The God of the Gaps

David Berlinski

THE IDEA that human beings have been endowed with powers and properties not found elsewhere in the animal kingdom—or, so far we can tell, in the universe—arises from a simple impulse: just look around. It is an impulse that handily survives the fraternal invitation to consider the great apes. The apes are, after all, behind the bars of their cages, and we are not. Eager for the experiments to begin, they are also impatient for their food to be served, and they seem impatient for little else. After undergoing years of punishing trials at the hands of determined clinicians, a few have been taught the rudiments of various primitive symbol systems. Having been given the gift of language, they have nothing to say. When two simian prodigies meet, they fling their placards at each other.

More is expected, but more is rarely forthcoming. Experiments—and they are exquisite—conducted by Dorothy Cheney and Robert Seyfarth indicate that like other mammals, baboons have a rich inner world. Simian social structures are often intricate. Chimpanzees, bonobos, and gorillas reason; they form plans; they have preferences; they are cunning; they have passions and desires; and they suffer. In much of this, we see ourselves. But beyond what we have in common with the apes, we have nothing in common, and while the similarities are interesting, the differences are profound.

If human beings are as human beings think they are, then questions arise about *what* they are, and so do responses. These responses are ancient. They have arisen spontaneously in every culture. They have seemed to men and women the obvious conclusions to be drawn from just looking around. Accordingly, an enormous amount of intellectual effort has been invested in persuading men and women *not* to look around.

"With all deference to the sensibilities of religious people, the idea that man was created in the image of God can surely be put aside." Thus *Nature* magazine in a recent editorial. As for those unwilling to put their "sensibilities" aside, the scientific community has concluded that they are afflicted by a form of intellectual ingratitude. After all, the same editorial insists, "The idea that human minds are the product of evolution is unassailable fact."

It is remarkable how widespread our ingratitude really is, and also how far back it goes.

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II

Together with Charles Darwin, Alfred Wallace created the modern theory of evolution. He has been unjustly neglected by history—perhaps because, shortly after conceiving his theory, he came to doubt its veracity. Darwin, too, had his doubts; no one reading *On the Origin of Species* can miss its note of moral anxiety. But Darwin's doubts arose because, in considering his theory's implications, he feared it might be true. With Wallace, it was the other way around. Considering its implications, he suspected the theory might be false.

In an essay entitled "Sir Charles Lyell on Geological Climates and the Origin of Species" (1869), Wallace outlined his sense that evolution was inadequate to explain certain obvious features of the human race. The essay is of great importance. It marks a falling-away in faith on the part of a sensitive biologist previously devoted to ideas he himself introduced.

Certain of our "physical characteristics," Wallace observes in this essay, "are not explicable on the theory of variation and survival of the fittest"—the criteria of Darwinian natural selection. These characteristics include the human brain, the organs of speech and articulation, the human hand, and the external human form with its upright posture and bipedal gait. Thus, only human beings can rotate their thumbs and ring fingers in what is called "ulnar opposition" in order to achieve a grip, a grasp, and a degree of torque denied to any of the great apes. So, too, with the other items on Wallace's list. What remains is evolutionary fantasy, of the sort in which the bipedal gait is assigned to an unrecoverable ancestor wishing to peer (or pee) over tall savannah grasses.

It is with respect to the human mind that Wallace's argument gathers real force. Do we understand why, alone among the animals, human beings have acquired language? Or a refined and delicate moral system? Or art, architecture, music, dance, or mathematics? This is a severely abbreviated list. The body of world literature and philosophy offers an extended commentary on human nature, yet over the course of more than 4,000 years it has not exhausted its mysteries.

And here is the curious thing. Wallace writes that, among human beings, there is no evident distinction between the mental powers of the most primitive and the most advanced. Raised in today's England instead of the Ecuadoran Amazon, a native child of the head-hunting Jívaro tribe, otherwise destined for a life loping through the jungle, would learn to speak perfect English and upon graduation from Oxford or Cambridge would enjoy the double advantage of a modern intellectual worldview and a valuable ethnic heritage. He might become a mathematician. Or, for all anyone knows, he might find himself a commentator on the BBC, lucidly defending the cultural value of head-hunting in the Ecuadoran jungle.

