it comes to hypotheses or theories concerning the world around us, ordinary reasoning (typically implicitly) and scientific knowledge (often explicitly) proceeds through a process involving the following stages or steps: (S1) consider the available alternatives; (S2) consider the available relevant evidence; (S3) reject alternatives incompatible with the available evidence; (S4) appraise the likelihood of the alternatives in relation to the evidence to ascertain which provides the best explanation of the evidence, where the likelihood of hypothesis h given evidence e is equal to the probability of evidence e if hypothesis h were true; where (S5) the *preferable* hypothesis is the one that possesses the highest likelihood in relation to the available evidence; where (S6) the preferable hypothesis is *acceptable* when sufficient relevant evidence becomes available, which entails that it "settles down".

We typically employ these processes and procedures without reflection in our daily lives. Consider, for example, when I notice a bottle that looks like a bottle of beer in the refrigerator when I come home from work. Ordinarily, something looks like a bottle of beer because it is a bottle of beer. If I later open it and take a swig, only to discover that it tastes like fruit punch, I may have belatedly discovered that my daughter has brought home fruit punch in a bottle that looks like a beer bottle. I am thereby considering alternative hypotheses about the world around me and, perhaps less systematically than I might have preferred, discovering that there is available evidence to discount my original hypothesis in favor of an alternative as a manifestation of the tentative and fallible character of empirical knowledge and in contrast with "articles of faith", which are often held to be absolute and infallible.

According to the ethics of belief, we are logically entitled to hold beliefs about morality only if we are logically entitled to hold them on the basis of appropriate logical standards. While it may come as some surprise, I am suggesting that the standards for evaluating alternative moral theories are comparable to those for evaluating alternative empirical theories, when properly approached. First, we must separate legality from morality from propriety, respectively. The legal is what has the status of the law, which, in an open society, tends to be published and publicly accessible. These are behaviors that are punishable by the state via police, courts, and prisons. The moral concerns how we should treat other persons in our lives, not necessarily by heroic self-sacrifice, which is a special case known as *supererogation*. The proper deals with customs, manners, and etiquette.

The moral and the legal do not necessarily coincide, since conduct can be legal even when it is immoral and can be moral even when it is illegal. Slavery offers an instructive example, since slavery is immoral, if any actions are immoral, yet slavery was perfectly legal for much of the history of this country. Consuming alcohol as a beverage offers another, since prior to Prohibition, it was perfectly legal, just as it became after. But the moral status of consuming alcohol, unlike driving drunk or public intoxication, has remained constant and has always been, so far as I have been able to discern, perfectly moral. When disparity between the legal and the moral becomes excessive, social tensions tend to arise from the underlying inequities, which can produce unrest, passive resistance, or even civil wars. A good society maintains a suitable balance between legality and morality.

An important question thus becomes whether there are criteria of adequacy that might be employed to evaluate moral theories akin to those of inference to the best explanation for empirical theories. There appear to be three, namely:

(CA-1) an acceptable theory of morality must not reduce to the corrupt principle that *might makes right;* (CA-2) an acceptable theory must suitably classify pre-analytically clear cases of moral and immoral behavior (where these behaviors have been virtually universally acknowledged within human societies as moral and immoral, respectively, including speaking the truth and keeping promises, on the one hand, and murder, robbery, and rape, on the other); and (CA-3) an acceptable theory should shed light on the preanalytically problematical cases as well, including today, for example, abortion, cloning, and stem-cell research.

Actions based upon beliefs we are not morally entitled to hold are themselves immoral unless they qualify as moral by a standard that we are logically entitled to accept. This principle harmonizes with the Roman Catholic conception of natural law, according to which we must exercise our reason to discover what God would have us do, which in turn emanates from the classic question, "Is an action right because God wills it or does God will it because it is right?" There appears to be general agreement that the former alternative both denies the goodness of God and trivializes morality. Hence, we must exercise our reason to discover what is right in order to know what God would have us do. Here we are exercising our reason in order to know what is right, apart from any commitment to God at all.

I am going to begin with eight theories of morality, including four "traditional" theories, which make morality a (non-rational) matter of circumstance, such as who you are or what family, religion, or culture you were born into. Employing the method of counterexample, it should be possible to establish which of these eight theories qualifies as the most defensible based upon the exercise of reason. As will become apparent, none of these theories provides a suitable foundation for the conception of morality as a set of objective and universal principles that are capable of satisfying the criteria of adequacy adopted here—with exactly one exception. This argument will draw the conclusion that it is the most defensible and proceed somewhat more formally than was previously the case in Chapter 12.

According to the first theory (T1), *subjectivism*, an action A is right (for person P) if P approves of A. This theory, which exerts appeal on most freshmen, implies that morality can vary from person to person and from time to time as a function of each person's attitudes and values. If a person were malevolent and wanted to bring about your murder, rape, or robbery, then if this theory were correct, it would be mistaken to suggest that his action in doing that was immoral. On the contrary, if that person approved of that action, then, no matter how much you might deplore it, that action would be morally right (for him). The same obtains for everyone else, which means that this theory not only qualifies preanalytically immoral behavior as moral but also reduces to the corrupt principle that might makes right. (T1) therefore violates (CA-1) and (CA-2) and should be rejected.

According to the second theory, (T2), *family values*, an action A is right (for family F) if F approves of A. This approach effects a generalization of (T1) by substituting the attitudes and values of the family for those of the individual. But its consequences are no more defensible. Consider, for example, the Archie Bunker family, the Charles Manson family, or the family featured in "The Texas Chain Saw Massacre". While Archie was merely a bigot who was anti-Jew, anti-black, and anti-gay, Charlie actually attempted to start a war between blacks and whites by sending his followers to commit murders to trigger it off. And it does not take gruesome chainsaw killings to appreciate that (T2), like (T1) before it, similarly violates (CA-1) and (CA-2) and, on that basis, must likewise be rejected.

According to the third theory, (T3), *religious ethics*, an action A is right (for religion R) if R approves of A. The problems are no doubt already apparent from consideration of (T1) and (T2). There are many religions, including polytheism, monotheism, pantheism, deism, Buddhism, Confucianism, Taoism, Brahmanism, Hinduism, Zoroastrianism, Mohammedanism (Islam), Judaism, Christianity (Roman Catholicism, Protestantism, Fundamentalism, Assembly of God, . . .), which adhere to different articles of faith. While most would agree that actions such as murder, rape, and robbery are wrong, they tend to disagree on precisely why. And if you don't find one that you like, you are entitled to found a religion of your own, even if you happen to be the only member! So religious ethics does not look promising.

Fundamentalists, who maintain that the Bible is the literal word of God, could take exception on the ground that it is a religious text that should be taken to be a fundamental as opposed to a traditional religion. But taking the Bible literally in relation to moral maxims produces problems. We know that moral maxims found in religious texts, such as the Bible, are not always plausible candidates for moral truths. We have already discovered that, according to Leviticus, Chapter 20: Verse 9, "If anyone curses his father or mother, he must be [not grounded; not given time out; not sent to his room; but] put to death." And from Verse 10: "If a man commits adultery with another man's wife—with the wife of his neighbor—both the adulterer and the adulteress must be put to death." But there are many more imposing death for taking the Lord's name in vain (Leviticus 24:16) or for working on the Sabbath (Exodus 31:15), where, again, the punishment seems disproportionate to the offense.

Even more interesting from a philosophical point of view are the principles known as "The Ten Commandments", which include familiar injunctions against killing and stealing and lying. These are all very plausible as "rules of thumb" describing what should be done in most cases; yet they have exceptions, such as the spy caught behind enemy lines. Should he inform the Gestapo of the names and addresses of those with whom he has been collaborating, in which case they will be promptly rounded up and shot? Since the Gestapo is performing immoral acts, it does not deserve cooperation;

and it would hardly be treating collaborators with respect to give up their lives for their acts of supererogation. Their application requires taking into account all the relevant conditions affecting the rightness or wrongness of an action, where adhering to rules of thumb as though they had no exceptions is know as "the fallacy of accident". And the problems with citing religious leaders, whether we have in mind Jerry Falwell, Pat Robertson, or Jim Jones, are familiar from Chapter 12. We cannot know which of them exemplifies moral virtue without already knowing which traits are moral traits.

The forth theory, (T4), *cultural relativism*, according to which an action A is right (in culture C) if C approves of A, suffers from similar shortcomings. Can cultures in which polygamy, polyandry, cannibalism, or female genital mutilation are practiced all be equally right and equally moral? If this approach were correct, the answer would be, "Yes!" I have argued that virtually universal human experience qualifies murder, robbery, and rape, for example, as immoral within the society or group, a finding that is supported by studying different cultures. But it succumbs to (CA-1), nevertheless, since vast numbers of human beings have been deliberately killed in the name of religions and of cultures. Serbs and Muslims, Arabs and Jews, Sunnis, Shiites and Kurds exemplify a few of the variations in play around the world today, and there are many more. They may not succeed and they may not prevail, but as long as these actions conform to a cultural standards, they cannot be morally wrong.

The traditional theories suffer from a common defect, namely, they make moral criticism, moral progress, and moral reform meaningless conceptions. (This point is well-made by James Rachels in Rachels 1999 and Rachels 2003.) If a person (a family, a religion, or a culture) changes its attitudes about the kinds of actions that it approves and disapproves, such as by abandoning female genital mutilation, say, in African tribes, that cannot represent moral progress, but merely a change in the prevailing attitude. No matter what attitude prevails at a time, so long as it is the prevailing attitude, actions in conformity with it are right and deviations are wrong. Problems with traditional theories motivate consideration of different principles that might function as a theoretical foundation for moral theory, where I shall consider four. While they are more defensible than their traditional counterparts, only one of them appears to be capable of satisfying criteria of adequacy (CA-1) to (CA-3).

Three of them are consequentialist accounts, according to which an action A is right when it produces at least as much of The Good as any available alternative. Historically, candidates for The Good (which is supposed to be valuable in and of itself) have included happiness, pleasure, knowledge, power, and (least plausibly) money. Although there may be latitude for debate, I shall assume that the most defensible conception of The Good is *happiness*. The issue that then arises is this: whose happiness should matter? And the answer to that question generates the difference between three species of consequentialism, the first of which is known as "ethical egoism". According to our fifth theory, (T5), *ethical egoism*, an action A is right when it produces at least as much happiness for person P as any available alternative. Plug in Ted Bundy, John Gacy, or Jeffrey Dahmer as the value of "P", however, and it should be apparent that (T5) violates both (CA-1) and (CA-2).

After all, if someone derives more happiness from murder, robbery, or rape than from any available alternative, then those actions are morally right if (T5) were correct. And as long as that person is able to impose his will upon others, his actions do not qualify as morally wrong. The situation is not salvaged by the generalization of consequentialism to groups, moreover, where our sixth theory, (T6) *limited utilitarianism* , maintains that an action A is right when it produces at least as much happiness for group G as any alternative. Let the value of "G" range over The Third Reich, the Mafia, or even General Motors, however, and it should be obvious that, even if territorial expansion, military aggression, and systematic genocide produce more happiness for Nazis than any alternative, it does not make those practices moral. (T6) clearly violates (CA-1) and (CA-2).

Because groups can be far more efficient, effective, and reliable in bringing about its aims, objectives, and goals, limited utilitarianism turns out to be the the most pernicious of moral theories. The most important problem with both of these varieties appears to be that, in making moral judgments, they exclude from consideration consequences for anyone other than the person himself (in the case of ethical egoism) or than members of the group (in the case of limited utilitarianism). Consequences for others, no matter how dire, do not count! It follows that no actions whatever, including assassination, mutilation or genocide, are inherently morally wrong, because *no actions are inherently morally wrong*. If taking such actions would produce more happiness for the person or for the group, those actions would be right actions, were either of these theories correct.

The seventh theory, (T7), *classic utilitarianism*, therefore, appears to be more defensible, insofar as it maintains that an action A is right when it produces at least as much happiness for everyone as any alternative. This is the first theory that requires that the consequences of actions for everyone who is affected by them has to be taken into account in determining the morality of those actions. Since some persons may be made happier and others less happy by decisions that affect them, classic utilitarianism trades, not in happiness per se, but net happiness as gross happiness minus gross unhappiness. So an action is right, on this account, when it produces more net happiness than any other option.

Classic utilitarianism represents a giant step in the right direction because it requires taking into account the consequences for everyone affected by an action and not merely those for the person or the group performing it. But it harbors covert problems. Suppose, for example, that a social arrangement in which 85% of the population were masters and 15% were slaves was the one that produced the greatest net happiness? Suppose that, although the slaves would be far less happy, the masters would be so much happier that this exact distribution produced more net happiness than any alternative arrangement? Would that make it moral? Since slavery is immoral, if any action is immoral, it should be apparent that the very prospect of justifying a slave-based society on classic utilitarian grounds demonstrates that something is profoundly wrong.

Even through the formula, "The greatest good for the greatest number", has been enshrined as though it reflected a basic axiom of moral theory, it cannot be sustained. The greatest good for the greatest number as the maximization of net happiness could be used to justify a slave-based society! The problem, moreover, is not unique to this example. We have considered the possibility of rounding up 100 smokers at random each year, putting them on television and shoot them. But the gross immorality of classic utilitarianism manifests itself in far simpler cases, such as by lynch mobs. When a group of young, black men were accused of rape in Duluth, MN, not so very long ago, it was the mob’s desire, not that they be incarcerated, given legal representation and subjected to a fair trial, but hung by the neck until dead—then and there! No one should doubt that their deaths brought about the greatest happiness for the greatest number in that community at that time. But it was obviously wrong.

2. Abortion, Stem-Cells, and Cloning.

As students of political science are well aware, the principle of majority rule must be supplemented by principles of minority rights, lest the noble concept of democratic rule degenerate into no more than the tyranny of the mob. A more defensible approach toward understanding morality, (T8), is a *deontological theory*, according to which an action A is right when it involves treating other persons as ends and never merely as means. Treating others "as ends" means treating them as valuable in and of themselves, which may be encapsulated in the notion of always treating other persons with respect. [Technically, this is the second formulation of Immanuel Kant's Categorical Imperative. See, for example, Facione, Scherer, and Attig (1978), p. 148.] Persons are thus entities with interests that are entitled to due consideration. If this is the most defensible conception of morality, as I shall contend, then it also demonstrates that some religious maxims, such as "the Golden Rule" of doing unto others as you would have them do unto you, are correct, not because they are religious maxims but because they are logically justifiable.

(T8) does not mean that persons should never treat others as means but that persons should never treat others *merely* as means. We all treat one another as means all the time. Employers treat their employees as means to run a business and make a profit, while employees treat their employers as means to earn an income and make a living. As long as they are not treating each other with disrespect—by employers, for example, offering substandard wages, excess hours of employment, or unsafe work conditions; by employees clocking in for work not performed, stealing from their employer, or failing to perform the tasks for which they were hired—they can be moral relationships. Similarly for doctors and patients, lawyers and clients, students and teachers.

There are other accounts of morality, including the social contract theory. Sometimes characterized as "morality by agreement", there appears to be no reason why a community might not agree to a slave-based society, betting that they would be among the 85% who are masters! That would be "immorality by agreement". Sociobiologists have advanced selfish genes, kin selection, reciprocal altruism, and social cooperation as the biological foundation of morality. They can be readily refuted on the basis of counterexamples, however, where selfish genes justify serial rape; kin selection, hiring an unqualified cousin over a qualified non-relative; reciprocal altruism, engaging in insider-trading; and social cooperation in military aggression, territorial conquest, and systematic genocide (Fetzer 2005). It becomes increasingly clear that morality does not invariably advance our genetic self-interest, which means that, properly understood, morality transcends biology.

Only deontological theory appears capable of satisfying (CA-1) and (CA-2), while explaining why practices that are virtually universally condemned, such as murder, robbery, and rape, are immoral practices, and why practices that are virtually universally endorsed, such as keeping promises and speaking the truth, are moral practices. The former involve treating other persons merely as means, while the latter involve treating other persons with respect. There are situations, however, in which speaking the truth or promise keeping might conflict with morality. A spy caught behind enemy lines, for example, should not reveal the network of agents with whom she has been working because it would be wrong *not to speak the truth*. There are circumstances in which the right thing to do would be to remain silent or to deliberately misinform others.

Practices such as speaking the truth and keeping promises have exceptions, which makes them "rules of thumb" that are usually correct but sometimes not. Consideration must be given to the totality of circumstances in determining the right thing to do. Actions are right when they involve treating other persons with respect, which is a consequence of treating them as ends and not merely as means. But the consequences for you personally with respect to happiness do not matter. That is why a poor man who returns a wallet is doing the right thing, even if it does not enhance his happiness. A spy might therefore lie to save the lives of the network of agents with whom she has worked without violating deontological standards, especially in an adversarial context where speaking the truth would betray them. That would be the right thing to do.

Persons as persons have moral rights and incur obligations to treat others with respect, but not when others are violating those rights and not fulfilling their own obligations. Hence, there is no moral obligation to cooperate with those who violate morality. Interestingly, however, there might nevertheless be legal obligations to cooperate with those who violate morality, as with the whistleblower who abrogates contractual obligations to his company in order to expose crime and corruption. These are bona fide acts of supererogation, which all too often led to the punishment of those who sacrifice themselves for the sake of the common good, a conception that, in this time in history, almost appears quaint. But it reflects one more example of the possibility that the moral and the legal need not coincide, which is of primary concern.

So there can be conflicts between rules of thumb and exceptions to those rules. Even murder might be justifiable under special conditions. Historians of World War II have long speculated that, if attempts to assassinate Adolf Hitler had been successful, many lives might have been spared. Since murder involves the deliberate killing of a person that is illegal, however, there is clearly room for debate over whether killing Hitler would have been right. A tyrant who massively violates deontological principles by treating others with severe disrespect deserves to be punished, where the extent, duration, and intensity of their crimes may dictate extreme measures. Yet there is a virtually universal consensus on the fundamental importance of due process for those accused of crimes, prisoners of war, and even unlawful combatants.

The contrast case, of course, is that of taking the life, not of a tyrant, such as Hitler, but of an innocent, as in the case of abortion. The capacity to deal with cases like abortion, stem-cell research, and cloning is a crucial test of a theory relative to preanalytically problematical cases. The slogan, "Abortion is murder", raises the crucial questions of whether (a) the developing entity properly qualifies as a person and (b) whether killing the developing entity properly qualifies as wrongful. Since abortions are legal under Roe v. Wade (1973), question (b) is not whether killing the developing entity is legally wrong, which it is not, but whether it is morally wrong. It is morally wrong if it involves treating a person without respect and merely as a means. This in turn implies that the crucial question about abortion is whether the entity under consideration properly qualifies as a person. So the key question is (a).

Gestation for human beings tends to be divided into stages by weeks, where the fertilized ovum (zygotic) stage is the first two weeks after conception, the early developmental (embryonic) stage is from the second to the eighth week after conception, while the mid to late developmental (fetal) stage is from the ninth through the thirty-eight week of gestation, following which (for a normal pregnancy) a live birth occurs. If we accept (T8) as the most defensible theory of morality and explore its ramifications for abortion and stem-cell research, it follows that abortion and stem-cell research are immoral only if they involve treating other persons without due respect. The question is not whether these are stages in the development of a human being or whether or not life begins at conception. Those are questions whose answers are obvious and affirmative.

Do zygotes, embryos, and fetuses persons in the sense of social and moral entities that can have interests and that have to be treated with respect? Are they persons as entities with interests that are entitled to due consideration?

Given the ethics of belief, this question cannot be properly answered based on articles of faith. Even if the Roman Catholic Church, for example, maintains the doctrine of ensoulment—that the soul enters the body at conception—this does not qualify as an acceptable solution to the problem. The presence or absence of souls is not accessible, directly or indirectly, to observation, measurement, or experiment and cannot satisfy the condition of logical entitlement on the basis of inductive or deductive reasoning. Three possible sources of information that might matter to answering this question, however, include ordinary language, embryology, and law, especially the Supreme Court's decision in Roe v. Wade.

No unambiguous answer to this question appears to be derivable from the use of ordinary language. According to *Webster's New World Dictionary*, 3rd College Edition (1988), the term has a variety of senses, such as the following:

> person =df 1. a human being, especially as distinguished from a thing or lower animal; individual man, woman, or child....... 3. a) a living human body b) bodily form or appearance (to be neat about one's *person*) 4. personality; self; being; ....7. *Law* any individual or incoporated group having certain legal rights and responsibilities 8. *Christian theol.* any of the three modes of being (Father, Son, and Holy Ghost) in the Trinity.

