

Stephen Jay Gould: An Appreciation

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STEPHEN JAY GOULD, THE PALAEOLOGIST AND SCIENCE WRITER who died last year, wrote — brilliantly — on a bewildering series of subjects, but he is perhaps best known for his contribution to four: general evolutionary theory; the sociobiology debate; the relationship between science and religion; and the study (or critique of it) of intelligence testing.

This article will attempt mainly to introduce these debates to readers unfamiliar with them, and to summarize what Gould had to say. It is written by someone with no academic background in the natural sciences, but who came to admire Gould enormously as, at least implicitly, though often more than that, a socialist, even (broadly) Marxist scientist. Perhaps, indeed, this is an underlying and more general issue that Gould addressed and illuminated: whether the notion of a "socialist scientist" is not properly speaking false, or oxymoronic. Science, surely, is science; and attempts to box it into socialist or Marxist frameworks sound more like the appalling practices of the Soviet Union than much else. Gould, and in this is he was by no means alone, argued however for understanding science, like everything else, in its social and historical context.

The child of Jewish members of the Communist Party, Gould was politically engaged, beginning in the 1960s with involvement in Science for the People. His colleague, geneticist Richard Lewontin, is probably more overtly political, and writes with a harder ideological edge. But Gould was more well known (and a better writer); and so, for instance, one popular account of recent debates in science lumps one whole "camp" together as "Gouldians" (against the "Dawkinsians").[1] "Gouldism," in this simplification, stood for the social engagement of science, against racism, against genetic determinism, against science having ideas above its station — the recognition of the value of other areas of human enquiry, like social science, and indeed religion. This not an entirely accurate summary of a complex debate; but it captures an important truth about what Gould stood for, and was seen to stand for.[2]

Human Capacity (1): Sociobiology

THERE ARE, OF COURSE, CONNECTING threads between the different areas of controversy within which Gould was engaged. Perhaps that which most clearly reveals the overt and more subtextual issues of significance is the so-called sociobiology debate, which more recently has morphed into a debate about "evolutionary psychology." In truth, this entails an area outside, if not wholly, Gould's specific areas of academic expertise (which were palaeontology and geology) — but it was typical of the man not to confine himself to fossilized snails and rocks, and the debate will serve as a point of departure.

"Sociobiology" as a discipline launched itself on the world with a book of that name by Harvard entomologist EO Wilson in 1975.[3] Probably, had it not included a final chapter on human beings, Wilson's magnum opus would have been seen as a stuffy old text book. The theory built on work within evolutionary biology, and in particular what had come to be known as the "neo-Darwinian synthesis." The synthesis in question was between Darwin's theory of natural selection, and Mendelian genetics (which, odd as it seems today, were not immediately noticed to work well together). The basic underlying idea is best known to the general public by the name given to it (in a book published in 1976) by Richard Dawkins: the selfish gene.[4]

A great deal of argument has hinged around what precisely was meant by this theory. Put very simply, the theory was this: evolution occurs, fundamentally, at the genetic level — it is the product of genetic mutations which have effects at the level of the "phenotype" (the external forms and behaviors of an organism), which either contribute to or inhibit the organism's survival — or rather, if they contribute the organism will survive, and so this effect (trait, phenotype) will be passed down through generations, squeezing out members of the same species who lack it. Neo-Darwinism superseded, and sharply criticized, a version of evolutionary theory that saw it operate at the level of the species (or group).[5]

Against such woolly notions, selfish-gene theory saw itself as hard science. The gene is primary. Genes have no purpose other than replication. What enables replication will serve the interests, so to speak, of the gene. Everything about a species, from its appearance to its habits, even apparent altruism, has to be understood in this framework: a bird, for instance, might sacrifice itself for the flock, but only because by saving its genetic relatives, the gene saves, in effect, itself (copies of it). In particular, this framework focuses attention on the mating habits of organisms, on the "reproductive strategies" they employ — reproduction being, if you will, evolution's coal face. Fundamentally, an organism's behavior is shaped by the drive to reproduce, that is, for genes to replicate across generations. As Dawkins controversially put it: "We [he was referring to human beings] are survival machines — robot vehicles blindly programmed to preserve the selfish molecules known as genes." [6]

Around all this general theory much anger was to be expressed.[7] But in the first place, what made the question a political one — and, it turned out, political dynamite — was Wilson's decision to speculate about the applicability of what he called "sociobiology" to human society.[8] A Sociobiology Study Group, involving Lewontin especially, declared Wilson's theory, among other things, racist. It was one thing to define the behavior of non-human animals as determined by the replicative interests of genetic biology, quite another to wonder if this was true of human beings. Sociobiology was seen as the successor to, and reappearance of, earlier forms of biological determinism, which had, of course, buttressed racism and sexism, and in their most extreme form resulted in Nazi genocide.