From this manner of observation it follows, Wallace argued, that characteristic human abilities must be latent in primitive man, existing somehow as an unopened gift—the entryway to a world that primitive man himself does not possess and would not recognize. But the idea that a biological species might possess latent powers makes no sense in Darwinian terms. It suggests the forbidden doctrine that evolutionary advantages were frontloaded, far away and long ago. It is in conflict with the Darwinian principle that just as useful genes are selected for cultivation and advancement, useless genes are subject to negative selection pressure and must therefore drain away into the sands of time.

Wallace identified a frank conflict between his own theory and what seemed to him to be obvious facts about the solidity and unchangeability of human nature. That conflict persists; it has not been resolved.

III

No one doubts that human beings now alive are connected to human beings who lived thousands of years ago. To look at Paleolithic cave drawings is to understand that the graphic arts have not changed radically in 12,000 years. And no one doubts that human beings are connected to the rest of the animal kingdom. It is rather more difficult, however, to take what no one doubts and fashion from it an effective defense of the thesis that human beings are nothing but the living record of a random and extended evolutionary process. That requires a disciplined commitment to a point of view that owes nothing to the sciences, however loosely construed, and astonishingly little to the evidence.

Why, then, has the kinship between human beings and the apes been so avidly promoted in contemporary culture, and not just as an "unassailable fact" but as a positive moral virtue?

The reason is that it functions as a hedge against religious belief, in particular the belief in man's uniqueness. "Chimps and gorillas have long been the battleground of our search of uniqueness," wrote the late Stephen Jay Gould,

> for if we could establish an unambiguous dis-

> tinction—of kind rather than degree—between ourselves and our closest relatives, we might gain the justification long sought for our cosmic arrogance.

Following Gould, whose "cool authentic voice" he finds irresistible, Christopher Hitchens has likewise declared against our cosmic arrogance and in favor of mere cosmic happenstance. "If the numberless evolutions from the Cambrian period could be recorded and 'rewound,'" Hitchens writes in *God Is Not Great*, "and the tape played again, he [Gould] established there was no certainty it would come out the same way."

Of course, having no access to the tape of life, Gould established nothing of the sort. Yet so committed is Hitchens to his tautology that he repeats it. Had an early vertebrate named Pakaia not survived, he reports in amazement, its survivors would also not have survived. One waits breathlessly for Hitchens to enlarge upon these exercises in just-so logic to encompass nonlinear dynamics and Heisenberg's uncertainty principle, totems that in his "scientific" defense of atheism he waves at the reader like a majestic frond.

WHEN OUR cosmic arrogance is not being dismissed as religious prejudice, it is dismissed as a celebration of mere trivialities. Writing about "our inner ape," the zoologist Frans de Waal is concerned to demonstrate "how much [they] resemble us and how much we resemble them." How much, then? De Waal's answer: "If an extraterrestrial were to visit earth, he would have a hard time seeing most of the differences we treasure between ourselves and the apes."

Well, yes. If a fish were thoughtfully to consider the matter, it might have a hard time determining the differences we treasure between Al Gore and a sperm whale: both of them are large, and one of them is streamlined. But suppose the fish wanted a more detailed demonstration. Then it might profitably consult a fundamental paper on the subject published in *Science* in 1975. In it, M.C. King and A.C. Wilson provided for the first time an estimate of the degree of similarity between the human and the chimpanzee genome.

Far more than was thought possible, King and Wilson assert, human beings and chimpanzees do share the greater part of their respective genomes. But should we therefore conclude that if our genomes match up so nicely, we must *be* apes? In the second section of their paper, King and Wilson expound the deficiencies of that idea:

> Although humans and chimpanzees are rather similar in the structure of thorax and arms, they differ substantially not only in brain size but also in the anatomy of the pelvis, foot, and jaw, as well as in relative lengths of limbs and digits. Humans and chimpanzees also differ significantly in many other anatomical respects, to the extent that nearly every bone in the body of a chimpanzee is readily distinguishable in shape and size from its human counterpart. Associated with these anatomical differences there are, of course, major differences in posture, mode of locomotion, methods of procuring food, and means of communication. Because of these major differences in anatomy and way of life, biologists place the two species not just in separate genera but in separate families.