The notion of "a living human body" suggests that to be a person an entity must have a separate existence, which hints that even fetuses may not qualify under ordinary language criteria. Certainly, the notion of "personality" appears to be highly inappropriate for zygotes and embryos, especially, though some women report behavior by their fetuses during later stages indicative of personalities. At best, the use of the word "person" in ordinary language appears to suggest that zygotes and embryos are only early stages in the development of persons.

Nor can the problem be resolved by appealing to medical embryology. The stages of embryonic development, for example, proceed through the fertilized ovum to blastocysts and villus formation on to entities that resemble shrimp or seahorses far more than they do human beings. Were morphological similarity the standard for personhood, then there would be no basis for making such a claim prior to the 7th week or later (Sadler 1990). Consider, for example, the appearance of the developing entity at day 36, day 37, day 38, and day 39:

Figure 32. Some Stages in Embryogenesis.

At best, morphological similarities to live births likewise suggests that zygotes and embryos are no more than early stages in the development of persons. And surely that is what we should expect, since embryology is not a source of social and moral concepts but rather the study of the various stages of human gestation.

The prospect that zygotes and embryos are no more than early stages in the development of persons becomes important within the framework of the ethics of belief, because if they do not qualify as "persons", then the they are not kinds of entities that are capable of having interests that require due consideration. In that case, abortions are not murder, because they do not involve the deliberate killing of a person that is morally wrong. Indeed, this turns out to be the case on two grounds, since (a) they are not persons at all and (b) they are not among the kinds of entities that it would be morally wrong to kill. (It should be observed in passing that even the deliberate killing of persons is not always considered to be morally wrong, as the examples of soldiers in combat, police in the performance of their duties, and civilians in self-defense display.) The non-person alternative would seem to be to consider the developing entity as a special kind of property, which may appropriately be entitled to special forms of protection under the law.

The Supreme Court in Roe v. Wade (1973) considered several criteria for the performance of abortions and divided the cycle of gestation into trimesters (three three-month long intervals). The Court decided that the State had no compelling rationale for interfering with the performance of abortions during the first three months of gestation, when they are unrestrictedly permissible, but that it had an interest in protecting women in relation to their performance during the second three months of gestation, when how they were to be conducted could be subject to regulation. In relation to the third trimester, the Court held that abortions were permissible but only to preserve the life or the health of the woman. Conservatives have bridled at this ruling, claiming that abortions should be permissible but only in the case of rape, incest, or to save the life of the mother and for no other reason.

Perhaps the most interesting aspect of the Court's ruling was the division of the cycle of pregnancy into trimesters, which can be correlated, at least approximately, with the development of the fetus, such that heart function has been established and brain activity is detectable by the end of the first trimester; brain function has been established and viability attained by the end of the second trimester; and a live birth typically occurs at the end of the third trimester, as the following diagram displays:

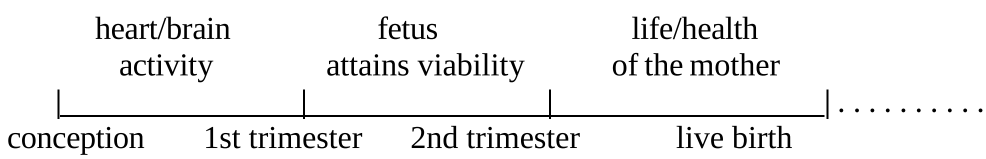

Figure 33. The Court’s Trimester Division.

Thus, although the Court preserved the concept of personhood for the issue of live births, it could be argued that it was imposing a graduated scale of personhood for which the earliest stage occurs at the end of the second trimester, where the entity first deserves to be treated as of a kind capable of having interests that require due consideration. It could be argued that, at this stage only, there are considerations in favor of a "right to life" of the fetus, provided it does not conflict with a woman's right to preserve her health and her life, should a tension develop between them.

The strongest inference that could be drawn from Roe v. Wade would appear to be that a person is *a human fetus that has attained the status of viability*. And that, indeed, appears to be a responsible position to adopt. Certainly, it represents a vastly better reasoned approach than to assume that zygotes and embryos are persons. Legal rights and responsibilities, after all, are distributed attendant upon attaining certain standing in the community, often as a function of a person's age. In most states, a person can obtain a driver's license at age 15, can marry without their parent's consent at age 18, and can vote in political elections at age 21. Their governments assume corresponding duties and obligations to protect those rights. This graduated theory of rights and responsibilities is pervasive in human societies.

No one would argue that infants or children should be able to drive, to marry, or to vote, which supports the conception of graduated rights that are contingent upon reaching certain stages of development, where the "right to life" of a fetus is only the first in a series of rights that increase with stages of development. And what if zygotes and embryos were persons? Governments would at the very least possess obligations to insure their "right to life" by such intrusive measures as, for example, mandatory monthly pregnancy testing; tracking the distribution of semen; monitoring sexual intercourse; promoting the "adoption" of unwanted zygotes and embryos; and otherwise enforcing their legal rights. The situation would be absurd.

This does not mean that the Supreme Court has had the last word, even though in a case of this kind it must have the final say. It could be argued that advances in technology make "viability" a shifting criterion. Today, in a well-equipped neonatal intensive care unit, survival in an artificial womb can sometimes be achieved at 22 weeks. But there are at least two responses to this observation, the first of which is that viability means survivability independently of any womb, natural or artificial. I happen to believe that is a defensible position to maintain. But if it were not, the

Court might still have reached the right decision on the basis of the wrong premise.

Once we have cleared away the religious beliefs that tend to obfuscate the issues, it becomes apparent that the *normative* notion of personhood as a social/legal/moral concept needs to be suitably correlated with *descriptive* personhood as a scientific/ empirical/testable property. We need a criterion, such as viability, as a generally reliable but not therefore infallible standard. The deontological theory of morality, moreover, at the minimum implies *the harm principle*—namely, that it is morally wrong to inflict physical harm upon persons in the absence of their consent—which typically implies the presence of sentience or consciousness (ordinarily, the existence of the capacity to experience pain). Sentience would therefore appear to provide an alternative to viability as a preferable conception of the earliest stages of personhood.

A suitable normative conception could define "persons" as genetic humans at or beyond the stage of sentience or consciousness and capable of suffering pain. In the absence of sentience/consciousness, the developing entities are not persons. In that case, prior to sentience, abortions do not involve the killing of persons and are not morally wrong. The corresponding descriptive property becomes cerebral cortical and CNS development at or beyond the stage sufficient for sentience/consciousness, which, interestingly, appears to coincide with the Court's end of the 2nd trimester on different grounds (Kandel 2000, Bear 2001). On either the viability criterion or the sentience criterion, therefore, the Supreme Court's decision appears to be defensible, even though a host of issues remain about the nature of consciousness and mentality.

An intriguing counterexample to this approach, however, arises from the fact that some persons are born without the capacity for the sensation of pain (Bear 2001, p. 422). Even by describing them as "persons", I agree it would be wrong to deny that they are "persons" as genetic human beings who are the products of live births but who lack the nociceptive system that warns most of us of the danger of damage to ourselves relative to painful stimuli. These persons therefore run risks and tend to live shorter lives than those with pain detectors. This suggests that, as in the case of viabililty, the standard should be understood as the stage at which pain sensitivity is ordinarily present during fetal development. As a criterion of personhood, however, sentience can serve as a generally reliable but not therefore infallible "rule of thumb", where viability would still be considered to be the more viable alternative definition.

3. Consciousness and Personhood.

The conception of graduated rights that accrue at different stages in the life of a person supports the inference that, prior to viability, an entity that could develop into a human being has no "right to life", especially in a conflict with those of the woman who bears it. Sentience, however, understood as implying the capacity to experience pain, serves as a (possibly more defensible) alternative to viability for justifying the proportional attribution of conditional personhood to the developing fetus, where the fetus having attained the stage of sentience has a "right to life" as long as it does not conflict with or adversely affect the life or the health of its bearer. On either viability or sentience criteria, there seems to be an appropriate correlation between the normative conception of personhood and its descriptive counterpart.

A theory of graduated rights parallels similar proportionment of value in other domains. The acorn that has the potential to become a mighty oak, for example, is not valued as greatly as the mighty oak. Indeed, there is a continuum of increasing value as the acorn turns into a sprig and then a small tree and eventually grows to become a useful form of timber. (The reason that some administrations can claim that there are more trees now than there were several decades ago is that those that exist today are younger and less valuable than those that have been taken.) Apart from the context of abortion, there are many examples of graduated values, such as the new hire as opposed to the trainee as opposed to the experienced worker. None of us would be inclined to think twice about experienced workers being paid more for their work than new hires. A new hire may have the potential to become an trained employee, but no one would suppose that he should be paid the same on that ground.

The investigation of these questions could be carried further by considering the prospect that consciousness might matter here. The most defensible conception of consciousness derives from the theory of minds as sign-using (or "semiotic") systems, where signs are things that stand for other things. On this approach, minds turn out to be properties of brains or, at least, of various kinds of systems of neurons, which can be extremely primitive (Fetzer 2002, 2005). There are three basic kinds of signs: iconic (things that resemble that for which they stand), indexical (things that are causes or effects of that for which they stand), and symbolic (things that are merely habitually associated with that for which they stand). Species tend to differ relative to the kinds of signs they can use and the range of signs within the kinds they utilize.

Thus, photos, statues, and paintings (at least when they are realistic or naturalistic in kind) are iconic in resembling what they stand for. Interestingly, everything can resemble other things in some respects without resembling them in every respect. My driver's license photo, for example, resembles me when viewed straight on (on not such a great day, perhaps), but not when it is turned on its side (because I am just not that thin)! Fire, smoke, and ashes all stand for one another as causes or effects of each other. Symptoms of diseases are other examples of indices, where it may take an expert to diagnose them (read the signs). Words and sentences are among the most familiar example of symbols, where ordinary languages represent systems of habitual associations between (written or spoken) words and things.

A red light at an intersection, for example, can function as an icon insofar as it resembles the color of the dress your wife wore the evening before. It functions as an index for a transportation department worker who has been sent out to repair it because it is stuck on red and won't change. And it functions as a symbol for those who are know the rules of the road, for whom it stands for applying the breaks and coming to a complete halt and only proceeding when the light changes to green. The fact that a husband whose wife has gone into labor and wants to get to the hospital as soon as possible, who consequently cautiously runs the light when he has checked for cross traffic, does not alter the meaning of that sign. He knows its meaning, but his motives and ethics override it. He has more urgent responsibilities than to conform to traffic regulations when his wife's water has broken. So he runs the light instead.

On this approach, which I have elaborated in various places—including earlier in this book—consciousness is relative to signs of specific kinds: a system is conscious (with respect to signs of kind S) when it has the ability to use signs of kind S and is not incapacitated from the exercise of that ability. Similarly, cognition is an effect that occurs as the outcome of a causal interaction between a system that is conscious with respect to signs of kind S and the presence of a sign of kind S within suitable causal proximity. It does not require rocket science to recognize that fetuses, even in the third trimester, have extremely limited capacity for the use of signs. Consciousness for them turns out to be extremely primitive, and occurrences of cognition must be extremely few and far between. That is not to say it does not occur at all, but rather that the use of signs by a fetus—where signs, unlike mere stimuli, painful or not, are meaningful by virtue of standing for something for the sign user—is virtually nil. So appeals to consciousness and cognition do not support the case for fetal personhood.

This result implies that the mental capacity of fetuses, even in the later stages of pregnancy, are extremely limited. The difference between stimuli that function as causes of responses in the fetus, such as painful stimuli that may induce avoidance response, and stimuli that serve as signs that are meaningful for the fetus by virtue of standing for something for that fetus deserves to be emphasized. The possession of a neurological system (or "a brain") is not identical to the capacity to exercise the use of signs (as "a mind"). This suggests a potentially even more powerful criterion for personhood that might eventually become more important in deliberations over issues of this kind. The possession of sentience and viability are not the same thing as the possession of mentality or semiotic ability, which, as we have now ascertained, presupposes a point of view. Since semiotic abilities appear to be extremely limited, if not nearly non-existent, during pregnancy, the adoption of the capacity to use signs as a criterion of personhood strongly reinforces the exclusion of early-term fetuses.

No doubt, some women have been known to insist that their fetuses, during later stages of pregnancy, became accustomed to their voice and tended to respond to it. Anecdotal evidence, of course, is vastly weaker than controlled experiments, but in the interest of covering all the bases, suppose we assume that that is true, namely: that at least some fetuses in the late stages of pregnancy display behavior within the womb that their mothers interpret as responding to the sound of their voices. In that case, it could be argued that, for those fetuses, the sound of their voices is functioning as a sign—presumably, of love and affection—for them as sign users, in which case the semiotic criterion would support the case for personhood, after all. Such phenomena, assuming they take place, however, would selectively support the standing of late-term (third trimester) fetuses as possessing the status of persons with a qualified "right to life", which I have taken to be the case on other grounds.

Many examples illustrate that the use of signs presupposes a point of view. Since my driver's license photo may resemble my facial appearance viewed from the front but not from the side, discerning the resemblance relation depends upon adopting the right "point of view". Nothing could exemplify that more clearly than the case of the red light at an intersection. Taken as an icon, it resembles the color of a dress. Taken as an index, it displays the effects of malfunction. Taken as a symbol, it induces most drivers, under ordinary conditions, to adapt their behavior to its instructions. None of these "stand for" relations is inherent in a sign-user absent a point of view. And this, in turn, suggests another potential criterion of personhood, which is having a point of view. While there could be a convergence of opinion about what kinds of treatment, for example, might or not be in the interests of a fetus, it is difficult to imagine any justification for claiming a fetus has "a point of view" in some non-attenuated sense, which affords another foundation for denying that fetuses should qualify as persons. But, as before, it may be said that late-term fetuses are developing in that direction.

The principal conclusions of this investigation are therefore as follows.

(C1) We are not logically entitled to hold the belief that stem cells, zygotes, embryos, or early-term fetuses are "persons" on the basis of theological religious beliefs.

(C2) We are not logically entitled to hold the belief that abortion and stem cell research are immoral on the basis of theological religious beliefs.

(C3) We are not logically entitled to hold the belief that abortion and stem-cell research are immoral on the basis of social/political religious beliefs unless they can be shown to be immoral on the basis of deontological standards.

(C4) In order to be shown to be immoral on the basis of deontological standards, it would be necessary to show that stem cells, zygotes, embryos, and early-term fetuses properly qualify as "persons" in the moral sense.

(C5) Neither ordinary language nor medical embryology nor The Supreme Court provides any logical entitlement to conclude that stem cells, zygotes, embryos or early-term fetuses properly qualify as "persons" in the appropriate sense.

(C6) Appeals to sentience and to viability appear to provide objective criteria that support the view that late-term fetuses may properly qualify as "persons" in the absence of stronger standards.

(C7) Consciousness and cognition as characteristics of the possession of mentality appear to provide a stronger standard, but it is one which supports and reinforces distinctions between early stage and late-term fetuses.

(C8) Moreover, there seems to be no other non-theological basis for qualifying early stage fetuses as "persons".

(C9) It follows that we are not logically justified in holding the belief that early term fetuses properly qualify as "persons".

(C10) Since we are not logically entitled to hold that belief, therefore, we are also not morally entitled to hold it.

It follows that the slogan, "Abortion is murder", simply does not apply to taking the life of early-term fetuses, since they do not properly qualify as persons. If the alternative is to qualify them as special kinds of private property, even ones that deserve recognition under the law, that is another matter entirely. There are good reasons to treat the killing of a pregnant woman as an aggravated offense in those cases when it brings about the death of the fetus as well. Even though women may voluntarily choose abortions, that does not give anyone else the right to bring about the termination of their pregnancies. Indeed, since as the treatment of early term fetuses as persons cannot be logically justified and thereby violates the ethics of belief, even religious persons who interfere with the right of others to abortions and stem-cell research—no matter how sincere their beliefs or moral their lives in other respects—are pursuing immoral politics. Indeed, it is violations of the ethics of belief that appear to be creating the major obstacles for scientific research today.

And this extends to the debate over cloning, which has even reached into the United Nations ("UN to Consider Whether to Ban Some, or All, Forms of Cloning of Human Embryos", The New York Times 3 November 2003). The primary focus has been on *reproductive cloning*, which produces an offspring that is genetically identical with its parent, rather than on *therapeutic cloning*, which can be used to produce tissues and organs for replacement or transplantation. Opposition here, as in the case of abortion and stem-cell research, is largely rooted in the religious doctrine that even the earliest stages of gestation are entities that deserve legal protection. When these arguments are excluded from policy debates, the issues can be addressed with less emotion and greater clarify. The use of reproductive cloning for infertile couples, who would like to have offspring as closely related to them as possible, appears to be a perfectly moral and appropriate procedure.

The conclusion that abortion, stem-cell research, and cloning appear to be perfectly moral and appropriate procedures when properly understood from the perspective of the ethics of belief does not mean that they are applicable without restriction. Even when we are not dealing with persons and they are morally permissible, special conditions may still apply. The use of stem cells for research—no matter whether embryonic, umbilical, or adult—should only be pursued with the consent of the donor. Abortions—no matter whether 1st, 2nd, or 3rd trimester—should only occur as voluntary actions with the consent of the woman. During the 2nd trimester, they can still be regulated by the state and, during the 3rd trimester, should only be performed to preserve the health or to save the life of the mother. And exploitative cloning for immoral purposes, such as to produce slaves, should obviously be impermissible. Clones, after all, post-2nd trimester, are persons, too. A summary of the situation is as follows:

	Persons?	Morally Permissible?	Special Conditions?
Embryonic Stem Cells	**NO**	**YES**	**Consent**
Umbilical Cord Stem Cells	**NO**	**YES**	**Consent**
Adult Stem Cells	**NO**	**YES**	**Consent**
Abortions (1st trimester)	**NO**	**YES**	**Choice**
Abortions (2nd trimester)	**NO**	**YES**	**Regulated**
Abortions (3rd trimester)	**YES**	**NO**	**Only to save the mother's life or health**
Therapeutic Cloning (pre-3rd trimester)	**NO**	**YES**	**Regulated**
Reproductive Cloning (post-2nd trimester)	**YES**	**YES**	**For infertile couples**
Exploitative Cloning (post-2nd trimester)	**YES**	**NO**	**NO**

Table XXII. A Summary Overview.

The politicialization of religion, which prevails in this administration, together with advances in technology, has put issues of this kind "front and center" in the political arena. The government restricts research that has the greatest potential to deal with some of the most debilitating of human problems, such as Alzheimer's and Parkinson's, diabetes and other inherited diseases. Opposition that is based on the belief that life begins at conception is not only misconceived—since the issue is the onset of personhood and not whether life begins at conception—but, given the ethics of belief, is not even moral. If we are to regain control of scientific research and its enormous potential to enhance the quality of life, then we must restrict the influence of religious beliefs on public policy debates. There are some promising signs, happily, as universities seek private funding to pursue stem-cell research ("U of M plans embryo research", Duluth News Tribune, 9 February 2004; "2 New Efforts to Develop Stem Cell Line for Study", New York Times, 7 June 2006; and, "U.S. scientists seek to clone human embryos", Duluth News Tribune, 7 June 2006).

The mix of religion with politics and science, no doubt, can produce outcomes that rational agents can find difficult, if not impossible, to appreciate. The stem-cell debate, after all, verges on the absurd, insofar as the overwhelming majority of the embryos used for harvesting cells would otherwise be discarded. Does the Christian Right seriously believe that it makes more sense—from either a logical or a moral point of view—to simply discard these cells rather than use them for the potential benefit of human beings? This appears to be one more example where ideology overrides sensibility and irrational beliefs improperly affect public policy.

The right of a later-term fetus, however, is not absolute but relative to the rights of its mother. When those rights conflict, those of the mother—as an adult whose rights outweigh those of a fetus—are properly given precedence. Hence, a late-term fetus has a right to life that can be overridden by risks to the health and life of its parent. Women who want to control their bodies, which is a very basic right, are therefore well-advised to avoid sex with men who do not respect them. Before a woman engages in sex with a man, she should gain his acknowledgment that she has the right to decide what should be done in the case of an unplanned pregnancy. In the absence of that assurance, the best policy would seem to be, "Just say, 'No!'"

The conclusions that I have drawn in this chapter could be contested on various grounds, including, for example, that there are other moral theories that may deserve consideration, such as social contract theory. None of them appears to be as defensible as deontological theory, however, an approach that exerts profound influence in the world today through documents such as The Declaration of Independence, The Constitution of the United States, and The UN Declaration of Human Rights, all of which are based upon deontological principles. It should be observed, however, that classic utilitarianism can still serve as an appropriate foundation for decision making in a democracy but cannot function properly without concomitant minority rights, which are manifestations of human rights to which every person is entitled.