It should be understood that sociobiology, if it is/was genetic determinist (and I will examine the arguments in a moment), it was never so in the obvious sense, that associated with the more recent discipline of behavior genetics, which looks for specific genes on specific chromosomes and attributes to them specific effects (genes for alcoholism, homosexuality, violence, etc). Sociobiology is interested not in any gene in particular, but in *evolved behavior*. It is based on the assumption that if an animal behaves in a certain way — if its social structures (ant hills, prides of lions etc) are of a particular type, they are so because these have proved evolutionarily successful, and so underlying them there is a particular genetic evolution. But it is the study of how particular behavior might have been of evolutionary advantage; sociobiologists couldn't care less about locating the gene in question. What Gould et al. identified as dangerous in applying this approach to human society is obvious. It explained — and implicitly therefore justified[9] — current social arrangements as the result of evolutionary pressures; so, for instance, women could be said to occupy particular social positions as a result of evolution, not contingent social and historical circumstances; the same could be true of black people, and so on. There was more to it, but this was the gist of the argument.

Gould addressed sociobiology repeatedly; though he did not write a book devoted to the question, *An Urchin in the Storm* in particular contains a number of essays on the theme.[10] Lewontin, the British biologist Steven Rose, and others, have attempted to develop, in riposte to it, ideas about "dialectical" biology, etc.[11] Gould, characteristically, rarely ventured into such waters very directly. But he shared the general framework of other critics of Wilson and his successors. I will leave the argument regarding the nature of evolution as a whole to a later section. As regards

human beings, the argument was, essentially, straightforwardly this: that sociobiology was a pseudoscience, claiming scientific knowledge but on the basis of unprovable assumptions, unprovable claims — assumptions and claims rooted in prejudices about *contemporary society*, which are then read back into nature and the evolutionary process. Human beings, however, are far too complex to understand in this simplistic way.

Darwin's co-thinker, Alfred Russel Wallace, who independently came up with the theory of natural selection, unlike Darwin balked at applying it to the evolution of the human mind. The mind, he thought, was so extraordinarily complex that it had to be explained by something else; Wallace thought God. Gould agreed that there was much in the complex workings of the mind — and by extension, human society in general — which could not be explained by evolution in a one-plus-one sense.[12] He had an answer to the general theoretical issue this implied, as we shall see; the point here is that some phenomena, like the mind, can develop their own momentum, so to speak. Not every aspect of the human mind, or human behavior, or social organization, can be reduced to this or that evolutionary advantage — which in any case is only guessed at retrospectively, inferred from modern facts without real evidence. Gould thought this observation held quite generally. For human society, contrary to the assertions of sociobiology, it held with a vengeance. To understand such complex things, we need other intellectual disciplines than biology.

"Human sociobiology," in effect, mutated over the years into so-called "evolutionary psychology." [13] Indeed, this school forms part of a larger trend, described by Gould and his broad cothinkers as "ultra-Darwinism," "Darwinian fundamentalism," and such like. Darwinism, indeed, has become a kind of meta-narrative deemed applicable to all manner of phenomena, in a period when meta-narratives have been rejected as unfashionable. The philosopher Daniel Dennett calls natural selection a "universal acid" that can eat through — oddly, he means "explain" — everything, a theory with unlimited explanatory power.[14] Gould remained hostile to these generalized, and often ideological developments; he contributed to a volume of "arguments against evolutionary psychology" published in 2000 (his article being largely a refutation of a polemic against him by Dennett).[15]

Evolutionary psychology in its crudest manifestations has infiltrated popular culture, and in that form, unquestionably, serves to reinforce all manner of reactionary notions, especially in sexual politics. *Homo sapiens*, it is claimed, finished evolving in the paleolithic period: as a species, we are evolved to live hunter-gathering lifestyles, in which men hunt, and women gather. These supposed facts are used to explain, in the name of one British television documentary, for instance, "why men don't iron." Faced with such stuff, it is hardly surprising that feminists and leftists in a number of spheres have seen it as a political and moral obligation to challenge this latter-day sociobiology as much as they did its predecessor.[16]