There is nothing in this that was not evident to Alfred Wallace—or to any student of comparative anatomy. King and Wilson go on to suggest that the morphological and behavioral differences between humans and the apes, if they are not due to variations between their respective genomes, must be due to variations in their genomic regulatory systems. These control the activities of the various genes by telling them when to sound off and when to shut up. They are of an astonishing complexity, if only because they themselves require regulation. Higher-order regulation in turn involves higher-order codes beyond the genetic code, and these codes then require their own regulation. Even the simplest cell involves an intricate, never-ending cascade of control and coordination of a sort never seen in the physical world.

It is entirely safe to assign the differences between human beings and the apes to their regulatory systems. But nothing is known about the evolutionary emergence of those systems, and we cannot describe them with any clarity. Whatever the source of the human distinction, however, its existence is obvious, and when it is carelessly denied, the result is a characteristic form of inanity.

Thus, an English professor named Jonathan Gottschall has recounted his experience reading Homer's *Iliad* while under the influence of Desmond Morris's *The Naked Ape*. "[T]his time around," Gottshall writes,

> I . . . experienced the *Iliad* as a drama of naked apes—strutting, preening, fighting, and bellowing their power in fierce competition for social dominance, beautiful women, and material resources.

Actually, social dominance and material resources are not quite to the point:

> Intense competition between great apes, as described both by Homer and by primatologists, frequently boils down to precisely the same thing: access to females.

The governing words in this quotation are "boils down." What is essential about the boiling process is not what has been distilled but what has evaporated—namely, everything that is of interest in the *Iliad*.

For those purporting to be worried about the cosmic arrogance of human beings, what this suggests is an obvious counsel of humility. Before putting aside so flippantly "the idea that man was created in the image of God," they might first consider the ideas they propose to champion in its place.

IV

"In much the same way as prophets and seers and great theologians seem to have died out," Christopher Hitchens claims in *God Is Not Great*, "so the age of miracles seems to lie somewhere in our past."

Prophets and seers? I would have thought that Einstein, Bohr, Gödel, Schrödinger, Heisenberg, Dirac, and even Richard Feynman were all, in their own way, prophets and seers.

And miracles? The word seems to engender its own current of contempt. If one demands of a miracle that it violate the inviolable, there can be, by definition, no miracles. Surely this is too infantile a victory to afford even Christopher Hitchens a sense of satisfaction; he does not deign to debate the proposition that what could not be cannot be.

A miracle is exactly what it seems: an event offering access to the divine. And if this is what miracles are, whether they are seen will always be contingent on who is looking.

The miracles of religious tradition are historical. They reflect the power the ancient Hebrews brought to bear on their experiences. They did what they could, they saw what they could see. But we have other powers. We are the heirs to a magnificent scientific tradition. We can see farther than men whose horizons were bounded by the burning desert.

In a remark now famous, Feynman observed with respect to quantum electrodynamics that its control over the natural world is so accurate that in measuring the distance from New York to Los Angeles, theory and experiment would diverge by less than the width of a human hair. Einstein's theory of general relativity is in some respects equally accurate. We cannot account for these unearthly results. The laws of nature neither explain themselves nor predict their success. We have no reason to expect such gifts, and if we have come to expect them, that is only because, as the saints have always warned, we expect far more than we deserve.

Foremost among the undeserving are evolutionary dogmatists of the brand represented by Richard Dawkins and Daniel Dennett and marketed by their apostle Hitchens. Although theirs is not an undertaking notable for imaginativeness, it does seem to have conjured up a kind of god. Unlike the God of old, who ruled over everything, this god rules over lapses in argument or evidence. He is a presiding god, but with limited administrative functions. With gaps in view, he undertakes the specialized activity of incarnating himself as a stopgap. He may be called the god of the gaps.