The ethics of belief imposes a very high standard. Most persons may find that standard psychologically impossible to satisfy in their personal lives, where they find belief in God or in heaven and hell irresistible. But that does not entail the right to impose those beliefs upon others who may not share them. Democracy degenerates into mob rule when majority votes can overpower the rights of the minority. Let there be no doubt about it. The integrity of the United States as a democratic republic founded upon the separation of church and state requires a vigorous defense. Immoral beliefs must be excluded from public policy debates. Religious persons who interfere with abortions, stem-cell research, and cloning—no matter how sincere their beliefs or moral their lives in other respects—are practicing immoral politics. It must come to an end. Democracy requires no less.

CHAPTER 15: POLITICS, RELIGION, AND MORALITY

We have discovered profound differences between articles of faith and scientific hypotheses. Articles of faith are unconditional, untestable, and are held to be true without qualification. Scientific hypotheses, by comparison, are conditional, testable, and would be relinquished under suitable conditions. Indeed, the logical features of abductivism reflect the nature of objectivity in science, where different investigators relying upon the same evidence, the same alternatives, and the same rules of inquiry would tend to accept, reject, and hold in suspense all and only the same hypotheses. No such standards obtain within the religious domain. There is no counterpart to the principle of inference to the best explanation that brings about a convergence in the inferences drawn based upon the same body of evidence and alternative hypotheses.

Anyone can believe that God is male or that God is female and no one can prove that they are wrong. Unfortunately, that means no one can prove that God is not a woman any more than any one can prove that God is a man! Those who have the least desire to retain their rationality and rely upon reason in forming their beliefs are accordingly well-advised to consider agnosticism, which acknowledges neither the existence of God nor the non-existence of God can be known. This is not to deny that one or the other of those propositions must be true: As Aristotle observed, for every proposition, p, which makes an assertion, either p is true or it is not the case that p is true. In this case, there is no third alternative, which is why this principle is known as the law of excluded middle. Aristotle also identified the law of non-contradiction, which holds that, for every proposition p, it is not the case that p is both true and false. They jointly imply that every proposition p is either true or false, but not both.

So given a definition of "God", it will be the case that, under each such definition, either God exists or it is not the case that God exists. But it does not follow that we could ever know which is which. That depends upon the precise meaning ascribed.

If "God" is an old man who lives on a mountain, presumably we could travel to that location and search for him. If we found him, we would know that God exists under that definition. If "God" is an omniscient, omnipotent, and omnibenevolent entity, whose existence transcends space and time, however, then matters are not so easy. Indeed, the problem of evil raises doubts in many minds, which ministers, priests, and rabbis often attempt to assuage. The enduring distress of the human species, however, with respect to terrorism, AIDS, and pandemics, has the capacity to raise questions even for those who are inclined to believe but who would like to know that their beliefs, if not rationally well-founded, are at least not wildly indefensible.

This book demonstrates that such a refuge from rationality, alas!, is unavailing. The only rational attitude toward the existence of God in his classic manifestations is agnosticism. Since the non-existence of God can no more be proven than can the existence of God, atheism violates the canons of rational belief no less than theism. So atheists who regard their attitude toward God as superior to that of thesists are simply mistaken. As long as you acknowledge the difference between what you believe as articles of faith and what you believe on rational grounds, philosophers are not going to critique your position. But when articles of faith are permitted to affect public policy debates, then the situation becomes serious. The absence of objective standards for articles of faith means that virtually anyone can believe virtually anything as articles of faith, including contrary and even contradictory beliefs. There is no prospect for rational public policies under those conditions.

The obsession of the Christian right with abortion, stem-cell research, and cloning appears to have deep roots in its preoccupation with human sexuality. According to its public proponents, there are only two reasons for humans to have sex, which are procreation and recreation. Procreation is ordained by God, recreation is not. Hence, if sex is not motivated by a desire to procreate, it contravenes God's will and becomes an animalistic exercise. It follows from this framework that contraception and birth control—and even sex education and planned parenthood—are unacceptable to them and in the eyes of God. The Bush administration has catered to their preferences by undermining the Constitutional separation of church and state thorough "faith-based initiatives", on the one hand, and by withholding US funding for the United Nations and undermining its efforts to bring contraception and birth control to third world countries, on the other. This is a legacy of which Americans should not be proud.

The problem is not simply that the existence of God cannot be proven but that there is no end of sources claiming to speak for God. On the day following 9/11, for example, my wife and I were in our kitchen with the television on. Pat Roberson's "The 700 Club" came on, with Jerry Falwell as Pat's guest. Falwell observed that, in his opinion, the events of the previous day were manifestations of God's will, because America deserved to be punished for its rampant homosexuality, abortions, and the ACLU, with which Robertson solemnly agreed. They were secure in their opinions insofar as no one could prove that they were wrong. (It would take me years to figure out why the ACLU, which is dedicated to upholding the first ten amendments to the Constitution, commonly referred to as "The Bill of Rights', was on that list, but it has become apparent to me that Falwell, among others, doesn't really believe in freedom of religion, but prefers a Christian theocracy.)

This is a domain that abounds with fallacious reasoning. The division of inter-course as having to be motivated by reproduction or by recreation exemplifies the fallacy of the specious bifurcation, in which two alternatives are juxtaposed and treated as though they were mutually exclusive and jointly exhaustive. Think about the third alternative: sexual relations as an expression of affection between adults in a loving relationship. The rhetorical condemnation of non-reproductive sex loses much of its impact as soon as we acknowledge that there may be a place for sex which is not intended to be reproductive, yet does not fall into the category of merely recreational. Not all non-reproductive sex is reckless or casual sex, even if Christian evangelists talk about it as if it were. In relation to the expression of affection between adults, after all, there is a role for contraception and birth control.

It was therefore stunning to discover that the Christian right has taken an extreme stand against a major scientific innovation that protects girls and young women from cervical cancer. A federal panel has recommended that all girls and women between the ages of 11 and 26 should receive this vaccine, Gardasil. According to an article in *The New York Times* (Harris 2006), "(it) protects against cancer and genital warts by preventing infection from four strains of the human papillomavirus, the most common sexually transmitted diseases." The practical problems attending this vaccine concern its complex schedule of inoculations (three shots over six months), its cost (at $360, among the most expensive ever), and by opposition from religious groups (especially those that advocate abstinence). Even though it has been hailed as a "breakthrough for women's health" in combating hundreds of thousands of deaths from cancer each year and the federal government is expected to contribute to offsetting its expense, a powerful lobby stands poised to oppose it and to take an aggressive stand to defeat it.

According to Gene Gerard (2000), even though Gargasil seems to be approximately 100% effective in guarding against cervical cancer, "many conservative organizations oppose it on the grounds that it might promote promiscuity among adolescent girls. Now that the FDA has approved the vaccine, conservatives are already working feverishly to limit or prevent its use." Assuming the claims made on its behalf are well-founded and not financially motivated, it would be hard to imagine a more clear cut case in which acceptance of religious doctrines contravenes scientific progress and the health and welfare of women. Does anyone seriously believe that a young woman will be motivated to have sex because she knows of the existence of a vaccine which protects her from cervical cancer and genital warts? Give me a break. This appears to be on a par with the attitude displayed by the religious right in relation to abortion as though a young women would become pregnant in order to have an abortion. These policies provide striking support for the inference that the religious right is not just opposed to abortion but actually obsessed with sex, not really "pro-life" but anti-sex.

1. Flag Burners, Hookers, and Pot Heads

Politics and morality have an uneasy relationship, because while most Americans like to think they are moral, their understanding of its principles is typically shallow and insubstantial. A distinction has to be drawn here between "popular morality" and "true morality", of course, because most Americans would take strong exception to the idea that they might not be moral, even if they discriminate on the basis of race, religion, ethnicity, or sex. They do not understand that morality entails treating everyone with respect and never treating persons merely as means. That deeper lesson somehow has never quite caught on. Consequently, in the popular mind, practices like flag burning, smoking pot, and prostitution are commonly assumed to be immoral. Beliefs that are widespread, however, need not be true. The hypocrisy that runs like a river through American politics appears to crest within the G.O.P. for reasons that are easy to grasp.

Republicans repeatedly accuse the Democrats of being a party of special interests, including blacks and gays, feminists and unionists, the poor and the homeless. Exactly what the Republicans represent than other special interests is not entirely clear. What is entirely clear is that the Republican Party is the party of the rich. But, because the rich are small in number, their candidates cannot be elected without receiving support from other segments of society with whom they share practically nothing in common. The party uses social issues to harvest votes from the non-rich by fanning the flames of emotions over abortion, school prayer, and burning the flag. Since the Supreme

Court has ruled that abortions are legal and no one—not even the government!—can stop any one from praying—in school or out—these are all implausible planks for a national party. Does anyone think that the rich do not arrange abortions for their daughters when they incur unwanted pregnancies? But the non-rich still rally to their cause by the millions. The G.O.P. has run up an impressive string of victories.

Since burning a flag is the proper method for disposing of a flag, it is not really flag burning that provokes such heated opposition but burning the flag as an act of protest against policies of the government of which you disapprove. I would have thought it was far better to burn a symbol of the country than the country itself, but that is not how these social conservatives see it. Only about six flags are actually burned in any given year, so it is not much of a problem, and it brings a lot of voters to their booths. So, the non-rich, who favor school prayer and oppose abortions and burning the flag, periodically join with the rich, who really could care less, to elect candidates to public office. Since their non-rich supporters are large in number while their rich supporters are few, they are thereby compelled to adopt positions in which they do not believe to promote the interests of the rich, which they want to advance. But only officially as a sop to gain support. Which is why Republicans so often disavow their platform!

Each election cycle is strikingly like the past. Imagine if you wanted to maximize the flag-burning issue to motivate your base. Surely the best possible way to secure that objective would be by arranging for a very close vote. And, indeed, it could not have been closer during 2006, where a 66-to-34 vote left the amendment just one vote sort of the 67 needed to send it to the states for ratification (Hulse 2006). There are signs that the American people are catching on. Even Gary Trudeau ran a sequence in "Doonesbury" (Trudeau 2006), where an aide explains to President Bush, "Sir, the reason we're not getting a bounce from flag-burning is that it hardly ever happens anymore." He continues, "We may need to stage something. You know. Pay some kid to burn a flag in a public place." And the President replies, "Yes . . . . I like that! Find someone who has a beef with the government, maybe someone who has just been fired." "Doonesbury" fans know what happened next. Humor has its roots in truth.

The strongest argument against prostitution is its alleged immorality. If this means no more than that most people tend to believe prostitution is immoral, that appears to be correct. But if this is taken to mean prostitution actually is immoral, then an argument is required. Believing something isn't enough to make it true. That the Sun revolves around a flat and motionless Earth is part and parcel of false beliefs that once were also widely held. Some people probably believe it to this day. That an activity is presently illegal does not establish that it is immoral, any more than its morality guarantees its legality. We know slavery has been both legal and illegal, even though slavery is immoral if any action is. We also know that the duty to always treat others with respect does not entail never treating others as means.

The relationship between employers and employees, it bears repeating, is one in which employers use their employees as a means to conduct a business and make profits, while employees use their employment as a means to make a buck and earn a living. Within a context of mutual respect, this is moral conduct. When employers subject their employees to unsafe working conditions, excessive hours, or poor wages, however, the relationship becomes exploitative and immoral, which can also occur when employees do not perform their duties, steal from their employers, or abuse the workplace. Similar considerations apply to doctors and patients, students and faculty, or ministers and congregations, which may explain our dismay at their betrayal. We learned these things during the course of our previous discussion of moral theories.

Indeed, adults commonly engage other adults in physical activities for which they receive compensation. Consider the therapeutic massage, when administered by a woman or a man. Consider physical therapy and even sex therapy. Not every man enjoys success in locating suitable sex partners within the context of an affectional, romantic or loving relationship. Given the sexual nature of the human species, it is unrealistic to suppose they should be denied the opportunity for engaging in (what some would call) the most basic function of its members. It seems disrespectful, even cruel, to deny members of the species the opportunity for sex with a willing and voluntary partner, even if that interaction is one for which there is financial compensation. And men are not the only adults who might derive those benefits.

There appear to be no inherent reasons prostitution should not qualify as moral so long as hookers and their tricks treat one another with respect. Hookers are immoral whenever they do not provide the services agreed upon, steal their trick's money, or expose them to venereal disease, while johns are immoral when they do not pay for services rendered, engage in physical abuse, or infect them with disease. Respect works both ways round. Even when prostitution happens to be legal, immorality can enter by means of other relationships. When husbands or wives commit adultery and thereby betray their commitments to each other, they are not displaying respect for their spouses and are acting immorally. But that remains the case apart from any commercial aspects. Not for nothing is it qualified as the world's oldest profession.

The problems that arise in relation prostitution are derived largely by its illegality, not by its immorality. In those locales where prostitution is legal, such as regions in West Las Vegas, women can freely choose this line of work without the intervention of pimps, who turn them into sexual slaves. When prostitution is illegal, no doubt, the consequences can be immoral both for hookers and their tricks alike. During his days as Governor of Minnesota, Jesse Ventura observed, "If it's legal, then the girls could have health checks, unions, benefits, anything any other worker gets, and it would be far better" (Grobel 1999). As long as men and women want to have sex and cannot locate suitable partners any other way, it shall persist and endure. The problem with prostitution is not its immorality. The problem is to handle it properly.

The situation relative to pot, if anything, appears to be even more clear-cut. Our nation is saturated with drugs, from aspirin, Advil, Tylenol, and Claritin to cigarettes, chewing tobacco and even cigars. You cannot read a newspaper or a magazine, watch television or listen to the radio without encountering a plethora of advertising for drugs promising to reduce weight, promote hair growth, or help overcome erectile disfunction. The "Noble Experiment" banning alcohol, which endured from 1920 to 1933 with the enactment and then repeal of the 18th Amendment by the 21st, had devastating consequences for the USA. Prohibiting the manufacture, transportation, distribution, and sale of alcoholic liquors for beverage purposes produced effects that parallel those we are encountering today from prohibiting the sale of marijuana.

The profound and enduring effects of prohibition, as Peter McWilliams (1996) has observed, include (1) generating disrespect for the law, (2) eroding respect for religion, (3) creating organized crime, (4) corrupting law enforcement, the court system, and politics, (5) overburdening the police, the courts, and the penal system, and (6) harming millions of persons financially, emotionally, and morally. It also (7) caused physical harm, because safe alcoholic beverages were not then available, (8) changed the drinking habits of the country for the worse, (9) made cigarette smoking a national habit, (10) inhibited the treatment of drinking problems, (11) produced a new category of immorality, and (12) consumed vast financial resources that might have been better used to support education, eradicate diseases, and feed homeless.

Some of these effects are especially ironic. Because Prohibition was promoted by evangelists and others who wanted to control how other people choose to live their lives, the failure of Prohibition was interpreted as God's failure, especially in the eyes of those who think everything that happens happens in accord with God's will. If God wanted Prohibition to succeed, after all, surely Prohibition would have been a success. Moreover, the cost of this social experiment may be rather difficult to calculate, but McWilliams has estimated that it had to have run into the billions of dollars at a time when the average worker at Ford Motor Company made $5 per day. "In addition to this cost," McWilliams remarks, "let's not forget the taxes on alcohol the government lost because of Prohibition, and the profit denied honest business people and diverted into the hands of organized crime". It was a costly proposition.

The situation with respect to pot appears to be very similar or even worse. Every consequence that attended Prohibition now attends the "New Prohibition". Marijuana is less addicting than nicotine and less harmful to health than alcohol. Yet cigarettes and alcohol are not illegal: their use is regulated, their quality is controlled and their sales are taxed, thereby drastically reducing or even completely nullifying the effects attending Prohibition. The arguments that pot use leads to the use of stronger drugs, moreover, appears to be a red herring. This claim trades upon a simple equivocation because, while it is true that use of marijuana can lead to using stronger drugs, it is false that smoking marijuana always leads to the use of stronger drugs. Those who use stronger drugs usually have smoked marijuana, but they typically also smoked cigarettes, consumed alcohol, and drank milk. So should drinking milk be a crime?

The strongest opposition to the legalization of marijuana appears to comes from self-appointed religious figures who regard themselves as custodians of morality, cowardly politicians who are unwilling to address controversial issues with candor, and the liquor industry, which does not want competition from those who want to smoke their high rather than drink it. Even the effects upon health appear to favor pot over booze. The penalties can be harsh. George Pataki, as Governor of New York, granted clemency to four first-time offenders who were serving long terms under that state's harsh drug laws. But there are hundreds of thousands more who are not the recipients of compassion from politicians. The toll in human life over the casual use of recreational drugs staggers the imagination. Uneven enforcement of the law has to disturb even the most unconcerned citizen. Lives are ruined over the recreational use of pot. And the lack of evenhandedness is morally outrageous.

Anthony Lewis of *The New York Times* has observed that the operating costs for prisons, overflowing with non-violent prisoners, ran about $40 billion in 2000. This cost could be drastically reduced by legalizing the use of pot. Our current policies are so completely ineffectual that even our nation's former "Drug Czar", General Barry R. McCaffrey, has proposed the more humane approach of drug testing and treatment. No one wants to encourage the widespread use of drugs, but drugs are not going to go away. The drug cartels have expanded and flourished because demand for drugs exceeds the legal supply. When marijuana is legal, its use can be regulated, its quality can be controlled, and its sale can be taxed. Profits from pot will stay out of the hands of organized criminals. Crime and its costs will also drop dramatically. We know those who ignore the past are destined to relive it. Surely we can do better.

2. Are Corporations Inherently Immoral?

When former Enron chief executive, Kenneth Lay, now deceased, declined to testify before Congress regarding the apparent fraud and deception being practiced by his company, whose discovery led to its collapse, that profoundly troubled many of our elected representatives. According to the *Duluth News Tribune* (February 4, 2002), Senator Byron Dorgan, D-ND, for example, observed, in response to new disclosures, "It is almost a culture of corruption", where "Once you start peeling away the layers of this onion, it starts to look pretty ugly." The especially troubling question remarks such as these may raise in the minds of Americans is the possibility that corruption might be inherent to corporations. The thought sounds almost vaguely unAmerican.

After all, if corporations are inherently corrupt, we should have every reason to expect that this Enron may be followed by many other Enrons and that there is really no good reason to suppose that the situation should get better on its own. Indeed, the thought has crossed more than one rational mind that, if corporations as prominent as this one have been able to exert such vast influence in political and economic affairs, then perhaps the only reason we haven't heard of more cases of this kind—apart from the occasional savings and loan scandal, for example—has been a function of ignorance, where we haven't known because our nation's press has failed to keep us informed.

The reasons, however, may run deeper than that. One problem that has arisen within this context has been a matter of understanding what the word "corporation" should be understood to mean. The alternatives range from that of a nexus of contracts to a person, where the first reflects a function of corporations (to enter into contracts) and the second a legal fiction (since a business is not a person). A place to start to come to grips with this problem is the dictionary, which offers the following conception(s):

(D1) *corporation* =df *1 a legal entity, consisting usually of a group of people who have a charter granting it perpetual life, that is invested with many of the legal powers given to individuals: a corporation may enter into contracts, by and sell property, etc. 2 a group of people, as the mayor and alder- of an incorporated town, legally authorized to act as an individual. 3 any of the political and economic bodies forming a corporative state, each being composed of the employers and employees in a certain industry, profession, etc. 4 a large, prominent belly* (*Webster's New World Dictionary*, 3rd College Edition 1988).

Imagine my surprise to discover that, contrary to my sincere belief that corporations are not persons, there are definitions, such as 4 above, according to which a part of a person can qualify as a corporation, especially since I had never before thought of myself from that point of view! The evidence in my case may be indisputable, but the sense at stake here is not 4 but 1, which identifies corporations with a group of persons organized for the conduct of business by entering into contracts, which assigns the function (entering into contracts) with those who exercise it (the owners).

Owners of corporations are not always the same as their officers or employees, except in cases in which the officers or employees own stock in the company. So a rather important distinction must therefore be drawn between "stockholders" as the owners of the company who profit from it and "stakeholders" as those persons or other entities having interests that may be affected by its conduct of business, for better or for worse. That includes employees, customers, creditors, and suppliers as well as stockholders, not to mention the community, the environment, and the world.

Just to sharpen our focus and avoid misunderstanding, the concept of corporation that appears to matter within this context can be captured by the following definition:

(D2) *corporation* =df *a legal entity consisting of an arrangement of people and property (roles and assets) interacting together for the purpose of conducting business by a nexus of contracts.*

Although this definition may appear to be neutral with regard to the question before us, it fails to take into account the historical context of the times. As Marjorie Kelly, *The Divine Right of Capital* (2001), has astutely observed, the standard conception of corporations—the prevailing paradigm within American society—accepts the crucial principle that "the only social responsibility of the corporation is to make a profit", which was initially enunciated by a Nobel Laureate in Economics, Milton Friedman.