But embittered though this particular dispute has remained, there does seem to have been some degree of (relative) synthesis. Both sides are no doubt unwilling to admit to shifting ground; but it seems to me that both sides have shifted. When the opponents of sociobiology attempted to enlist the support of Noam Chomsky in the 1970s, although politically he shared many of their concerns, he rejected their dismissal of the concept of human nature.[17] Opposition to sociobiology could not, for Chomsky, take the form of pure social constructivism and cultural relativism. Nearly thirty years on, I think few on the antisociobiology side would dispute that the human mind, and human culture, are the products of evolution. The argument is about how, and to what extent, rather than whether this is true. As Gould put it:

Humans are animals and the mind evolved; therefore, all curious people must support the quest for an evolutionary psychology. But the movement that has commandeered this

name adopts a fatally restrictive view of the meaning and range of evolutionary explanation.[18]

On the other hand, the evolutionary psychologists themselves have attempted to rescue their youthful self-styled science from the accusations of sexism, etc., leveled at it. This may be, as Gould and others would have it, because of the need to distance themselves from sociobiology. But it is also because the polemics of Gould, Lewontin et al. plainly had an effect.

This fact confuses perception of past debates. The advocates of evolutionary psychology, selfish gene-theory, etc, can point to their many statements denying those evils of which they have been accused, or to modified and more sophisticated versions of their theories, and claim that the opponents of sociobiology were misguided, if not ranting theoretical luddites, all along. But this would be to see science as the purely ivory tower activity Gould was always at pains to remind us it is not. In the view of this writer, at least, there are aspects to evolutionary psychology, and even sociobiology, which require reassessment and a closer look; the theories have moved on in thirty years.[19] But they would have been unlikely to have done so without the polemical engagement of Gould and others.

And a great deal of what Gould, Lewontin, etc, opposed is only a little less present in the work of a writer like Steven Pinker, evolutionary psychology's top PR man and polemical scrapper. Pinker's most recent book is full of idiotic suggestions, not least that it doesn't make much difference how you bring up your children, since most of their behavior is genetically- programmed anyway.[20] He spends some time defending a truly execrable tome entitled *A Natural History of Rape*,[21] which exhibits every staggering arrogance and inanity of sociobiology at its worst, in spades.

The battle Gould was waging is far from over. Evolutionary psychology — wearing its more reactionary face — is probably in the ascendant.

The Nature and Mechanisms of Evolution

THE ISSUES RAISED IN THIS DEBATE about human beings are echoes of underlying questions to do with evolutionary theory as a whole. It is in this sphere, as a scientist, that Gould made his most important contribution. There are several areas most closely associated with him. One, which clearly relates to the issues described above, concerns what Gould called "the adaptationist program," the tendency to make speculative deductions about the adaptive origins of the features of organisms, which amount to no more than "just so stories" in the style of Rudyard Kipling. The other, which is perhaps more famously linked to his name, is a challenge to the "gradualist" assumptions of most Darwinians, and the claim that evolution proceeds not bit-by-bit, but in sudden bursts. This is the theory of "punctuated equilibria" which he developed with fellow-palaeontologist Niles Eldredge.

Gould and Eldredge, as specialists in fossils (Gould's own area was snails), were professionally outside the mainstream of evolutionary theory before the 1970s. Most Darwinists studied insects or the behavior of living animals, or they were high theorists, developing mathematical models. Selfish gene theory, and a host of important theoretical developments associated with it (like "kinship selection," the selfish gene explanation for altruism), were fundamentally mathematical. Gould and Eldredge were more hands-on — Eldredge calls himself a "naturalist." [22] As palaeontologists they were aware of a huge problem for Darwinist theory, expressed in the fossil record. If natural selection operates in the gradual, bit-by-bit change/mutation/adaptation fashion implied by the theory, you would expect to find fossils expressing this gradual change over time. But, on the

contrary, the fossil record revealed that species could remain almost completely constant and unchanging for millions of years, with no evidence of anything happening; and then — suddenly by geological standards — there would be rapid evolutionary change, new species come into being. Evolution was not a long, gradual shift across aeons: it was very, very long periods of "stasis" followed by rapid change: punctuated equilibria.