As a rhetorical contrivance, the god of the gaps makes his effect contingent on a specific assumption: whatever the gaps, they *will* in the course of scientific research be filled. It is an assumption both intellectually primitive and morally abhorrent—primitive because it reflects an absence of curiosity, and abhorrent because it assigns to our intellectual future a degree of authority alien to human experience.

The truth is otherwise: Western science has indeed proceeded by filling gaps, but in filling them it has created gaps all over again. The process is inexhaustible. Einstein created the special theory of relativity to accommodate certain anomalies in the interpretation of Clerk Maxwell's theory of the electromagnetic field. Special relativity led directly to general relativity. But general relativity is inconsistent with quantum mechanics. Understanding has improved, but within the physical sciences, anomalies have grown great, and what is more, anomalies have grown great because understanding has improved.

The god of the gaps? Why not say with equal authority that, for all we know, it is the God of old who continues to preside over the bent world with His accustomed fearsome majesty, and that He has chosen to draw the curtain on His own magnificence at precisely the place where general relativity and quantum mechanics should have met but do not touch? Whether gaps in our understanding reveal nothing more than the god of the gaps or nothing less than the God of old is hardly a matter open to rational debate.

This, however, has hardly prevented peevish displays of vanity on the part of scientists. In considering the possibility that the facts of biology might

suggest an intelligent designer—which surely they do, even if they do not prove the case—the Darwinian biologist Emile Zuckerkandl has found it difficult to contain his indignation. Writing in the journal *Gene*, he overflows with epithets:

> The intellectual virus named "intelligent design". . . certainly is a problem in the country. . . . [T]he "creationists" . . . have decided some years ago . . . to dress up in academic gear and to present themselves as scholars. . . . [T]hey try to foster on society . . . some enterprising superghost. The "intelligent designers'" theme song . . . guided by a little angel . . . medieval in concept . . . an intellectually dangerous condition . . . the divine jumping disease. . . . Feeding like leeches on irrational beliefs . . . offensive little swarms of insects . . . must be taken care of by spraying biological knowledge. . . .

And so forth. For his part, Daniel Dennett answers the proponents of intelligent design thusly:

> Contemporary biology has demonstrated *beyond all reasonable doubt* that natural selection—the process in which reproducing entities must compete for finite resources and thereby engage in a tournament of blind trial and error from which improvements *automatically* emerge—has the power to generate breathtakingly ingenious designs. [emphasis added]

The self-confidence here is wonderful. Nothing in the physical sciences, it should go without saying, has been demonstrated beyond "all reasonable doubt." The phrase belongs to a court of law. As for the thesis that improvements in life appear "automatically," it represents nothing more than Daniel Dennett's conviction that living systems are like elevators: if their buttons are pushed, they go up. Or down, as the case may be. Although Darwin's theory is very often compared favorably with the great theories of mathematical physics, on the grounds that evolution is, in the hackneyed phrase, as well established as gravity, very few physicists have been heard observing that gravity is as well established as evolution. They know better, and they are not stupid.

Nor are all biologists. They know better, too. The greater part of the debate over Darwin's theory is not in service to the facts, or to the theory. The facts are what they have always been: unforthcoming. And the theory is what it always was: unpersuasive. "Darwin?" a Nobel laureate in biology once remarked to me over his bifocals. "That's just the party line."

THE GOD of the gaps occupies a very considerable comfort zone in biology. We know better than we ever did that a great many aspects of biological behavior are innate. They arise in each organism. They are a part of its nature. This is certainly true of human beings. The point has been made with great force by the linguist Noam Chomsky. Just as children are not taught to walk, they are not taught to speak. The environment serves only to trigger an innate program for maturation. Human language is the very expression of human nature.

This is widely seen as offering dramatic confirmation of Darwinian evolution. It is easy to see why. What is "innate" in an organism, so it is claimed, reflects its genetic endowment, and its genetic endowment reflects the long process in which random variations were sifted by a stern and unforgiving environment. If we are born with the ability to acquire a natural language, the gift lies within our genes and our genes lie within the shifting tides of time.