Lest we fail to recognize the importance of this principle, Kelly elaborates upon it:

> *In corporate society, good is what is in the interest of stockholders. That is the primary criterion of morality. It means the corporation has the right to do financial violence to its employees or the environment (conducting massive layoffs, clear-cutting forests), or to attack other corporations (brutal competition, hostile takeovers), if that increases the well-being of the ruling tribe, the stockholders.*

Indeed, according to Kelly, prominent philosophers, including Karl R. Popper, have characterized (what he calls) "the totalitarian theory of morality" as maintaining that "good is what is in the interest of my group; or my tribe; or my state". Thus, such states, for example, are permitted to attack other states, or to do violence to their own citizens, if it benefits the ruling tribe. Or, alternatively, such corporations are permitted to attack other corporations, or to do violence to their own employees, if it benefits the stockholders. They exemplify the ethics of limited utilitarianism.

The conclusion that corporations are inherently immoral appears plausible, but it might be a good idea to investigate the matter further to ascertain whether or not corporations can be moral, in which case they are not necessarily inherently corrupt. If we assume the prevailing paradigm of corporations as profit maximizing entities, then since profits are generated as the difference between income (as a function of revenue/income for products or for services) and expenditure/costs (of producing those products or services)—schematically, *profits = (prices - costs)* or, more precisely, *profits = (revenues – expenditures)*—and the aim of profit maximization implies the desirability of inflating revenues in general and prices in particular and deflating revenues in general and costs in particular, in the language of accounting.

Costs themselves tend to be a function of the cost of natural resources, the cost of human labor, and (local, state, and federal) taxes. To increase profits, therefore, at least three broad avenues of approach are available related to decreasing costs, namely: (a) decrease the cost of natural resources; (b) decrease the cost of human labor; and (c) decrease the cost of (local, state, and federal) taxes. Alternatively, increase prices to the optimal point where sales produce maximal profits, where the term "profits" should properly be construed broadly to include such forms of profit as retained earnings, stock options, reinvestments in companies, and such).

The modes of operation that tend to maximize profits include (a) decreasing the cost of natural resources by, for example, (i) exploiting the environment, (ii) converting public land to private use, and (iii) evading the expenses of pollution cleanup or costs of environmental restoration; (b) decreasing the cost of human labor by, for example, (i) paying minimal wages, (ii) offering minimal benefits (health coverage, dental plans, and such), and (iii) opposing the organization of or diminishing the influence of labor unions that engage in collective bargaining.

Additionally, (c) decrease the cost of taxes, for example, by (i) resisting paying corporation taxes, (ii) seeking to reduce income tax rates and (iii) attempting to abolish inheritance taxes; or (d) increase the price of your product, for example, by (i) reducing competition, (ii) promoting monopolies, and (iii) manipulating markets (by contriving shortages, disseminating misinformation, and the like). These techniques are morally acceptable to corporations because, as limited utilitarian entities, they are obligated to consider the consequences for no one but themselves. The consequences of their acts for others simply do not matter.

Indeed, the situation is so drastic corporations operating as limited utilitarian entities can even resist supporting the social safety net that has been developed since the days of The New Deal, including unemployment insurance, workmen's compensation, Social Security, Medicare, Medicaid, and similar programs, which tend to defeat profit maximization for at least three reasons: (1) they increase the cost of (local, state, and federal) taxation; (2) they create alternatives to low-paying, menial jobs; and (3) they thereby empower the workforce with options.

The current trend toward globalization, including the emergence of the North American Union combining Canada, the US, and Mexico, moreover, appears to be intended to make North American more business friendly and extend the reach of corporations around the world, where the potential benefits are enormous as a as a new form of (or a new name for) colonialism and imperialism, for example, by (1) reducing the cost of natural resources; (2) reducing the cost of labor; and (3) reducing the cost of (local, state, and federal) taxation. Thus, it should come as no surprise that the diminution of sweatshops in the United States should be taking place with a commensurate increase in sweatshops around the world!

It should be apparent that, when their conduct is controlled by the principle of maximizing profits, corporations are inherently corrupt. The problem results from the operation of corporations on the basis of Friedman's principle rather than from the definition of corporations themselves. Consequently, it may be said that corporations are inherently amoral, which means that they can, but are not obligated to, operate on the basis of principles of morality that involve treating other parties with respect. The situation can be changed, therefore, only by adopting a different paradigm than the prevailing corporate paradigm.

Indeed, as David Korten (2001), has observed, many corporate managers are possessed of a social conscience and want to do “the right thing”, both in terms of their obligations to other persons and their responsibilities toward the environment. Those who suggest that voluntary controls might be enough to solve the problem overlook that, “while responsible action may even be more profitable over the long term, financial markets demand instant returns and corporate raiders are standing by to trash any company that isn’t responding”

(p. 202). The pressure thus becomes intense for short-term profit maximization even when it comes at the expense of the better long term interests of society.

Kelly (2001) suggests that corporate responsibilities ought to be redefined to maximize benefits, not merely to stockholders, but to stakeholders, where the responsibilities of corporations include taking into account the consequences of their actions for the parties that they affect by not violating their rights. From a moral point of view, this is analogous to abandoning limited utilitarianism and adopting deontological principles as binding on corporations in their relations with stakeholders and only seeking to maximize profits to an extent consistent with deontological morality. This represents a change in corporate paradigms.

Now the stakeholders include every party whose interests are being affected by the actions of the corporation, that is, which is causally affected, for better or for worse, by its mode of operation, including employees, customers, suppliers, and stockholders, but also the community, the environment, and the world. This approach forsakes short term gains for long term planning, where decisions are made taking into account the answers to questions such as the following three:

* *How do corporate actions affect the qualify of life of employees?*
* *How do corporate actions affect sustainability over the long run?*
* *How do corporate actions affect the survival of the human species?*

Such a change represents a shift toward corporations that serve the public good and do not merely promote private greed, as we have seen in the case of Enron.

A realistic assessment of where we stand today, however, suggests that movements to affect the relationship between corporations and the nation have actually shifted in the opposite direction, alas, toward (what is known as) "fascism" but also by the name of "corporatism" (Perkins 2006). Most historians would agree that the threat to the republic from the right (fascism) has always been greater than any threat from the left (communism), yet the the nature of fascism is seldom discussed and has received little attention in the public domain. The word "fascism" itself can be used as an emotionally laden description serving as a convenient label that circumvents rational discourse instead of promoting it. It would be irresponsible of a professor of logic and critical thinking to use this word without defining it. Because it is a concept that Americans increasingly need to understand, let's begin with *Webster's New World Dictionary*, 3rd College Edition (1988), as follows:

fascism: 1 the doctrines, methods, and movements of the Fascists; 2 a system of government characterized by rigid one-party dictatorship, forcible suppression of opposition, private economic enterprise under centralized government control, belligerent nationalism, racism, and militarism, etc.: first instituted in Italy in 1922 3 a) a political movement based on such policies b) fascist behavior (see Nazi).

An obvious question is the extent to which the candidates of the right represent the interests of the military-industrial complex President Eisenhower warned us about. It ought to be obvious to everyone that George W. Bush and his coterie represents the interests of the big corporations. The form of collusion between government and corporations known as "corporate welfare" is only a most blatant abuse of the government to benefit the rich and the powerful. The government should act on behalf of all of the people, not merely on behalf of special interests.

The problem is that, without big government to oppose them, big corporations use people merely as mechanisms to produce profit without respecting them as human beings. Does anyone think that Firestone and Ford, for example, would ever have considered recalling their products, no matter how defective, were it not for the influence of our government? Anyone who doubts that it makes a difference who is president should consider the differences between Bill Clinton and George Bush. When governments are controlled by corporations, as they are today, the forces of fascism thrive and flourish. That is the problem—THE CENTRAL PROBLEM—that confronts us in this day and age. We verge on fascism. We must understand it.

Benito Mussolini was a principal in the advancement of fascism in Italy during the mid-20th Century. He said that it could equally well be defined as corporatism, the merge of big business with big government, a form of government typified by rampant nationalism and militarism. The state is identified with the leader, where criticism of the leader is taken as unpatriotic or even treasonous. "Fascism," he wrote, ". . . believes neither in the possibility nor the utility of perpetual peace. . . . War alone brings up to its highest tension all human energy and puts the stamp of nobility upon the peoples who have courage to meet it. All other trials are substitutes, which never really put men in the position where they have to make the great decision—the alternative of life or death" (Moussolini 1932).

What Mussolini described sounds like a description of the United States in the early-21st Century, as a nation whose leaders are glorifying nationalism and militarism, including reckless invasions of nations that never attacked us in an apparent effort to seize control of their natural resources, especially oil. The case of Afghanistan is quite illuminating. Prior to 9/11, we negotiated with the Taliban over construction of a Unocal pipeline across northern Afghanistan. We promised to bathe them in gold if they would permit it and bathe them in bombs if they did not. They didn't and we did. Today that pipeline is under construction across northern Afghanistan, two enormous bases are situated perfectly to protect it, the President of Afghanistan is a former Unocal oil official and the Ambassador to Afghanistan is another former Unocal oil official. Some would say this is not rocket science.

The ascension to power of George Bush and Dick Cheney, two long time oil industry agents, signaled a dramatic change in the foreign and domestic policies of the United States from a transparent government that was responsive to the people into a secretive entity operating without regard for popular opinion. We seem to be making a transition from an open society to a closed society. Naomi Wolf (2007) has identified some “10 Easy Steps” in transforming our democratic republic into a fascist state, which include many that our history has already taken:

(1) Invoke a terrifying internal and external enemy: What could have benefited this administration more than the events of 9/11. In The Grand Chessboard (1997), Zbig Brzezinski explained that, as the sole remaining superpower, the US had a unique historical opportunity to create an empire greater than the world has ever seen by projecting its power aggressively into the Middle East, but that Americans were unlikely to be willing to sustain the financial expense and the human sacrifice that would be involved absent their perception of an attack by an external enemy.

(2) Create a gulag: Once the nation is terrified, create a system of prisons that lies outside the rule of law and where torture is permitted. Initially, it is directed toward perceived enemies of the nation, but gradually it is used to contain persons who are perceived as enemies of the state, now identified with the administration. So critics of the government’s policies, opposition members, labor leaders, clergy and journalists become prime targets for arrest and incarceration in these facilities.

(3) Develop a thug caste: In this case, the desirability for “outsourcing” seems to have created the opportunity for privatized armies, mercenary forces operating beyond the rule of law, such as Blackwater USA, which could be used against the citizens of the United States were the Constitution to be suspended, given that the

Army and Marine Corps has been weakened, if not broken, by constant rotation in and out of Iraq, the National Guard has been placed directly under the President's control, and police departments across the nation have been training with them.

(4) Set up an internal surveillance system: Does anyone today doubt that the NSA and other super-secret agencies are conducting nationwide surveillance of our phone calls, our email and other personal records? With computers at hand which can perform a trillion operations per second, there is nothing to inhibit the kind of "data mining" that depends upon the use of key phrases or expressions, possibly even ones critical of the administration, except for enforcement of the rule of law.

Other steps include (5) harassing citizens' groups, including those who want to know the truth about 9/11, (6) engaging in arbitrary detention and release, using rendition as a technique, whereby persons are kidnapped and transported to distant lands where they are subjected to torture, (7) target keying individuals, threatening civil servants, academics and entertainers with public humiliation or the loss of their jobs if they speak out, (8) controlling the press, which has been the case for decades here in the United States, (9) equate dissent with treason, where "You are either with us or with the terrorists" and, finally, (10) suspend the Constitution on the basis of another alleged terrorist attack or some national disaster as the pretext (Wolf 2007).

3. Corporatism as American-Style Fascism

The extinction of principled Republicans must qualify as one of the most stunning developments of Bush/Cheney governance. The GOP used to stand for at least five basic principles: balanced budgets, Constitutional governance, a non-interventionist foreign policy, keeping the government out of our personal lives, and states' rights. No one today would mistake the party of Bush and Cheney for the GOP of the past. They have run up the most massive deficits in American history, undermined the

Constitution, launched two wars of aggression and promise to launch yet another, utilize electronic surveillance to keep track of our personal lives, and disregard the desires of the states and their governors. The Republican Party of the past, at least, represented a coherent political philosophy that deserved respect. This one does not.

Every American ought to pause and ask where we, as a country, are going. There have been times in our history when we experienced a certain moral clarity about the world and its affairs, which today appears to be lost amidst seemingly endless mind-numbing warnings of terrorist threats of one kind or another and the necessity to surrender our civil liberties for increased security. What was it about fascism and communism, for example, that made them so diametrically opposed to our own nation's principles? How can this president claim to be expanding democracy and freedom abroad while concurrently constricting democracy and freedom at home? Has the nation ever confronted an administration more Orwellian in its operation?

There appear to be at least three basic traits that reflect the differences between totalitarian states and democratic nations, where the former display, first, a tendency toward world domination; second, government by secrecy; and, third, control through fear. Our sense of righteousness and moral superiority has derived from our opposition to these practices, rooted in our own traditions of Constitutional government, democratic procedure, and the rule of law. But this administration has used 9/11 as an instrument to restrict civil liberties, increase centralized power, and launch wars of aggression in Afghanistan and Iraq in violation of international law, the UN Charter, and even the US Constitution. This nation’s conduct now bears comparison with that of its past enemies.

Consider, for example, the tendencies toward world domination displayed by Nazis and Communists. Hitler, Stalin, and Mussolini were demonized in part because of their willingness to engage in territorial aggression, changing governments at will, and the assassination of foreign leaders. They were condemned, in part, because of their blatant disregard for the principles of international law, for violating treaties, for substituting the rule of men for the rule of law. But are we as a nation currently doing doing any better? Pat Robertson, a prominent religious leader, makes a public appeal for the assassination of Hugo Chavez, the popular leader of Venezuela, who has been elected twice by large margins, and the government of the United States stands mute.

The President of the United States makes a verbal attack upon Iran, Iraq, and North Korea—the "axis of evil"—the centerpiece of his State of the Union address and is met with nothing but praise. He subsequently declares the unilateral right of the United States to launch "preemptive attacks" upon other nations if we believe that they are contemplating actions contrary to our own national interests. Since the countries that are targeted for attack pose no imminent treat to us, these are in fact *preventive* wars, not *preemptive* attacks, which are warranted by the UN Charter. Secretaries of State and of Defense actively campaign against the establishment of a World Criminal Court! The Vice President argues in the Senate over which he presides against a ban on torture!

The notion that the US has the right to bring about "regime change" around the world when it suits our interests has taken a hold upon the imagination of Americans to the extent that we seldom ask whether such actions are even remotely in accordance with international law. We are so preoccupied with threats to our safety that we do not ask whether they might be more imaginary than real. Until the State of the Union speech, Iran had been tending toward more moderate domestic policies, North Korea had been exploring peace talks with South Korea, and Iraq had not engaged in acts of terrorism for at least ten years, according to our own CIA! Yet George W. Bush simply lumped them together as potential targets of preemptory strikes and as obvious candidates for regime change. And the public seems to accept it (Roberts 2006b and Roberts 2007).

The US reserves unto itself the right to decide when its national interest is at stake, which increasingly appears to be related to the amount of oil that can be found there.

From Afghanistan to Iraq and even Venezuela, the politics of oil trump the practice of democracy. We have demonstrated willingness to engage in territorial aggression, to change governments at whim, and to assassinate foreign leaders. Precisely why we are entitled to a sense of moral superiority becomes increasingly difficult to surmise. The administration's behavior at home has been equally appalling. Government by secrecy has reached a high plateau when the President of the United States can keep official documents and records from the hands of historians and scholars at the stroke of a pen; when a "secret government" can be formed in the absence of consultation with even the highest ranking members of Congress; and when the nation's energy policy can be fashioned without allowing the public to even know the names of those consulted! If the people are not allowed to know the foreign policy of the United States, how can they possibly know if they support it? The situation is intolerable.

We have abrogated international agreements, including the Kyoto Accords and the ABM treaty, apparently without consideration for their long-term consequences for global warming or their short-term implications for destabilizing the nuclear balance, thus disregarding the intrinsic value of the survival and reproduction of the species. The press appears to have no interest in keeping this nation free or contemplating the propriety of this administration's actions. That George Bush and Dick Cheney should want to conceal the identity of those who are dictating the nation's policies with regard to energy should come as no surprise, since this is a government of, by, and for corporations, especially companies with names like "Enron", "Harkin", and "Halliburton". Perhaps they don't need to tell us who runs the government because we already know. Perhaps the American people have a government they deserve.

That Bush should want to withhold records from the Reagan administration that would almost certainly reveal that his father was the point man on Iran-Contra, in which we, the United States, traded arms for hostages with Iran and influenced our own election, may also be unsurprising. But surely every American ought to react with alarm at the creation of a secret government operating at "undisclosed locations", where we appear to be moving far beyond the practices of most totalitarian states.

As though more evidence were needed, the administration has been apprehending, incarcerating, and interrogating persons, some American citizens, whom it charges with vague acts as nonmilitary combatants while denying them the right to legal representation. Indeed, neither the number nor the names of these prisoners are being made available to the public under the guise of undefined threats to "national security". The Military Commissions Act and national surveillance conducted with no supervision are signs that the nation has lost its way. We are abusing and blatantly violating our most fundamental principles of due process, some of which, such as *habeas corpus*, date from the Magna Charta! Legislation that would make thoughts into crimes threaten to plunge us even farther into a deep, dark, back abyss. We have lost our moral bearings and the Congress and the Courts are doing nothing about it. .

The administration has shown a remarkable lack of interest in the causes of 9/11. After all, if we actually knew why the United States was being subjected to attack, it might help us to understand what we can do about it. But that has not been the approach of Bush and Cheney, who have actively opposed inquiries by Congress. In the past, blue-ribbon commissions have been created—by FDR within 11 days of the attack on Pearl Harbor, by LBJ within 7 days of the assassination of JFK. But in the case of 9/11, it was 441 days before Bush acceded to a formal investigation, and then only after political pressure from four women whose husbands had died during the attack on lower Manhattan made continued resistance politically unpalatable. Even then he refused to testify under oath and only when accompanied by Dick Cheney.

9/11 has been used as the justification for the “war on terror”, which is supposed to eradicate evil from this planet. So 9/11 has functioned as the fuse that ignited the conflagration in the Middle East. Yet Bush has acknowledged that Saddam Hussein had nothing to do with 9/11. The Senate Intelligence Committee determined that he was not only not in cahoots with al Qaeda, but was actively tracking down its leaders in order to incarcerate or even kill them. And the FBI—our own FBI! —has admitted that is has “no hard evidence” connecting Osama bin Laden to the events of 9/11. But if Saddam was not responsible and Osama was not responsible, who was responsible for the death of some 3,000 civilians? The administration has not told us but has been playing the American people for saps (Griffin 2004, Griffin 2005, and Fetzer 2007).

The very day that Arlene Specter (R-PA) reported that the administration did not merely have "vague warnings" or a "series of dots" that needed to be connected, but actual "blue prints" of the terrorists' plans to attack the World Trade Center, Bush announced his plan for reorganizing the government by the creation of a new Office of Homeland Security. This sweeping change has brought together a large number of functions from the Secret Service to the Coast Guard, but not the FBI or the CIA. Anyone who actually thinks that agency-shuffling is going to enhance government efficiency does not understand the situation we are supposed to confront. Coping with terrorism requires timely actions based upon current information. This entity by design has no intelligence capability of its own instead remains dependent upon the FBI and the CIA for its information. These agencies, by the way, are the same agencies that failed to predict these terrorist attacks or the fall of the Soviet Union.

The Bush administration has openly promulgated its plan for world domination. Under the title of "The National Security Strategy of the United States" (*The New York Times*, 20 September 2002), this new approach betrays our past heritage as the moral leader of the civilized world and expends our military power for the purpose of promoting our own national self-interest, regardless of the consequences for the rest of the world, in a new form of American imperialism. It represents a shift in our moral values to limited utilitarianism. Its origins are rooted in a study written and published in September 2002 by the Project for the New American Century, a neo-conservative think tank, which lays out the case for US world domination.

Those who signed or supported this study included Dick Cheney, Donald Rumsfeld, Condoleeza Rice, Donald Feith, Paul Wolfowitz, William Kristol, Charles Krauthammer, Jeb Bush, and others who would have positions in the Bush administration. Many of them, such as Cheney and Rumsfeld, had held posts in past administrations, which meant that, when they returned to power, they already knew which buttons to push and which levers to pull in order to get things done. And, as every informed American has become aware, part of their mission, as they saw it, was to create a massively powerful chief executive under the guise of the theory of “the unitary executive”, according to which the president has complete control over every action taken by the executive branch And the results have been disastrous (Dean 2006, Dean 2007, and Savage 2007).