Controversy still rages about this theoretical innovation, though its nature has shifted somewhat. Dennett, who devotes a considerable part of *Darwin's Dangerous Idea* to an attack on Gould, essentially claims that there is hardly anything of interest in the theory anyway, and it is only Gould's tendency to self-publicize which has ensured its notoriety.[23] However, Eldredge seems fairly convinced they had something important to say, and the accusation seems less persuasive in his regard. "Gould and I were regularly derided and dismissed as neo-saltationists for many years" he writes.[24] ("Saltationism" is the discredited theory that new species literally pop into being in a single generation). There is an endnote in *The Selfish Gene* where Dawkins virtually claims to have come up with the idea of punctuated equilibria independently, adding: "I have since . . . become somewhat petulant — perhaps too much so — over the way the theory . . . has been oversold." [25] Andrew Brown comments: "A measure of the theory's success is that its opponents now deny there was anything new or interesting about it." [26]

Dawkins devotes a chapter of *The Blind Watchmaker* to an attack on the Gould/Eldredge theory.[27] He largely ignores the two central points of it — the fact of stasis, and the need to explain speciation (the division of a lineage into distinct species: neo-Darwinism implicitly shows no interest in species, and describes a natural world in which there is a sort of continuum of small variations). Instead, he focuses on the "saltationist" side to the question, charging Gould with confusion on the matter: Gould's "leaps" are still very, very slow on a human timescale.

It seems some of the heat was turned up in this debate by Gould's decision to challenge the gradualist starting-point more generally. "If gradualism is more a product of Western thought than a fact of nature," he wrote, "then we should consider alternative philosophies of change to enlarge our realm of constraining prejudices. In the Soviet Union, for example, scientists are trained with a very different philosophy . . . the so-called dialectical laws . . ." This was not a plea for Stalinist philosophy in science: "The dialectical laws express an ideology quite openly; our Western preference for gradualism does the same thing more subtly." [28] It was in the context of this debate that Gould remembered that he "learned his Marxism at his daddy's knee" — his father being a member of the Communist Party. This kind of stuff was a red rag to a bull. Eldredge recalls:

As if we had laid our souls bare in *True Confessions*, punctuated equilibria was seized upon as a Marxist tract, plain and simple. Leading the charge was . . . British paleontologist Lambert Beverly Halstead — who, I am told, was a Marxist himself in his student days. Having seen the light, and knowing a Marxist (especially a supposedly self-confessed one), Halstead wrote to *Nature* with an astounding proposition: "Her Majesty's schoolchildren were being subjected to Marxist propaganda as they viewed the newly renovated dinosaur exhibit at the Natural History Museum . . ." [29]

In fact, Halstead was confusing punctuated equilibria with cladistics, a system of classifying evolutionary lineages. But this gives some flavor of the nature of the controversy at the time.

Similar politicized controversies surrounded other of Gould's innovations. In 1979, he presented a paper jointly written with Lewontin to a Royal Society conference, entitled "The Spondrels of San Marco." [30] (Lewontin couldn't be there because he has a problem with air travel.) Spondrels are an

architectural feature, exhibited in a church in San Marco, Italy, which look as though they are part of the basic design. In fact they are not: they are a consequence of something else. Gould and Lewontin asked whether this was not true of evolutionary features, of supposed "adaptations." The adaptatist program looked to explain everything by some imagined evolutionary advantage. Suppose, though, there was no simple causality in this way — things "just happen?" Or they happen as a consequence of something else. Later, with Elizabeth Vrba, Gould coined the term "exaptation" to elaborate on this theme. Evolution sees "aptations," he argued; there are the familiar "adaptations," but there are also "exaptations," in which a trait that evolved due to one evolutionary pressure turns out to have a different use entirely — perhaps because the environment abruptly changes, and a trait suddenly comes into its own. A good example of exaptation would be the human mind: it evolved through whatever evolutionary pressures, but its current functions and attributes can't be reduced to those pressures; and having adapted, its use can become progressively extended, without reference to the original adaptive pressures.

Underlying all these things, plainly, is a dissatisfaction with the explanatory power of neo-Darwinism alone. To Gould, it seemed that mainstream evolutionary theory presented a picture of the gradual accumulation of change that was contradicted by the evidence, and explained much less than it seemed — or, perhaps, explained too much. For Gould, a very great deal of natural history was the result of pure chance, contingent circumstance. At heart, here, I think there is a concern to see evolution *as history*, rather than an abstract model — to identify and explain the actual shape of evolutionary history; in large part that Gould's sphere, palaeontology, is a historical science, accounts for this. Gould was impatient with explanations that focused only on one area of causality, and appealed — in the spirit of Darwin, he often said — for "pluralism."