The view is common; it is also incoherent. What is both interesting and innate in an organism cannot be explained in terms of its genetic endowment. If the concept of a gene has any content at all, it lies entirely within the context of molecular biology and biochemistry. The gene is a chemical, a part of the molecule deoxyribonucleic acid, or DNA. Its function is straightforward: it specifies the proteins needed by a living organism, and it specifies them by means of a remarkably complicated system of translation and transcription. To speak clearly of the genetic endowment of an organism is to speak *only* of the passage from one chemical structure to another, and nothing more.

But to speak of the genetic endowment of an organism in terms that answer any interesting question *about* the organism is to go quite beyond the coordination of chemicals. It is to speak of what an organism does, how it reacts, what plans it makes, and how it executes them; it is to assign to a biological creature precisely the properties always assigned to such creatures: intention, desire, volition, need, passion, curiosity, despair, boredom, rage.

These properties of a living system cannot be easily seen as the consequences of any chemical reaction. It would be like suggesting that a tendency toward kleptomania follows the dissociation of water into hydrogen and oxygen. If this were so—research is required!—it would represent a connection that we do not understand and cannot grasp. The gap is too great. When Richard Dawkins observes that genes "*created* us, body and mind" (em-

phasis added), he is appealing essentially to a magical connection. There is nothing in any precise concept of the gene that allows a set of biochemicals to create anything at all. If no precise concept of the gene is at issue, the idea that we are created by our genes, body and mind, represents a far less plausible thesis than the correlative doctrine that we are created by our Maker, body and mind.

V

"The more comprehensible the universe becomes," the physicist Steven Weinberg has written, "the more it also seems pointless." This has struck many of his readers as an ungenerous attitude, and Weinberg has subsequently made every effort to cover his comment in confusion, chiefly by affirming that he considers the universe a fine place after all.

My sympathies are with the sour and unregenerate Weinberg. The arena of the elementary particles—his arena—*is* rather a depressing place, and if it resembles anything at all, it resembles a fluorescent-lit bowling alley as seen from the interstate highway, tiny stick figures in striped bowling shirts jerking up and down in the humid night.

What *is* its point?

We humans seem to live our lives in perfect indifference to the Standard Model of particle physics. Over *there*, fields are pregnant with latent energy, particles flicker into existence and disappear, things are entangled, and no one can quite tell what is possible and what is actual, what is here and what is there, what is now and what was then. Solid forms give way. Nothing is stable. Great impassive symmetries are in control, as vacant and unchanging as the eye of Vishnu. Where they come from, no one knows. Time and space contract into some sort of agitated quantum foam. Nothing is continuous. Nothing stays the same for long—except the electrons, and they are identical, like porcelain Chinese soldiers. A pointless frenzy prevails throughout.

Over *here*, thank God, space and time are stable and continuous. Matter is what it is, and energy is what it does. There are solid and enduring shapes and forms. The sun is largely the same sun now that it was 4,000 years ago when it baked the Egyptian deserts. Changes appear slowly, but even when rapid they appear in stable patterns. There is dazzling variety throughout. The great river of time flows forward. We anticipate the future, but we remember the past. We begin knowing that we will end.

The god of the gaps may now be invited to comment—strictly as an outside observer, of course. He is addressing us, and this is what he has to say: you have *no idea* whatsoever how the ordered physical, moral, mental, aesthetic, and social world in which you live could have ever arisen from the seething anarchy of the elementary particles. It is like imagining sea foam resolving itself into the Parthenon.

And even though the god of the gaps is speaking strictly as an observer, perhaps he will be forgiven for borrowing some phraseology from the God of old and inquiring of Christopher Hitchens, who has wandered into this discussion prepared to dispute anyone at the bar: "Where wast thou when I laid the foundations of the earth? Declare, if thou hast understanding."