The administration's 33-page document, available on-line via *The New York Times*, was submitted to Congress in response to a law passed in 1986 that requires such an assessment from each President. It adopts the most aggressive foreign policy in the history of the United States by abandoning non-proliferation treaties in favor of "counter-proliferation", which includes scrapping the ABM treaty to undertake the construction of our own missile defense systems, and emphasizing our right to "strike first" at those who would threaten American interests, which the administration takes to be preeminent: *whenever US interests are at stake, there will be no compromise.*

Under the Constitution, treaties have the same standing as the Constitution itself. While the Clinton administration had emphasized reliance upon and enforcement of international treaties—the 1972 ABM Treaty, the Comprehensive Test Ban Treaty, and the Kyoto environmental accords, for example—this document "celebrates" the decision to abandon the ABM treaty, because it imposed constraints upon American efforts to build a missile defense system of its own. The expectations imposed on countries in Kyoto to reduce their CO_2 emissions have been displaced by “targets”, where meeting them becomes merely voluntary. And it rejects the new International Criminal Court, whose jurisdiction, it claims, does not extend to US citizens, no matter what atrocities against humanity they may have committed either at home or abroad.

Although this document is couched in language that expresses appreciation for the UN, the WTO, and NATO, it accents the special status of the US as the world's only superpower and baldly asserts that the President has no intention of allowing foreign nations to complete with the US in military power. This document makes it obvious the US supports multilateral approaches to problem solving only when that happens to coincide with US interests, where the US reserves the right to strike first whenever it perceives its national interests are at stake. Its underlying premises appears to be that, because the US has the power to impose its interests, it has the right to do so. Stunningly, the ancient doctrine that "might makes right" has been repudiated by every student of moral theory except, it would appear, the present administration.

The reason for entities like the UN and WTO is supposed to be that differences in military strength and economic power not compromise the right of nations to be treated alike and with respect in accordance with international law. These policies are blatant examples of limited utilitarianism, according to which an action is right for a group when it brings about the greatest benefits for that group, regardless of its consequences for everyone else. As we have discovered, this is the most pernicious of all moral theories, because the actions of a group, such as those of the Nazis, can be far more devastating than those of mere individuals. That is the new American way. We as a nation now engage in actions that we have previously strongly condemned.

Consider Pearl Harbor. A surprise attack upon naval and marine forces stationed in the Hawaiian Islands would have been morally justifiable under the principles of our own “National Security Strategy". As Robert B. Stinnett, *Day of Deceit* (2000), has explained, the US undertook a series of actions—including arrangements to use British bases in the Pacific; to use bases and acquire supplies in Dutch East Indies; to give all possible aid to Chiang Kai-shek; to send a division of heavy cruisers and two divisions of submarines into the Orient; to station the US fleet in the Hawaiian Islands; to insist that the Dutch refuse Japanese requests for economic concessions, especially oil; and to join with the British in an embargo of Japanese trade—to provoke Japan.

The key point is this. All of these actions could have been perceived as threats to the national interests of Japan. Under the auspices of some counterpart "National Security Strategy of Japan", it would have been perfectly appropriate for Japan to undertake a preemptive strike at the perceived threat to its national interests then represented by the United States. Far from being regarded "a date that will live in infamy", 7 December 1941—consistent with this doctrine—could be remembered as a glorious attempt to uphold the national interests of Japan, an act whose morality and propriety are beyond all question. That the war ended in a fashion that was contrary to its interests is merely an accident of history. Japan did the morally right thing!

The philosophy underlying the Constitution, the Bill of Rights, and the UN charter, is not limited utilitarianism or even classic utilitarianism, according to which actions that bring about at least as much benefit for everyone as any alternative actions are right. In that case, since actions may not benefit everyone the same—our war on Iraq, for example, which is proving to be very costly for Iraqi civilians as well as for Iraqi soldiers—calculations of right and wrong must be made on the basis of net benefits, where the costs for some are subtracted from the benefits for others. This approach, however, like simple majority rule, can be used to justify the most corrupt acts, such as slave-based societies, when they do not properly take into account minority rights.

The Declaration of Independence declares that Americans have inalienable rights to life, liberty, and the pursuit of happiness. We think that's a pretty good thing, even if the founding fathers did not actually include women and slaves within the scope of the rights it was engaged in enumerating. Those would include the right to vote, for example, or the right to be free from unreasonable search or seizure, or the right to forfeit your life, liberty, or property only after a fair trial by a jury of your peers—something called "due process". These are the kind of rights that motivated the UN charter, which advocates universal human rights as rights of every human merely because that person is human. They are rights to which every human is entitled.

Unilateral actions are morally unobjectionable if one nation poses "an imminent threat" to another. But Iraq posed no such threat to the US. The existence of entities such as the United Nations and the WTO make the class of cases in which unilateral action is required a narrowly circumscribed class. Indeed, the US courted the UN for support because Iraq had violated sixteen of its resolutions intended to bring about the removal of weapons of mass destruction, while simultaneously maintaining that the policy of the US was to bring about regime change. The US had no right, under international law, to initiate "regime change" merely because it may find that to be in its national interest, and violations of UN resolutions are not "terrorist acts". Its appeals to the UN is merely a technique to conceal violations of international law that the US plans to perpetrate based on its commitment to a corrupt moral theory.

A policy of prevention is inherently destabilizing. Embracing first strikes simply encourages attacks for perceived threats, real or imagined. Unlike our policies of the past, according to which the US would attack you only if you attacked us first, this new approach functions as an incentive to *use 'em or lose 'em.* It will inevitably encourage Pakistan to attack India, China to attack Taiwan, North Korea its southern neighbor, or—as things now appear—Iran to attack US forces in the Middle East. In view of our announced objectives, if Saddam had possessed chemical, biological, or nuclear weapons, it would have been immoral for him not to use them against the threat the US posed under the auspices of "The National Security Strategy of Iraq"!

Among the objectives specified by the PNAC report that are explicit or implied by The strategic policy of the US are these: maintaining relations with allies as means to promote American global domination; treating "peace keeping" missions as requiring US rather than UN leadership; doing whatever is necessary to undermine European solidarity if that could rival US preeminence; permanently occupying Iraq, with or without Saddam, to maintain US influence in the Middle East and its control over oil; creating US "space forces" to control military uses of space; taking steps to insure US control of cyberspace; continuing to develop our own chemical, biological, and nuclear weapons; and maintaining focus on North Korea, Syria, Libya, and Iran as dangerous nations which, over the long run, along with China, are candidates for regime change.

The overt reason given for opposing the International Criminal Court, as Bush and Cheney have alleged, it that the United States might become the target of flimsy charges for political purposes by nations that dislike us. But there are more ominous reasons for supposing that we might become parties to suits before this court, such as blatant violations of international law. The US and its ally, Israel, have histories of committing serious crimes against humanity, including terrorism, assassination, and coups. Calling them "regime changes" does not alter their legal or their moral character. The best reason for opposing the Court, in their eyes, may simply be to keep Bush, Cheney, Rumsfeld, Wolfowitz, and their cronies free from prosecution and out of prison, where the cumulative evidence suggests that they properly belong.

That fascism has come to America becomes increasingly apparent when Bush has imposed his interpretation upon legislation passed by Congress, not once or twice but over 750 times, thereby presuming unto himself the functions of the legislative and of the judiciary branches of government. A more conspicuous sign that the US has lost its Constitutional compass would be difficult to arrange—unless, say, the people of the United States were to awaken to the realization that their President has gone forward with a plan to create a North American Union merging Canada and Mexico with the United States, where national sovereignty and even states' rights no longer matter, without consulting them, including a set of NAFTA "super highways", which will turn the US into several zones of commerce and completely transforming the nation for the benefit of corporations. And they are displaying ingenuity in pursuing this goal.

Naomi Klein (2007), for example, has clearly noted the emergence of (what she calls) <u>disaster capitalism</u>, involving "orchestrated raids on the public sphere in the wake of catastrophic events, combined with the treatment of disasters as exciting market opportunities", where the complete privatization of the traditional functions of government is the goal. Outsourcing thus becomes the means for effecting the dismantling of America as a democratic republic, where corporations acquire control over most areas of human life. The 9/11 attacks, the Katrina disaster, and even brush fires thus become occasions for further efforts to demonstrate that traditional government does not work and that the safety and security of the American people increasingly requires the kinds of operations that have been associated with police states of the past, including the subversion of our Constitutional rights, resorting to massive surveillance, and the rise of Blackwater USA.

In an astute commentary on Klein's book, Carolyn Baker (2007) has observed that "disaster capitalism" has its origins in the Chicago School of economics dominated by Milton Friedman, who actually introduced the phrase, "shock treatment", to describe "the psychological pummeling of societies and individuals who might stand in the way of or could be made more useful to the advancement of corporate goals", which even extends to the use of literal "shocks" in the form of "electroshock therapy" for some who are especially deserving. The very idea of treating other persons with respect is no part of this approach toward the domination of the world's resources using the military power of the United States as the means for the benefit of corporations. But it confronts the risks associated with the suppression of truth for the sake of politics.

Taken as a case study, we confront a situation where short-term profit maximization is promoting global warming and the extinction of the species, while greed and ideology overwhelm our ability to survive and reproduce. The systematic disregard for science and what it can tell us about the world around us vividly illustrates how rationality of action can subvert commitments to truth—whether about global warming, the events of 9/11, the reasons for going to war in Iraq, or developments in medicine and technology—even when the truth about those events is known to those in power. The control of the mass media thus becomes increasingly important to those who would subvert the nation's principled interest in the general welfare for the special interests of the rich and powerful. Which may explain why this administration has engaged in such extensive secrecy, lies, and deception. If the public knew as much about the evidence as those in power possess, it would be far more difficult to control the content of their rational beliefs and enlist them in courses of action that benefit corporations in ways contrary to their own best interests.

Government, in general, should exist to perform functions on behalf of the people that they are not well-positioned to perform for themselves, whether in relation to the nation's defense, its police and judiciary functions, transportation and communication, health and welfare, or wage standards and working conditions. One of the greatest of all deceptions is to maintain that privatized entities can perform these functions better and even cheaper than traditional government—thereby ignoring the obvious, namely, that whatever cost is associated with the competent performance of these tasks by government, private entities can only perform them and make a profit by costing more! So the choice becomes paying more for the same performance or paying the same for incompetent performance, since, either way, profits will be made. Perhaps the importance of government should not be underestimated and the corrupting influence of corporations should not be overlooked.

If the Constitution is not suspended and the nation is not turned into a police state, if semi-honest elections are held and if some semblance of democracy is restored, then historians of the future may record that this—the blackest chapter in the life of this once great nation—was an era during which ideology gained precedence over science and special interests were given control of the government, in which American-style fascism gained ascendancy and traditional deontological moral values were supplanted by unrestrained limited-utilitarian commitments. It was a period during which global warming was allowed to continue unabated and the risks of nuclear warfare increased exponentially. It will prove to be an object lesson in the grim reality that can ensue when gross psychological motives are allowed to trump minimal biological concerns and cultural evolution to pervert the best interests of the survival of Homo sapiens.

EPILOGUE

> Men never do evil so completely and cheerfully as when the do it from religious conviction. — Pascal, Pensees

These considerations reinforce the importance of appreciating the differences between purely genetic evolution and gene-culture co-evolution. We know that evolution can be envisioned in at least three different ways, namely: as a set of causal mechanisms, including genetic mutation, sexual reproduction, natural selection, genetic drift, sexual selection, group selection, artificial selection, and genetic engineering; as a set of evolutionary explanations, where those mechanisms are applied to specific historical circumstances to explain specific evolutionary events, such as the extinction of the dinosaurs; and as a history of species, which records the emergence and the extinction of various species across time as a consequence of the operation of its causal mechanisms to those historical conditions.

But our conception of the full range of those causal mechanisms must be substantially broadened to encompass the place of culture in evolution. This shift in perspective can be displayed by using simple models of the evolutionary process. Figure 34, for example, reflects a rather standard conception of genetic evolution, for which evolution is measured by means of changes in gene frequencies across time; survival and reproduction to perpetuate genes by means of offspring is the motive that dominates behavior; and what transpires subsequent to reproduction —apart from looking after those offspring—has little or no biological significance. The tendency here is to assume that every instance of the same body (phenotype) possesses the same behavioral dispositions, where minor variations affect fitness.

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                        .          .
                       .          .
                      .          .            Completion of Life
                     /          /
              ef3   /    ef6   /          .
                   /          /          .
                R1          R2          .       Event of Reproduction R1, . . .
     .            /|          /|        /
     .   ef2  /  |  ef5  /  |  ef8  /
     .       /   |      /   |      /
          B1    |    B2    |    B3          Level of Bodies B1, B2, . . .
     |   /      |   /      |   /
     |  /  ef1  |  /  ef4  |  /  ef7
     | /        | /        | /
    G1          G2          G2      . . .    Level of Genes G1, G2, . . .

  -------------------------------------------->  +t
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Figure 34. A Model of Genetic Evolution.

Even while acknowledging the role of pleiotropic and polygenic effects as a source of variation in phenotypes, the role of cultural contributions to behavior tends to be suppressed either because every member of the species displays similar behavior (the instinctual species) or because the influence of inherited tendencies greatly outweighs that of acquired ones (biological determinism). But, while genes are indeed the units of selection, behavior is the level at which selection occurs; and to the extent to which behavior is affected by culture, the first model appears deficient. The second, however, assumes that similar bodies (phenotypes) can acquire and display different behavioral dispositions, because—even if every instance of a phenotype has the same predispositions to acquire behavioral dispositions, under the same conditions—those conditions, in turn, are subject to a wide range of variation.

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                          .                .
                        .                .
                      .                .
                    R1              R2                 Reproduction R1, . . .
                   / |             / |
             ef3  /  |     ef7    /  |            .
                 /   |           /   |          .
               C1    |         C2    |        .        Culture C1, C2, . . .
  .           /      |         /     |       /
  .   ef2   /        |  ef6   /      | ef10 /
  .       /          |      /        |     /
      B1             |   B2          |    B3           Bodies B1, B2, . . .
  |   /              |   /           |   /
  |  /  ef1          |  /  ef5       |  /  ef8
  | /                | /             | /
 G1                 G2              G2       .  .  .   Genes G1, G2, . . .

  -------------------------------------------->  +t
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Figure 35. A Model of Gene-Culture Co-Evolution.

Thus, Figure 35 goes beyond Figure 34 by acknowledging a place for culture in contributing to the survival and evolution of the species by means of causal mechanisms that transcend those admitted by more conventional evolutionary theories, including the role of customs, traditions, and practices that are transient rather than permanent properties of the members of those species, races, or groups. These causal mechanisms are psychological rather than biological in in their character, encompassing different forms of learning from classic conditioning to rational criticism as forms of intelligence that are responsive to the current environment, whereby they can acquire dispositions reflective of the latest customs, traditions, and practices in the evolution of memes, which make gene-culture co-evolution a Lamarckian rather than merely Darwinian process.

1. The Morality of Science.

It would be a mistake, however, to suppose that gene-culture co-evolution implies that genetic evolution allows the biological inheritance of acquired characteristics, which is not the case. What gene-culture co-evolution permits is the cultural inheritance of acquired characteristics, encapsulated by the notion that we don't have to reinvent the wheel (jet propulsion, color television, or digital machines, for that matter). Thus, what gene-culture co-evolutionary theory provides is an evolutionary framework for understanding cultural and evolutionary phenomena as they are instantiated by species whose behavior is not entirely or predominantly instinctual, including especially the higher species. For the study of the behavior of individuals, of groups, and of cultures reflects laws of nature only to the extent to which that behavior is the product of permanent properties.

Once again, however, the situation must not be misunderstood. The permanent properties of neurologically-normal human beings include predispositions to acquire other dispositions under suitable conditions, which include especially predispositions for the acquisition of semiotic abilities in the form of intelligence as mentality of a high order in comparison with other species. The existence of evolved differences between subpopulations supplies a foundation for understanding differences between them, but it does not preclude taking measures to change or improve them. Within democratic societies, however, steps of that kind must be decided by a political process in determining how public resources should be expended in the public interest. Science as such can contribute to the public debate over such issues, but it cannot determine what measures society should undertake.

As Carl G. Hempel (1965) has explained, a distinction must be drawn between value judgments of two kinds, namely: hypothetical (or conditional) and categorical (or unconditional). Hypothetical imperatives concern means that are effective, efficient, or reliable in attaining a certain end, and thus have the form, "If goal G is to be attained, under conditions of kind C, then means M would be appropriate". Categorical imperatives concern or affirm commitments to goals themselves, and thus have the form, "Goal G should be attained". Unconditional value judgments, however, lie beyond what science is able to provide. As he observes, science can ascertain whether or not children are happier and better adjusted when they are raised in permissive rather than restrictive environments, for example, but cannot decide whether a society should have happier and better adjusted children.

In this sense, science can contribute to the attainment of the goals of a society by discovering which means are the most efficient, effective, or reliable for the attainment of specific aims, objectives, or goals, but does not decide which aims, objectives, or goals are those of a society. When Herrnstein and Murray report,

(T1) The cognitive elite is getting richer, in an era when everybody else is having to struggle to stay even;

(T2) The cognitive elite is increasingly segregated physically from everyone else, in both the workplace and the neighborhood;

(T3) The cognitive elite is increasingly likely to intermarry.

(Herrnstein and Murray 1996, p. 114)

Table XXIII. Three Theses from The Bell Curve.

therefore, it is essential to distinguish these reports as descriptive findings about society from prescriptions as to precisely what, if anything, should be done about them. Questions of fact, such as "Is a cognitive elite emerging within our society?", must be separated from questions of value, such as "Is the emergence of a cognitive elite within our society a good thing?" Insofar as science is preoccupied with answering questions of fact and not with answering questions of value, moreover, it should be apparent that science cannot dictate the course society should follow.

2. Are Religious Beliefs Immoral?

The process of adopting means that are efficient, effective, or reliable in order to attain specific goals, however, presupposes the availability of relevant findings of the kind that science can provide. Without knowing empirical facts about the emergence of a cognitive elite (the evolution of predispositions toward semiotic abilities, which may differ within subpopulations, and so on), however, it is very difficult to imagine that societies can make rational decisions about the allocation of its resources in the public interest. It appears to be rather ironic that some of the most serious students of group and racial differences, including Rushton and Herrnstein and Murray, have been attacked for pursuing scientific studies of important issues in the absence of knowledge of which appropriate public policies are unlikely to be adopted within our own society (Murray 1996, Rushton 1996).

To offer an illustration, the acquisition of different habits of action and habits of mind as an effect of our life histories strongly affects our capacity to subsume various experiences by means of corresponding concepts. Those with restricted opportunities to learn and to acquire concepts are therefore inhibited from interacting with their environments in ways that might enhance their fitness. A society that wants to benefit all of its members, therefore, should promote their opportunities for diversified experiences that enhance their acquisition of concepts, especially at an early age. Clark Glymour (1998, p. 30) has suggested that the impact of computers may turn out to be quite positive, insofar as computers enable people with relatively modest training to perform many tasks "as well [as] or better than those with special talents." But this presumes that they will receive that training.

In deontology, "categorical imperative" has a more specific meaning than the one Hempel defines, namely, forms of behavior that are universally binding on every human being, in particular, always treating others as ends (as valuable in themselves) and never merely as means. When we embrace the ethics of belief, which dictates that we are not morally entitled to accept a belief unless we are logically entitled to accept it, the arguments presented in Chapters 12 and 14 establish that the deontological principle of always treating other persons with respect can be justified on the basis of the patterns of reasoning applied there. This means that, in relation to Clifford's conception, we are morally entitled to adopt deontological moral theory (in the form presented here) because we are logically entitled to hold it (by the arguments presented here). Insofar as the "golden rule" qualifies as a counterpart religious principle, it follows that some religious beliefs about moral principles are justifiable on logical grounds.

The situation with respect to most theological religious beliefs, however, is not comparable. Beliefs about the existence of God, like beliefs about the non-existence of God, in most of their formulations, fall beyond the scope of what can be known on the basis of ordinary or scientific inquiries, as we discovered early on. The objective measure of evidential support for empirically untestable hypotheses is 0. Because we are not logically entitled to believe in God (under those formulations), as long as we adhere to the ethics of belief, we are also not morally entitled to believe in God (under those formulations). That means many beliefs about God that assume classic formulations (of the kind discussed here) are not beliefs we are logically entitled to hold, which means that we are not morally entitled to hold them, either. Many theological beliefs are immoral.

Human rationality arises from incorporating habits of mind corresponding to rules of reasoning (inductive and deductive), where our subjective degrees of belief should at least approximately correspond to the objective measures of support provided by the available relevant evidence, where objective measures of support range from beliefs that are necessary (that cannot be false) to those that are impossible (that cannot be true), and subjective degrees of belief range from indubitability (what we cannot doubt) to inconceivability (what we cannot imagine). These scales can therefore be diagrammed schematically as follows:

Necessity	Indubitability
1.0	1.0
Objective	Personal
Degrees	Degrees
0.5 of	0.5 of
Evidential	Subjective
Support	Conviction
0.0	0.0
Impossibility	Inconceivability

Figure 34. Evidential Support vs. Subjective Conviction.

Thus, if we embrace the principle enunciated by William Clifford, namely, *It is wrong always, everywhere, and for anyone to believe anything upon insufficient evidence,* the only responsible attitude toward belief in traditional conceptions of God is neither theism nor atheism but agnosticism. We must acknowledge what we cannot know.

At first glance, it may seem odd that beliefs we are not logically entitled to accept are also beliefs that we are not morally entitled to accept. But consider. We act on the basis of our beliefs. When they are merely articles of faith, both they and their contraries and contradictories are equally acceptable. Suppose a President named George W. Bush had a religious advisor named Billy Graham, who believed, like him, that we are living in the "end times" described by the book of Revelation in the Bible. According to that scenario, there will be a massive war in the Middle East, most Christians and non-believers will die, and Christ will return to Earth. A powerful person with these dispositions might be inclined to take actions, such as invade nations and initiate wars, without regard for their consequences for others, treating them merely as means and without respect. Initiating wars to fulfill these prophesies might be immoral but could come to pass (Seal 2003, Hill 2003). While it may be psychologically impossible for many to not believe in God, that does not mean that their theological beliefs should be allowed to influence public policies.

3. Must Science and Religion Conflict?

None of us have privileged access to the truth in matters of religion. When it comes to belief in God, we all appear to be in the same epistemic quandary, because we have no way to tell whether one or more divine beings even exist. No matter what course history may take, including overpopulation, global pollution, and nuclear war, it can be reconciled with the existence or the non-existence of God. Traditional conceptions envision God as a transcendent being completely unlike any natural phenomenon. Scientific inquiries cannot address phenomena that lie beyond the possibility of empirical investigation. Typical beliefs about God are therefore empirically untestable, which means there are no objective procedures to settle questions about God. While it is logically possible to reconcile religion with science by assuming, for example, that God created living things using the laws of evolution, answers that are based on faith do not qualify as knowledge.

Even Popes have disagreed about the relationship between science and religion. While John Paul II supported evolution as long as it was understood that God is the creator and lawgiver, Benedict XVI recently addressed evolution in his new book, Creation and Evolution (2007), where he expressed far greater skepticism: "The question is not to either make a decision for a creationism that fundamentally excludes science, or for an evolutionary theory that covers its own gaps and does not want to see the questions that reach beyond the methodological possibilities of natural science", but to make allowances for theological beliefs in the form of articles of faith. And while there is no logical contradiction in assuming that God created the world and living things using evolution as the means, there remain the moral inhibitions deriving from the ethics of belief. That is the ultimate quandary.

Jimmy Stewart starred in a movie, "Harvey", playing Elwood P. Dowd, an affable alcoholic who had an ongoing relationship with a large but invisible rabbit. While the film was amusing, few would mistake Elwood's belief in Harvey for knowledge. There was no evidence of Harvey's existence except in Elwood's mind. God is also an invisible being, but one that occupies all space and all time. There are many alternative conceptions, of course, including the existence of many gods, identifying God with nature, and the conception of God as having created the world and allowing it to run its course, as well as more traditional alternatives. The strongest conception envisions God as an omniscient, omnipotent, and omni-benevolent being, who knows everything, can do anything, and wants only good. But the existence of so much misery then becomes a mystery very difficult to comprehend.

Indeed, according to the ethics of belief, atheism is just as immoral as theism. The only justifiable position is that of agnosticism. Anyone can believe anything they want regardless of the evidence as an article of faith. 50% of the population believes in ghosts, 25% believes in witches, and programs and films about angels are wildly popular. You can believe in werewolves, vampires, and leprechauns if you like. Just don't mistake your beliefs for knowledge. Public schools should be secular out of respect for everyone's right to their personal beliefs. But they are not therefore bastions of atheism. The Ten Commandments, organized prayer, and creationism are out of place in public schools, which must be agnostic out of impartiality. Those who impose their religious beliefs upon others are acting immorally.

In Why I am Not a Christian (1957), Bertrand Russell has observed that more people have been slaughtered in the name of religion than from all other deliberate causes combined. This sad state of affairs, which continued unabated to this day, tends to reflect the power of faith and the impotence of reason. There are hundreds of world religions, denominations, and sects, each of which claims to have privileged access to the truth, which differs from one religion, denomination, and sect to another. These beliefs, undoubtedly, cannot all be true, since they bear allegiance to different leaders and texts, different conceptions of God, and different articles of faith. But there has to be an enormous attraction to holding beliefs that, because they transcend experience, cannot be proven false. If one religion promises eternal life to those who take the lives of their religious enemies, who can show them to be in error? For certain groups and times, those beliefs can even be adaptive.

A moral society cannot allow some citizens to slaughter other persons in the name of God. A democratic society cannot allow some religions to have priority over other religions in the education of its members. But that does not preclude the prospect of offering courses on religion in the public school classrooms, provided that they are conducted in ways that are respectful to all points of view. Creationism cannot be taught as science because its hypotheses and theories are not scientific. But creationism and other religious perspectives might readily be taught in their varied manifestations, where students have an opportunity both to explore and to evaluate a broad range of religious alternatives for themselves.

Scientific knowledge will never be complete and we will never know everything there is to know about the beginning of the universe (Rogers 1999, Johnson 1999), the origin of life (Wade 1999, Eschenmoser 1999), the evolution of species (Lemonck and Dorfman 1999, Stevens 1999), or the roots of culture (Wilford 1999a, 1999b). The temptation to deny our ignorance, which is great, by invoking articles of faith, which are abundant, will always endure. But if we substitute faith for knowledge in matters of this kind, our survival as a species will be in jeopardy. The challenge we confront as a species is doing our best to insure we do not join the 98% of species that have already attained extinction. There are no guarantees that we shall succeed, but forsaking science is not a viable option.

In the final analysis, the members of a moral society must become as tolerant of group differences as they are of individual differences. The underlying problem, after all, is not diversity but stereotypes, where persons are treated not as individuals but as instances of preconceptions. Aristotle defined humans as rational animals; others envision us as "the symbolic species" (Deacon 1997) or as "the moral animal" (Wright 1994). Species able to use symbols, of course, qualify as semiotic systems of a high kind, while those that are able to reason qualify as semiotic systems of an even higher kind. Our capacity for criticism, however, qualifies us as semiotic systems of the highest kind. Our aspiration for a moral society, rooted in the ability to compare differences between how things are and how they ought to be, displays it vividly. While our degrees of intelligence and rationality partially distinguish us from other species, our most remarkable trait is the ability to embrace a morality that transcends our biology.

FIGURES AND TABLES

1.6 Table I: Some Properties and Attributes.

Table 7.1 Some Properties and Attributes

R	A
red	round
wooden	cuckoo-clock
gold	melting point of 1064°C
polonium 218	half-life of 3.05 minutes

1.9 Table II: Means, Modes, and Medians.

Table 7.2 Means, Modes, and Medians

R	A
gifted children	130 median I.Q.
white Anglo-Saxons	usually Protestant
BMWs	average $35,000
New College students	mean 600 SATs

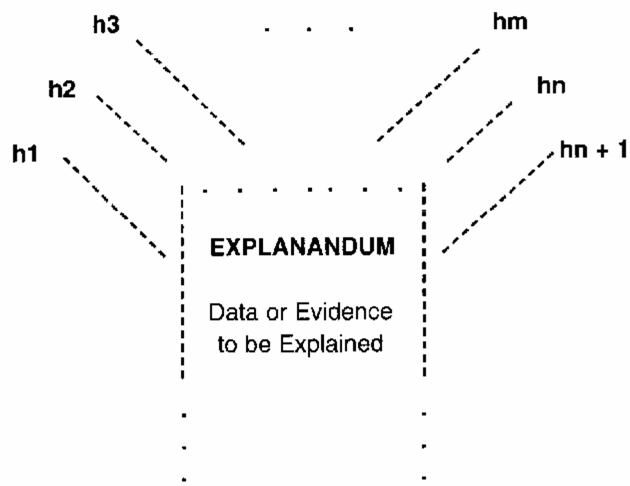
1.13 Table III: Alternative Conceptions of Scientific Procedure.

Table 7.3 Alternative Conceptions of Scientific Procedure

INDUCTIVISM	DEDUCTIVISM	ABDUCTIVISM
Observation	Conjecture	Puzzlement
Classification	Derivation ~~Deduction~~	Speculation
Generalization	Experimentation	Adaptation
Prediction	Elimination	Explanation

Derivation

Figure 7.1 Inference to the Best Explanation



1.23 Figure 2. Are Creationist Hypotheses Scientific?

Figure 7.2 Are Creationist Hypotheses Scientific?

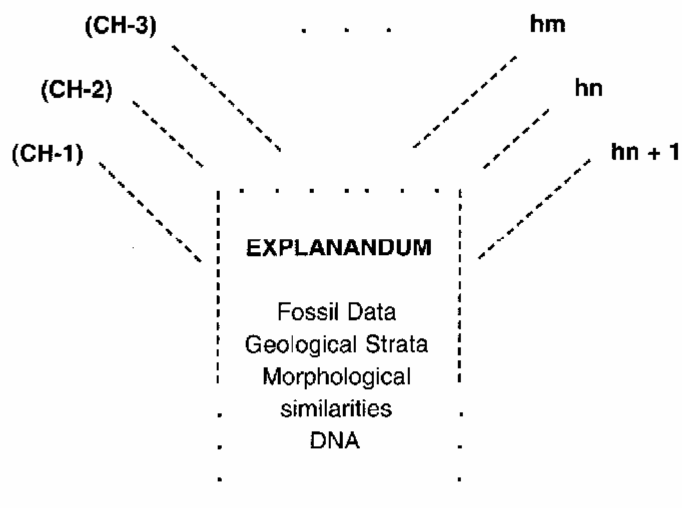


Figure 7.3 A Deterministic-Deductive Explanation

Law:	Striking a match of kind K under condition C*i* would cause it to light.	EXPLANANS
Initial Conditions:	This is a match of kind K being struck under conditions C*i* now.	
Description of Event:	This match is lighting now.	EXPLANANDUM

1.26 Figure 4. A Retrodictive Inference.

Figure 7.4 A Retrodictive Inference

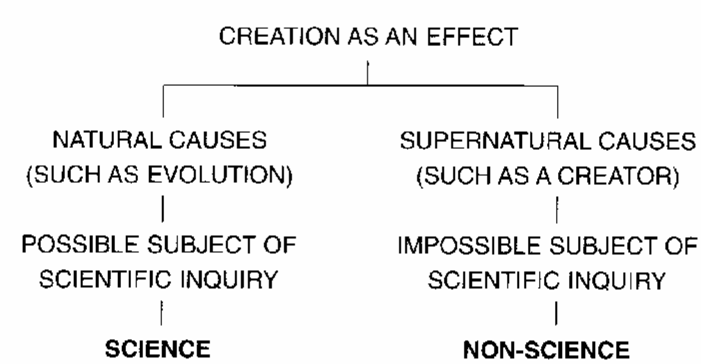
Law:	Being run over by a steamroller would bring about your death.	PREMISES
Initial Conditions:	You are not dead.	
Description of Event:	You have not been run over by a steamroller.	CONCLUSION

1.26 Figure 5. An Inadequate Explanation.

Figure 7.5 An Inadequate Explanation

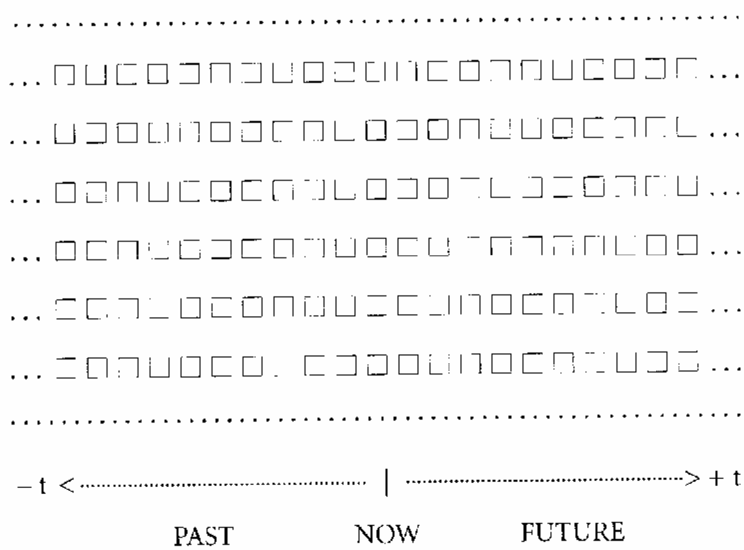
Law:	Men who take birth control pills do not become pregnant.	EXPLANANS
Initial Conditions:	John Jones has been taking birth control pills.	
Description of Event:	John Jones has not become pregnant.	EXPLANANDUM

Figure 1.1 Science as the Study of Causes and Effects



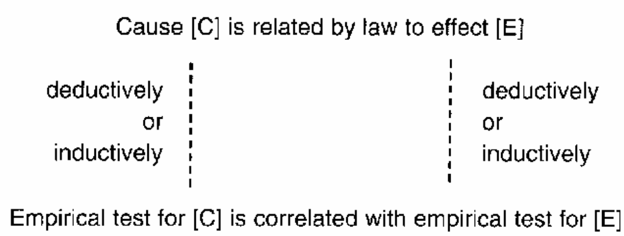
2.2 Figure 7. An Isolated Region of (Local) Space and Time.

Figure 1.2 An Isolated Region of Local Space and Time



2.4 Figure 8. A Causal Theory Square.

Figure 1.3 A Causal Theory Square



2.8 Figure 9. The Evolutionary Explanandum.

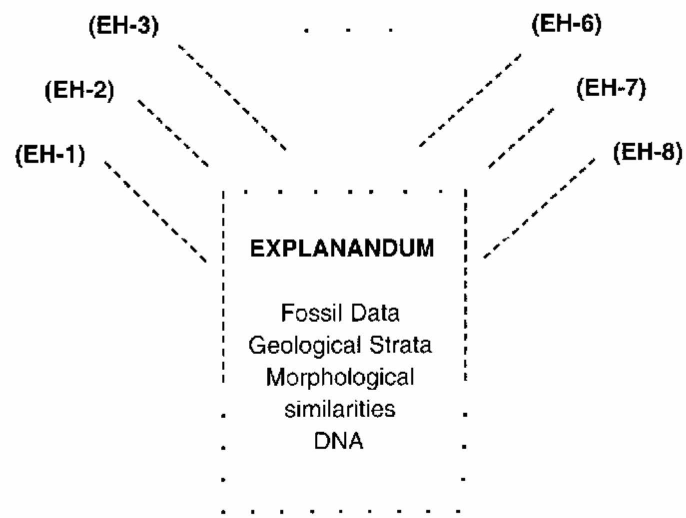
Figure 1.4 The Evolutionary Explanandum (Forey 1988)

HISTORY OF THE EARTH

EPOCH	SIGNIFICANT EVENTS	AGE
Recent	Ice retreats to present position	
Pleistocene (Ice Age)	Ice covers much of Europe and North America	2
Pliocene	Climate becomes colder. Many mammals become extinct. Appearance of man	6
Miocene	Rise and spread of grasslands, associated with spread of grazing mammals	22
Oligocene	Many early mammals become extinct	36
Eocene Paleocene	Early mammals diversify. Appearance of many modern mammal groups	65
	Many animals become extinct, including dinosaurs and ammonites. Rise of flowering plants	145
	Peak of dinosaur diversity. Rise of birds	210
	Reptiles diversify rapidly. First mammals appear	250
Pennsylvanian (Coal Age)	Widespread exinction of marine animals. Mammal-like reptiles diversify	290
Mississipian	Coal swamps with lush vegetation. Rise of winged insects and primitive reptiles	340
	Widespread shallow seas with reefs. Amphibians diversify	365
	Widespread invasion of fresh water by animals and plants. Rise of ammonoids in sea. Fishes diversify	415
	Rise of land plants. Prolific life in shallow seas	465
	Spread of shallow seas over land. Marine invertebrates diversify rapidly	510
	Many animals develop hard skeletons	575
	Soft bodied animals and algae present, including stromatolites	
	Development of free oxygen	3000
	Birth of planet Earth	4600

SYSTEM	PERIOD	LIFE FORMS
Cenozoic	Quaternary	ft
	Tertiary	]
Mesozoic (Age of Dinosaurs)	Cretaceous	-,rt
	Jurrasic	
	Triassic	
Paleozoic	Permian	1 · 1
	Carboniferous	<fk
	Devonian (Age of Fishes)	:1:cDL
	Silurian	bt
	Ordovician	•,,
	Cambrian (Trilobytes)	t
Precambrian		

Figure 1.5 Alternative Evolutionary Theories



3.1 Table IV. Morris's Evolution and Creation Models.

Table 2.1 Morris's Evolution and Creation Models

EVOLUTION MODEL	CREATION MODEL
Continuing naturalistic origin	Completed supernatural origin
Net present increase in complexity	Net present decrease in complexity

3.2 Figure 11. Comparison of Creation and Evolution.

Figure 2.1 Brown's Comparison of Creation and Evolution

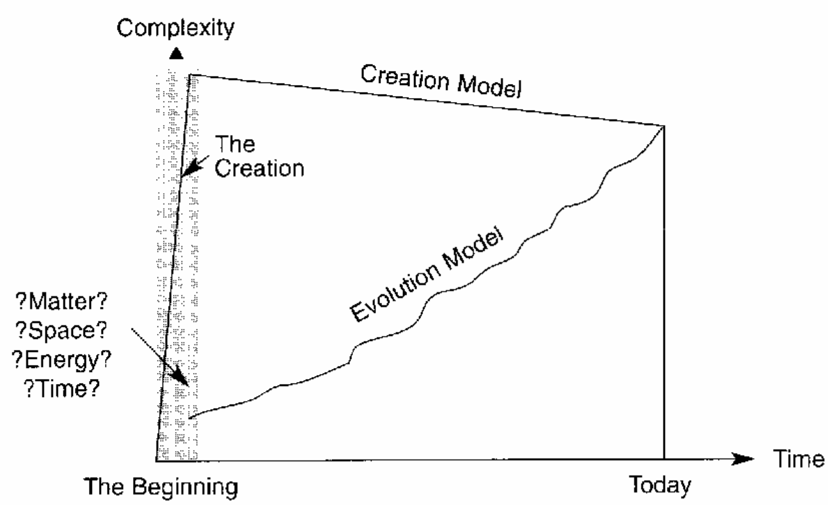


Table 1.i ~~Some~~ Basic Laws of ~~Evolutionary Theory~~ Developmental Biology

(L1) $(x)(t)[G1xt \Rightarrow (EF1xt = m \Rightarrow P1xt^*)]$

(L2) $(x)(t)[P1xt \Rightarrow (EF2xt = n \Rightarrow BT1xt^*)]$

5.10 Table VI. The Meaning of a Specific Belief.

Table 1.ii The Meaning of a Specific Belief

(D1) $(z)(t)[C1zt \Rightarrow (B1zt = m \Rightarrow R1zt^*)]$;

(D2) $(z)(t)[C2zt \Rightarrow (B1zt = n \Rightarrow R2zt^*)]$;

5.20 Table VII. Two Principles of Logical Omniscience.

Table 1.iii Two Principles of Logical Omniscience

(P1) If p were true, then z would believe p;

(P2) If p were false, then z would not believe p.