Such examples may be multiplied at will. They form a common pattern. No one has the faintest idea whether, in particular, the immense gap between what is living and what is not, between the organic and the inorganic, may be crossed by any conceivable means. That must be why the National Academy of Sciences has taken pains to affirm that it has *already* been crossed. "For those who are studying aspects of the origin of life," the Academy has proclaimed, "the question no longer seems to be whether life could have originated by chemical processes involving nonbiological components but, rather, what pathway might have been followed."

Unfortunately for the Academy, the view among biochemists actively engaged in research is different. "The de-novo appearance of oligonucleotides [some of the indispensable building blocks of life] on the primitive earth," Gerald F. Joyce and Leslie Orgel write in a volume entitled *The RNA World*, "would have been a near-miracle." A near-miracle is a term of art. It is like a near-miss. The theories that we have in our possession do what they can do, and then they stop. They do not stop because a detail is missing; they stop because we cannot go on.

Writing about the eye in *On the Origin of Species*, Darwin confessed that its emergence troubled him greatly. He was nonetheless able to resolve his doubts in his own favor. Ever since then, biologists have wrongly assumed that inasmuch as Darwin proposed a solution, they need not face a problem.

The solution that Darwin proposed and defended was to point to countless examples of intermediate visual structures scattered throughout the animal kingdom. His argument was interesting, but it did not touch the central issue. The eye is not simply a biological organ, although surely it is that. It is a biological organ that allows living creatures to

see. If we cannot say what seeing comes to in physical or material terms, then we cannot say whether *any* theory is adequate to explain the appearance of an organ that makes sight possible.

And this is precisely what we cannot say: how the twitching nerves, chemical exchanges, electrical flashes, and computational routines of the human eye and brain provide a human being with his experiences. The *processes* involved in sight are biological, chemical, and in the end physical. It may well be that at some point in the future, a physicist, perhaps by using quantum electrodynamics, will be in a position to write down their equations. Whether such an equation will encompass our experiences—why, this is something we simply do not know.

"Today we cannot see whether Schrödinger's equation contains frogs, musical composers, or morality," Richard Feynman remarked in his lectures on turbulence. The remark has been widely quoted. It is honest. The words that follow, however, are rarely quoted: "We cannot say whether something beyond it like God is needed, or not. And so we can all hold strong opinions either way."

If we do not know whether Schrödinger's equation will one day accommodate our experience, we certainly do not know whether our experiences reflect anything less than a miracle. For the moment, if asked to stand and declare ourselves on the most elementary aspects of the world in which we live, we can say nothing.

FOR ALMOST as long as the physical sciences have made their claims about reality, poets and philosophers have observed that there is something inhuman about the undertaking represented by these sciences. They are right. We gain purchase on the physical world first by stripping it to its simplest form, and second by emptying it of its emotional content. Whatever the elementary particles may be doing, they are not forming political alliances, or eyeing each other in mute incoherent longing, or casting an anxious glance at the clock, or awaking with a start in the early hours of the morning wondering what it all means, or coming to realize that they are destined to fall like the petals of the flower leaving not a trace behind.

These are things *we* do: it is in our nature to do them. But how do we do them? By what means accessible to the imagination does a sterile and utterly insensate physical world become the garrulous, never-ending, infinitely varied, boisterous human world? The more the physical world is studied, and the richer our grasp of its principles, the greater the gap between what it represents and what we embody.

We live by love and longing, death and the devastation that time imposes. How did they enter into the world? And why? The world of the physical sciences is not our world, and if *our* world has things that cannot be explained in *their* terms, then we must search elsewhere for their explanation. We who are alive in the early 21st century may permit ourselves to deprecate the parting of the Red Sea and to regard with unconcern the various loaves and fishes mentioned in the New Testament. Yet we who are heirs to the scientific tradition have been given a priceless gift of our own: a vastly enhanced sense of the miraculous. This is something that the very greatest scientists have always known and always stressed.

We are where human beings have always been, unable to place our confidence completely in anything, unable to place our doubt completely in everything, unsure of the conveyance—and yet conveyed.