5.21 Table VIII. Two Principles of Methodological Infallibility.

Table 1.iv Two Principles of Methodological Infallibility

(P3) $p \Rightarrow [SMzt \Rightarrow B(p)zt^*]$;

(P4) $\sim p \Rightarrow [SMzt \Rightarrow B(\sim p)zt^*]$;

5.22 Table IX. Comparison of Relative Frequency of Method Success.

Table 1.v Comparisons of Relative Frequency of Method Success

(SM1) Observation: # observe p & p / # observe $p = m1/n1 >>> 0$

(SM2) Memory: # remember p & p / # remember $p = m2/n2 >> 0$

(SM3) Testimony: # testimony p & p / # testimony $p = m3/n3 > 0$

Table 1.vi Cognitive Strategy IBE

(IBE1) $(z)(t)[IBEzt \Rightarrow (E1zt = m \Rightarrow B1zt^*)]$;

(IBE2) $(z)(t)[IBEzt \Rightarrow (E2zt = n \Rightarrow B2zt^*)]$;

5.27 Table XI. Acquiring Cognitive Strategy IBE.

Table 1.vii Acquiring Cognitive Strategy IBE

(L3) $(z)(t)[HS3zt \Rightarrow (EF3zt = m \Rightarrow IBEzt^*)]$;

(L4) $(z)(t)[HS3zt \Rightarrow (EF4zt = n \Rightarrow IBEzt^*)]$;

6.10 Table XII. Ristau's Inference to the Best Explanation.

Table 2.i Ristau's Inference to the Best Explanation

(h1) The bird's behavior is a reflexive fixed-action-pattern response.

(h2) The bird's behavior is a manifestation of conflicting motivations.

(h3) The bird's behavior manifests approach or withdrawal tendencies.

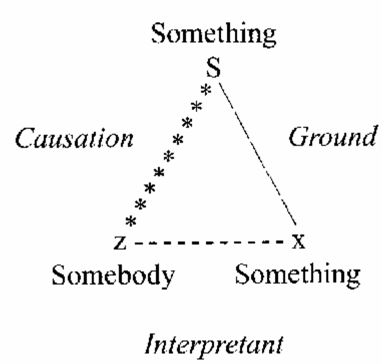
(h4) The bird's behavior is a pre-programmed sequence of behavior.

(h5) The bird's behavior has been acquired as a function of learning.

(h6) The bird's behavior is intentional or purposeful in its character.

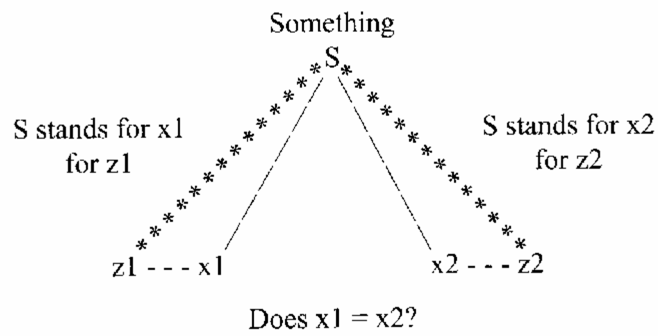
The behavioral observations (observational evidence) includes that injury-feigning is not random, not simply away from the nest or from an intruder, not inconsistently leading away from the bird's nest, not rigid and inflexible, not acquired from repeated exposures, and so forth.

Figure 2.1 The Triadic Sign Relationship



6.17 Figure 13. Communication Situations.

Figure 2.2 Communication Situations



7.4 Table XIII. Donald's Four Stages of Cognitive Evolution.

Table 3.1 Donald's Four Stages of Cognitivc Evolution

Stage	*Level* (A)	*Level* (B)
I. The Great Apes	Episodic	Gestural (stimulus bound)
II. *Homo erectus*	Mimetic	Gestural with re-enactment
III. *Homo sapiens* (early)	Mythic	(1) Song (tones of voicc) (2) Speech
IV. *Ilomo sapiens* (late)	Theoretic	Reading and Writing

7.10 Table XIV. The Theory of Minds as Semiotic Systems.

Table 3. ii The Theory of Minds as Semiotic Systems

CONJECTURE: Minds are semiotic systems (sign-users).

DEFINITION: mentality = df semiotic ability

CRITERION: the capacity to make a mistake

Type I	Type II	Type III	Type IV	Type V
definition:	*definition*:	*definition*:	*definition*:	*definition*:
iconic	indexical	symbolic	transformational	metamentality
criterion:	*criterion*:	*criterion*:	*criterion*:	*criterion*:
type/token recognition	classical conditioning	operant conditioning	logical reasoning	criticism

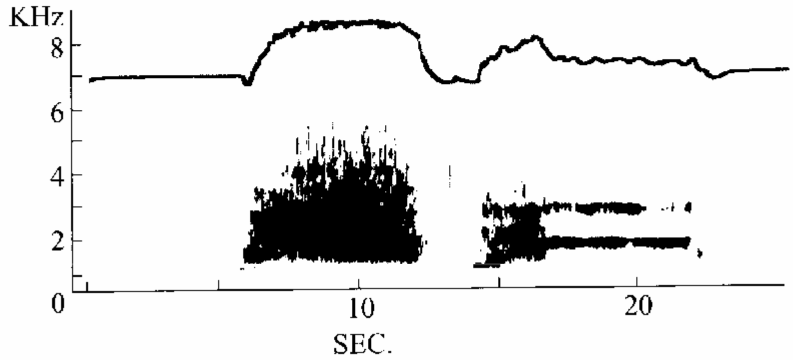
NOTE: Applicable to humans, to other animals, and to machines:

(1) species are predisposed toward types of mentality;

(2) machines have mentality if they are semiotic systems;

(3) a thing has a mind if it is capable of making a mistake; etc.

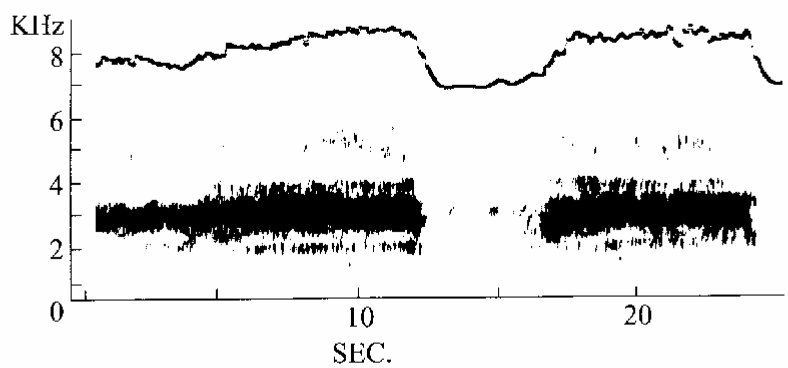
Figure 3.1 Roar



Roar. This monosyllabic loud outburst of low-pitched harsh sound lasted from 0.20 to 0.65 seconds, beginning and ending abruptly. As may be noted in Figure 1, there were individual differences in the frequency concentrations of a roar.

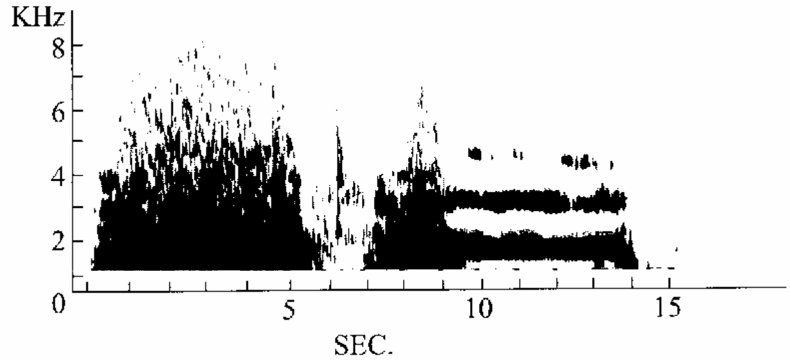
7.13 Figure 15. Screams.

Figure 3.2 Scream



Scream. This shrill and prolonged emission of extremely loud sound could last up to 2.13 seconds and be repeated as often as ten times. Unlike with the roar, individual differences in screams could not be denoted, either spectrographically or subjectively.

Figure 3.3 Wraagh

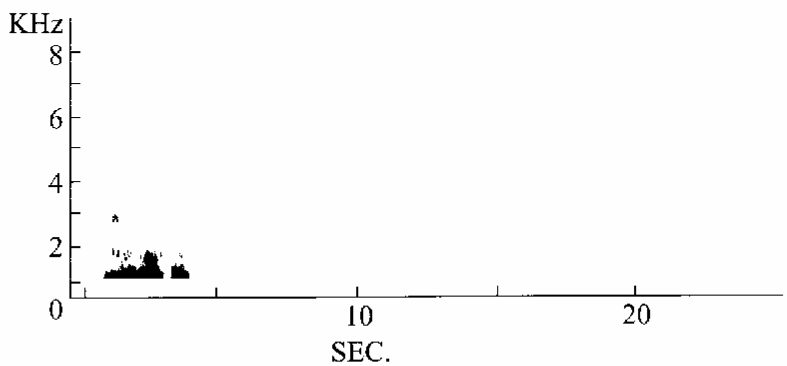


Wraagh. This explosive monosyllabic loud vocal outburst was not as deep as a roar nor as shrill as a scream. Like roars, wraaghs began and ended abruptly and lasted between 0.20 and 0.80 seconds. As may be noted in Figure 3, there were individual differences in the frequency concentrations of the sound, which was more harmonically structured than were roars.

7.14 Figure 17. Question Bark.

7.15

Figure 3.4 Question Bark



Question Bark. This vocalization is best described by its characteristic composition (both subjective and spectrographic) of three notes, with the first and third lower than the middle. The sound was short, lasting between 0.20 and 0.30seconds, and was heard more from silverbacks than from gorillas of any other age or sex.

7.14 Figure 18a. Cries going into Shrieks & 7.15 Figure 18b. Cries subsiding.

Figure 3.5a Cries Going into Shrieks

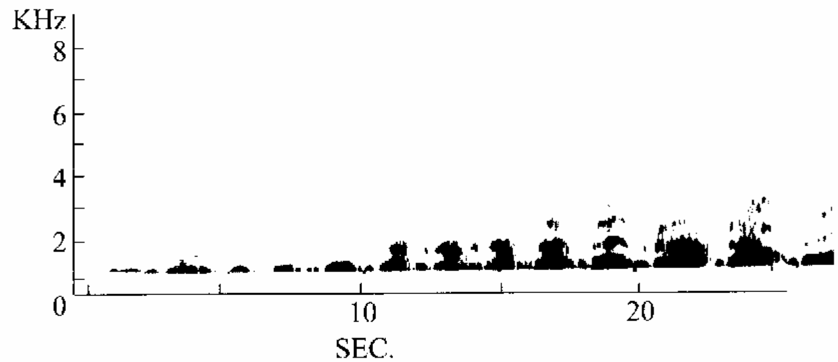
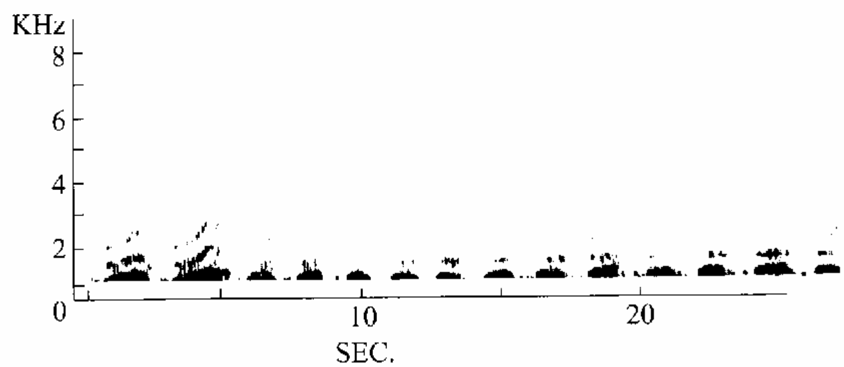


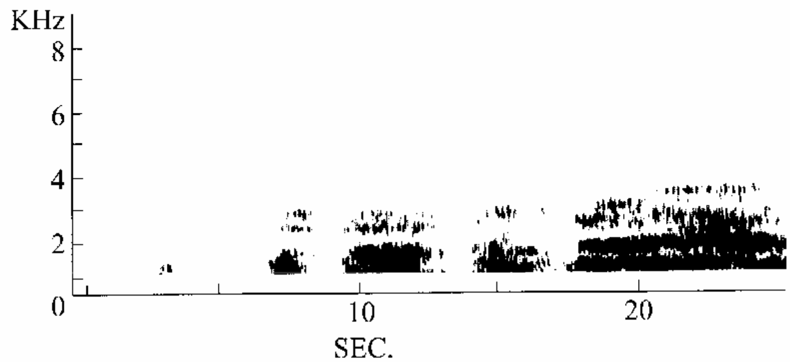
Figure 3.5b Cries Subsiding



Cry. This sound, resembling the wail of a human infant, could build up into a shriek much like a human's temper tantrums. (Figure 3.5a shows cries going into shrieks; in 3.5b they subside.) Cries were emitted between 0.03 and 0.05 seconds apart and could last for nearly 19 seconds at a time. The wails had four distinct frequency concentrations, but the shrieks were much less structured.

7.15 Figure 19. Pig-Grunts.

Figure 3.6 Pig-Grunts



Pig-Grunts. A series of short, rough, guttural noises, pig-grunts are usually delivered between 0.15 and 0.40 seconds apart in sequences of nine or ten outbursts. The sounds, resembling the grunting of pigs feeding at a sty, tended to become louder and more closely spaced if prolonged.

7.16 Figure 20a. Belch Vocalization 1. & 7.16 Figure 20b. Belch Vocalization 2.

Figure 3.7a Belch Vocalizations

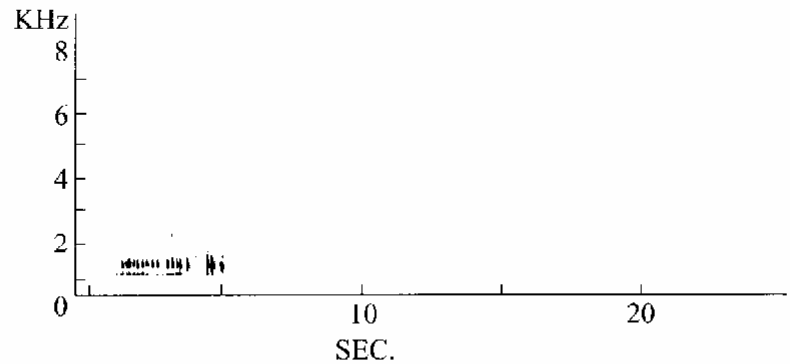
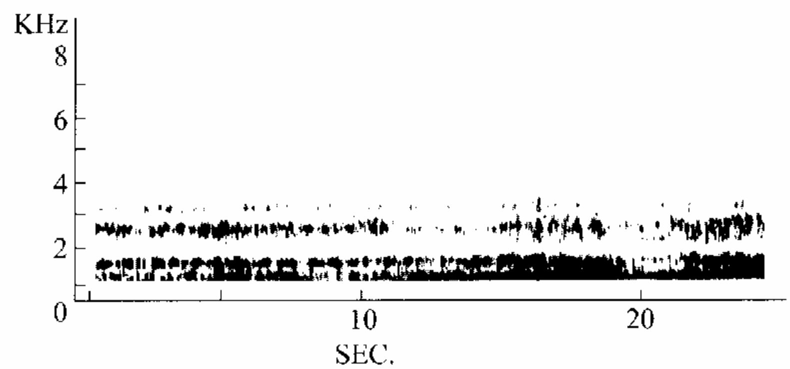
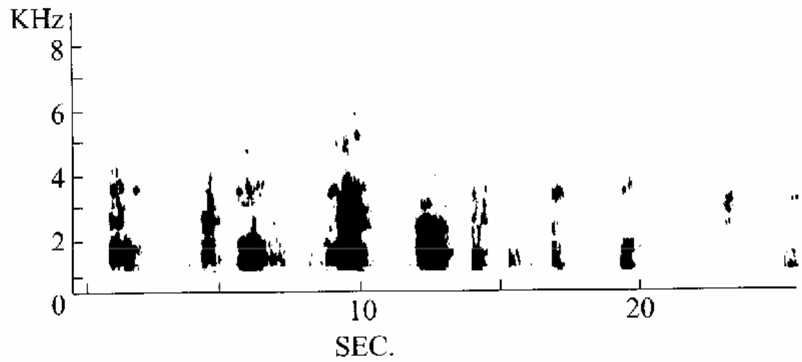


Figure 3.7b



Belch Vocalizations. These sounds resemble deep, prolonged rumbles (naoom, naoom, naoom) rather like throat-clearing utterances. The sound, as recorded from both free-ranging and captive gorillas, had two frequency concentrations and gradated into crooms, purrs, hums, moans, wails, and howls if prolonged in situations of maximum contentment.

Figure 3.8 Chuckles



Chuckles. These raspy expirations of noise were irregularly spaced spurts of sound varying in length from 0.02 to 0.10 seconds with a low frequency concentration. No individual differences were noted.

7.17 Figure 22a. Hootseries.

Figure 3.9a Hootseries

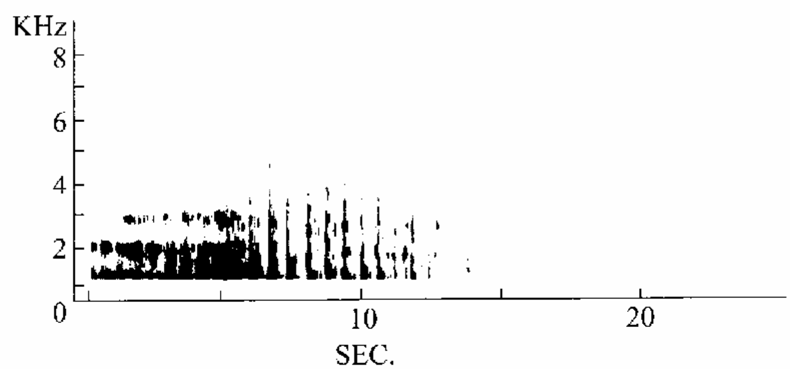
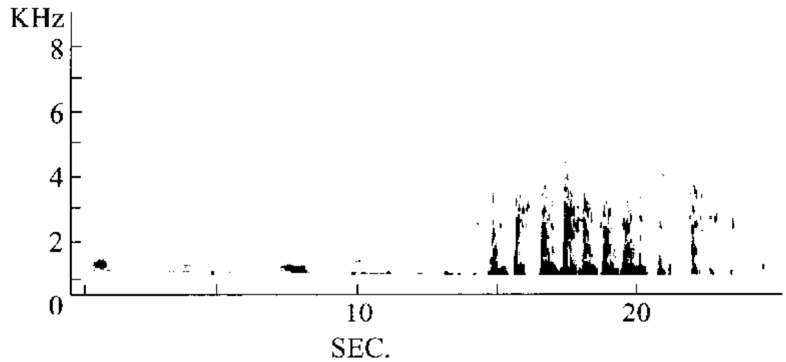


Figure 3.9b



Hootseries preceding chestbeats. The hootseries, given with or without a terminating chestbeat, consists of prolonged distinct *hoo-hoo-hoos*. These were low-pitched, often undetectable to the human ear at the beginning of the series, but usually built up into plaintive-sounding and longer hoots toward the end. The lengthier the series, the more individual the fluctuations in harmony and phasing. Frequencies ranged between 1.4 and 1.8 kilocycles per second for as many as eighty-four hoots per second.

7.22 Table XV. Phonemes, Morphemes, and their Semiotic Type

Table 3. iii Phonemes, Morphemes, and their Semiotic Type

Sound	*Meaning*	*Type*	*Kind*
1. Roar	"Get away!" "Don't mess!"	Imperative	Symbolic
2. Screams	"Damn it!" "Watch it!"	Exclamatory/ Imperative	Symbolic
3. Wraag	"Look out!"	Imperative	Symbolic
4. Question Bark (Curiosity)	"What's up?" "Who are you?"	Interrogatory (?)	Symbolic
5. Cries	Expressions of unhappiness	Exclamatory	Indexical
6. Pig-Grunts	"Stop!" "Behave!"	Imperative	Symbolic
7. Belch Vocalization	Expression of Contentment	Exclamatory	Indexical
8. Chuckles	Expressions of Joy	Exclamatory	Indexical
9. Hootseries Preceding Chest beats	"I'm here!" "My space!"	Declarative (?)	Symbolic

Table 3.iv Four Alternative Stages in Cognitive Evolution

Stage	*Level* (C)	*Level* (D)
I. The Great Apes	Gestural*	Iconic/indexical/symbolic/ mentality
II. *Homo erectus*	Gestural* with Re-enactment	Iconic/indexical/symbolic/
III. *Homo sapiens* (early)	1. Exclamatory/ Imperative	Iconic/indexical/symboli/c mentality
	2. Declarative/ Interrogatory	Iconic/indexical/symbolic/
IV. *Homo sapiens* (late)	Reading and Writing	Iconic/indexical/symbolic/ Transformational/critical mentality

*Gestural** means already including some imperative and exclamatory ability.

8.16 Figure 23. Multiplication Tables.

Figure 4.1 Multiplication Tables

Domain	*Range*
< 0 , 0 >	0
< 0 , 1 >	0
. . .	. . .
< 8 , 7 >	56
< 8 , 8 >	64
. . .	. . .
< 9 , 9 >	81

8.20 Figure 24. Semiotic Systems vs. Symbol Systems.

Figure 4.2 Semiotic Systems versus Symbol Systems

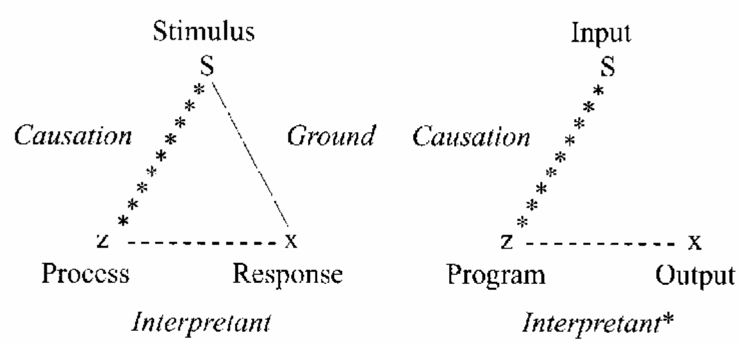


Figure 4.3 Panel 1 of "Cornish Game Clams"

8.25 Figure 26. Panel II of "Cornish Game Clams".

Figure 4.4 Panel 2 of "Cornish Game Clams"

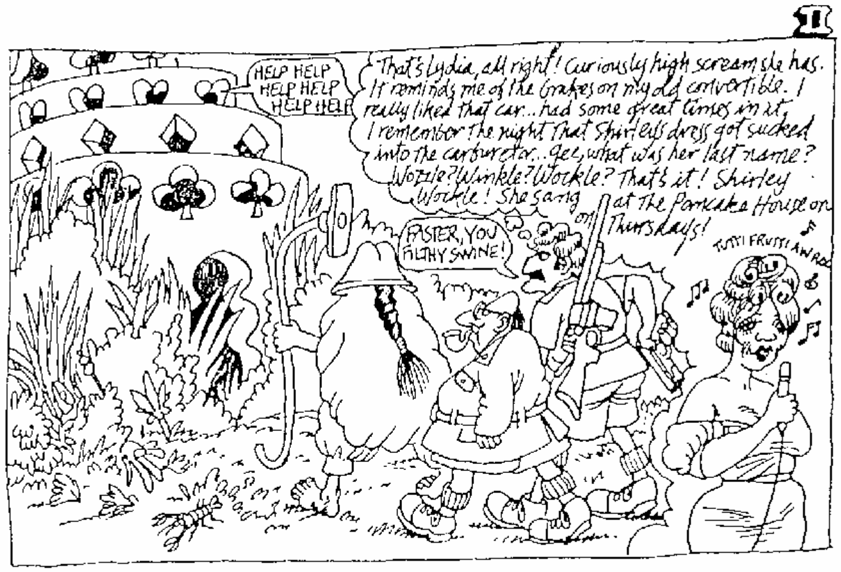
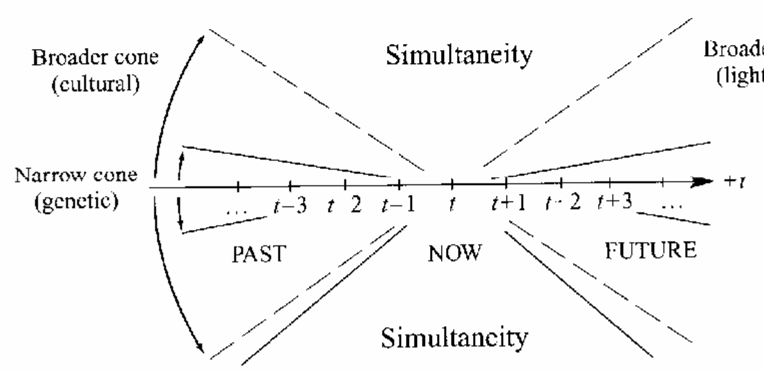


Figure 5.1 (Species Specific) Gene-Culture Co-Evolution Diagram



10.2 Table XVII. Six Theses of The Bell Curve (1994).

Table 6.i Six Theses of *The Bell Curve* (1994)

(T1) there is such a thing as a general factor of cognitive ability on which human beings differ;

(T2) all standardized tests of academic aptitude or achievement measure this general factor to some degree, but IQ tests deliberately designed for that purpose measure it most accurately;

(T3) IQ scores match, to a first degree, whatever it is that people mean when they use the words “intelligence” or “smart” in ordinary language;

(T4) IQ scores are stable, although not perfectly so, over much of a person’s life;

(T5) properly administered IQ tests are not demonstrably biased against social, economic, ethnic, or racial groups; and,

(T6) cognitive ability is substantially heritable, apparently no less than 40% and no more than 80%. (Herrnstein and Murray 1994, pp. 22–23)

10.1 Table XVIII. Relative Ranking of Races on Diverse Variables.

Table 6. ii Relative Ranking of Human Populations on Diverse Variables

Variable:	*Orientals*	*Whites*	*Blacks*
Brain size			
Autopsy data (cm3 equivalents)	1,351	1,356	1,223
Endocranial volume (cm3)	1,415	1,362	1,268
External head measures (cm3)	1,356	1,329	1,294
Cortical neurons (billions)	13.767	13.665	13.185
Intelligence			
IQ test scores	106	100	85
Decision times	Faster	Intermediate	Slower
Cultural achievements	Higher	Higher	Lower
Maturation rate			
Gestation time	?	Intermediate	Earlier
Skeletal development	Later	Intermediate	Earlier
Motor development	Later	Intermediate	Earlier
Dental development	Later	Intermediate	Earlier
Age of first intercourse	Later	Intermediate	Earlier
Age of first pregnancy	Later	Intermediate	Earlier
Life-span	Longer	Intermediate	Shorter
Personality			
Activity	Lower	Intermediate	Higher
Aggressiveness	Lower	Intermediate	Higher
Cautiousness	Higher	Intermediate	Lower
Dominance	Lower	Intermediate	Higher
Impulsivity	Lower	Intermediate	Higher
Self-concept	Lower	Intermediate	Higher
Sociability	Lower	Intermediate	Higher
Social organization			
Marital stability	Higher	Intermediate	Lower
Law abidingness	Higher	Intermediate	Lower
Mental health	Higher	Intermediate	Lower
Administrative capacity	Higher	Higher	Lower
Reproductive effort			
Two-egg twinning (per 1000 births)	4	8	16
Hormone levels	Lower	Intermediate	Higher
Secondary sex characteristics	Smaller	Intermediate	Larger
Intercourse frequencies	Lower	Intermediate	Higher
Permissive attitudes	Lower	Intermediate	Higher
Sexually transmitted diseases	Lower	Intermediate	Higher

Reproduced from Rushton 1995b, p. 23; see Rushton 1995a, p. 5.

10.15 Figure 28. Phylogenetic Tree for 26 Representative Populations.

Figure 6.1 Phylogenetic Tree for 26 Representative Populations

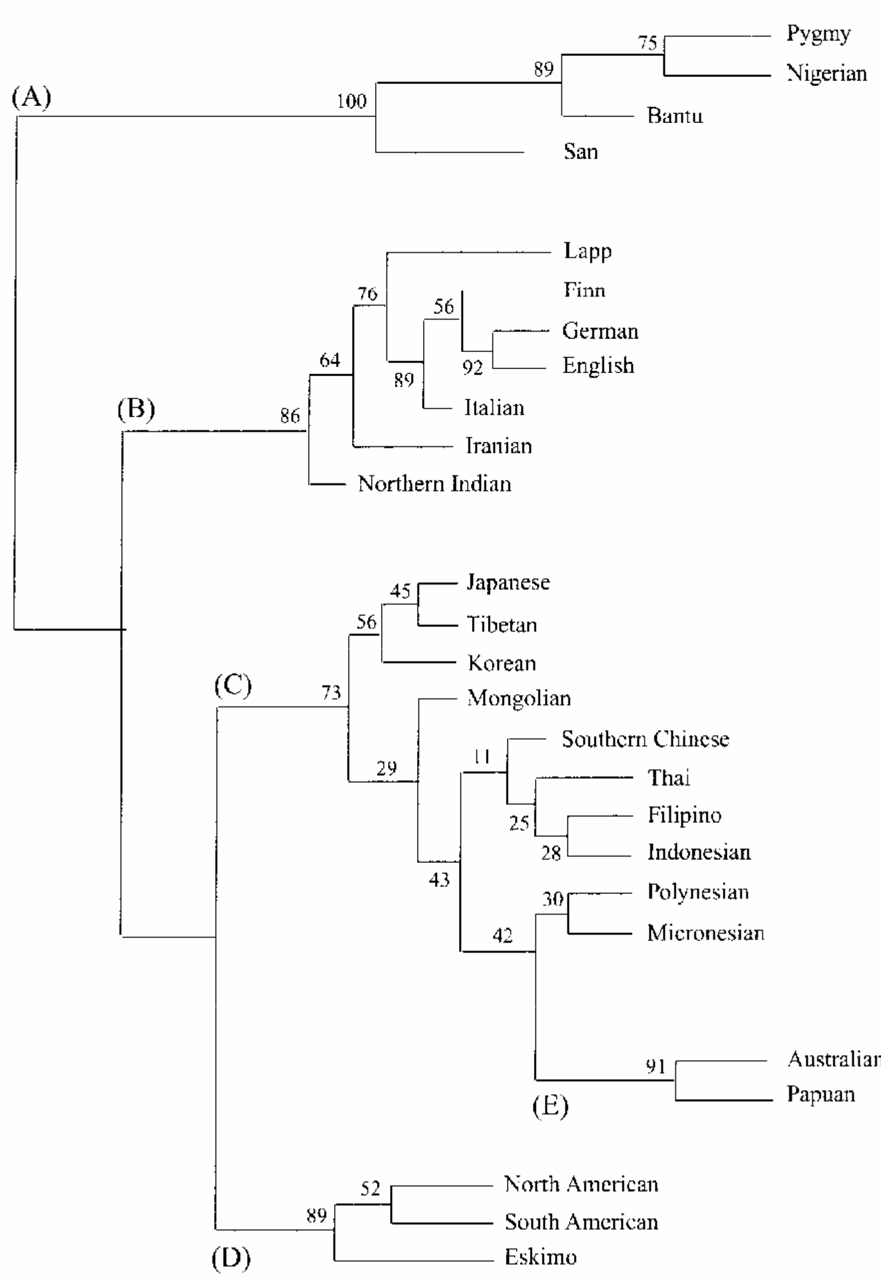
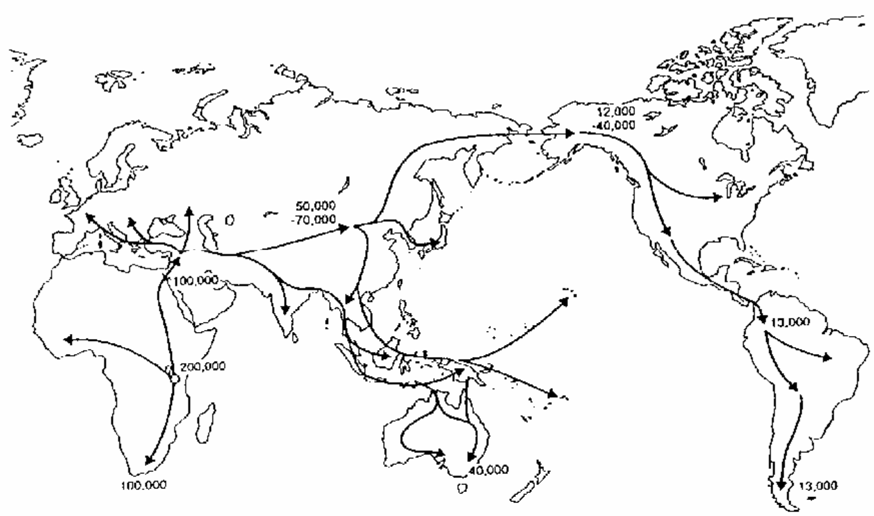


Figure 6.2 Scenario of the Origins of Major Human Populations



10.28 Figure 30. The Distribution of IQ Scores

Figure 6.3 The Distribution of IQ Scores

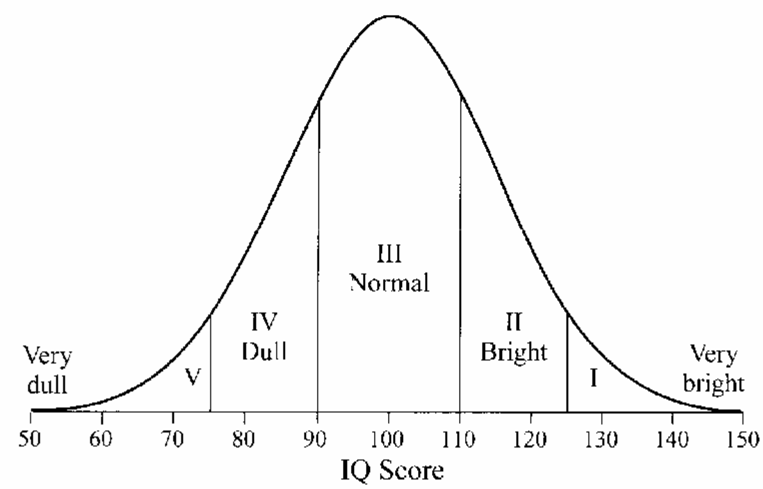


Figure 7.1 Brains and Minds

	PREDISPOSITIONS	DISPOSITIONS
Of Cognitive Function	Minds	Mind states
Of Neurological Structure	Brains	Brain states

11.18 Table XIX. Genetic vs. Cultural Evolution (Bonner)

Table 7.i Genetic versus Cultural Evolution (Bonner)

GENETIC EVOLUTION	versus	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 roughly by speed of light)

Table 7.ii Genetic versus Cultural Evolution (Fetzer)

GENETIC EVOLUTION	versus	CULTURAL EVOLUTION
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 natural selection sexual reproduction . . . artificial selection genetic engineering		classic conditioning operant conditioning imitating others . . . logical reasoning rational criticism

12.1 Table XXI. A Payoff Matrix

Figure 8.i A Payoff Matrix

	State of Nature	
Action Options	*He/She is wonderful*	*He/She is Not*
Accept date	Great time! * * * *	Awful time *
Reject date	Kick yourself * *	Relief * * *

14.18 Figure 32. Some Stages in Embryogenesis.

Figure 4.1 Some Stages in Embryogenesis

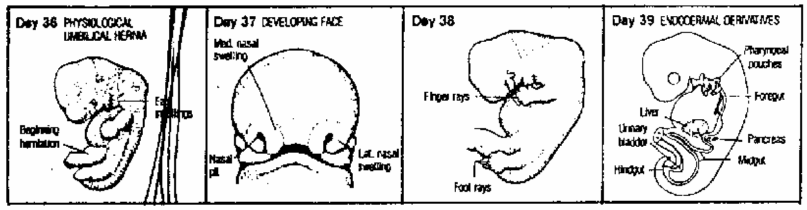
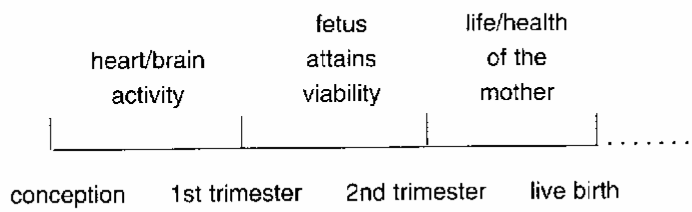


Figure 4.2 The Court's Trimester Division

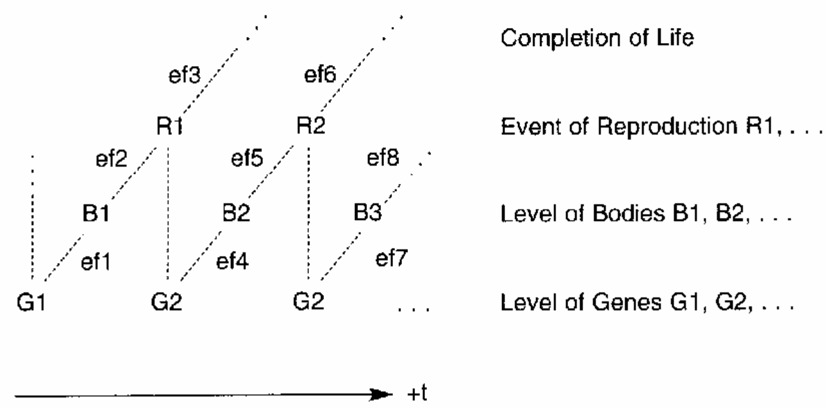


14.29 Table XXII. A Summary Overview.

Table 4.1 A Summary Overview

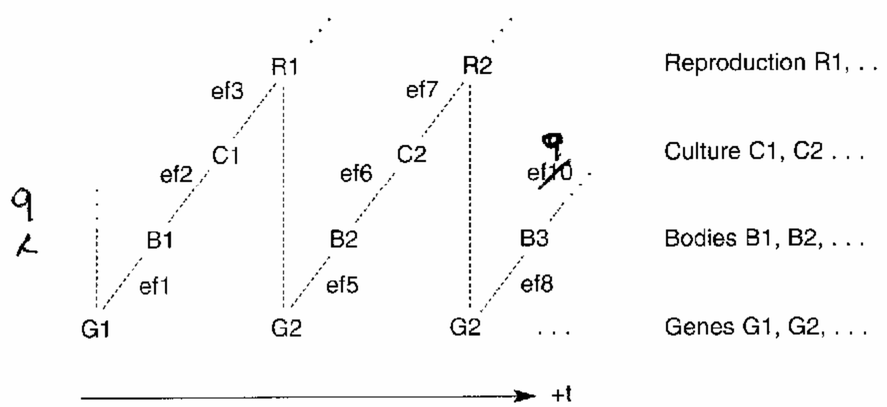
	Persons?	Morally Permissible?	Special Conditions?
Embryonic Stem Cells	NO	YES	Consent
Umbilical Cord Stem Cells	NO	YES	Consent
Adult Stem Cells	NO	YES	Consent
Abortions (1st trimester)	NO	YES	Choice
Abortions (2nd trimester)	NO	YES	Regulated
Abortions (3rd trimester)	YES	NO	Only to save the mother's life or health
Therapeutic Cloning (pre-third trimester)	NO	YES	Regulated
Reproductive Cloning (post-second trimester)	YES	YES	For infertile couples
Exploitative Cloning (post-second trimester)	YES	NO	NO

Figure 6.1 A Model of Genetic Evolution



E.3 Figure 35. A Model of Gene-Culture Co-Evolution.

Figure 6.2 A Model of Gene-Culture Co-Evolution



E.5 Table XXIII. Three Theses of <u>The Bell Curve</u> (1994).

Table 6.1 Three Theses from *The Bell Curve*

(T1) The cognitive elite is getting richer, in an era when everybody else is having to struggle to stay even;

(T2) The cognitive elite is increasingly segregated physically from everyone else, in both the workplace and the neighborhood;

(T3) The cognitive elite is increasingly likely to intermarry. (Herrnstein and Murray 1996, p. 114)

E.8 Figure 36. Evidential Support vs. Subjective Conviction

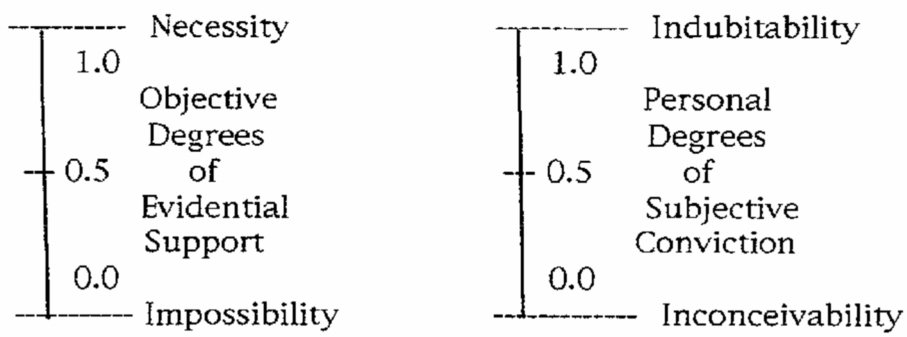


Figure 34. Evidential Support vs. Subjective Conviction.

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