The theme of contingency was one he returned to repeatedly. Gould, for instance, immediately embraced the theory that dinosaurs were wiped out by a meteor 65 million years ago, seeing it as a classic example of mere chance determining the shape of evolution.

There is an issue at the center of this that was crucial to Gould's worldview and politics. His book *Wonderful Life*, more than any other, spells out the meaning of all this.[31] The book describes the discovery and later reinvestigation of the fossils of the Burgess Shale in Canada, which date from the very beginnings of multicellular life, the "Cambrian explosion" of 580 million years ago. The extraordinary thing about the Burgess fauna, it turned out, is that many of them were bizarre organisms bearing no relation to anything that exists today. The lineage on which all living beings rest derives from only one of several possibilities which existed in the Cambrian era; the others just died out. But why they died out, and that which produced insects, mammals, etc survived, was the purest chance.

You press the rewind button and, making sure you thoroughly erase everything that actually happened, go back to any time and place in the past — say, to the seas of the Burgess Shale. Then let the tape run again . . . If each replay strongly resembles life's actual pathway, then we must conclude that what actually happened pretty much had to occur. But suppose the experimental versions all yield sensible results strikingly different from the actual path of life? What could we then say about the predictability of self-conscious intelligence? or of mammals? or of vertebrates? or of life on land? or simply of multicellular persistence for 600 million difficult years?[32]

Most, though not all, evolutionists would say they share this vision of history, and of humanity's place in it: there was absolutely nothing inevitable about the appearance of human beings, or even of intelligent life. But Gould's insistence on it was particularly sharp, and with a particularly political edge. Against any residual ideas we might have of a "chain of being," or a ladder of progress — ideas informed by a historical era in which progress meant imperialism, and the chain of being was racist — Gould defined humanity as an accident; indeed, for Gould even the notion that life became

gradually more complex over time is a statistical illusion: the vast bulk of organic matter on earth is still bacteria.[33]

As Copernicus and Galileo dethroned the earth from the center of the universe, Darwin removed humanity from the center of nature. Gould wanted us to see how profound this was. We are an accidental little species, not yet even around for very long.

There are biologists, and other scientists, who reject this vision, who see complexity as the result of the natural organization of things — and complex systems, including life, intelligence, etc, as derived from the patterns formed by "random" chaos.[34] Gould didn't address himself to these new scientific theories, as far as I know. In any case, his sharp opposition to any notion of progress did not lead him to indifference on social questions — on the contrary.

Human Capacity (2): Intelligence

ON THE CONTRARY. GOULD, IT MUST BE REMEMBERED, was professor of Zoology and Geology at Harvard: it would be hard to imagine a more cloistered environment. Yet he chose to climb down from his ivory tower and deliver a blistering polemical critique of intelligence testing, with *The Mismeasure of Man*, first published in 1981, and then in second edition in 1996.[35] He takes inspiration from Darwin himself: "If the misery of our poor," Gould quotes him, "be caused not by the laws of nature, but by our institutions, great is our sin." He sets out to show us how great, indeed, it is. Gould traces the whole history of intelligence testing, up to the IQ test itself, condemning it as an exercise in racism. His target is the "hereditarian" theory of IQ, that is, that intelligence is largely inherited, and that "intelligence" can be tested for.

One thing illustrates a more general feature of Gould: in describing "state of the art" science in the past, and revealing the absurdity of its assumptions — the transparent prejudice — he warns us not to be complacent about our assumptions today. I will mention here three features of this powerful, moving book which bear special attention.[36]

In the First World War, Harvard psychologist Robert M Yerkes carried out a series of tests on American soldiers. These were of a similar nature to the tests imposed on new immigrants to the U.S. — which, notoriously, had "proven" that immigrants from southern Europe and elsewhere were extremely stupid. Yerkes tests showed that the average mental age of white Americans was slightly above moronity. Gould describes the significance of these findings: they became "a rallying point for eugenicists who predicted doom . . . caused by the unconstrained breeding of the poor and feeble-minded, the spread of Negro blood through miscegenation, and the swamping of an intelligent native stock by the immigrant dregs of southern and eastern Europe." [37]

Gould subjects Yerkes' tests to an intensive critique, describing the spurious contents of the tests themselves, the difficult conditions — for the testees — under which they were set, and the fiddling, in effect, of the results to conform to prior prejudices (this latter being a feature of all intelligence testing). He also got some of his students at Harvard to sit the tests, and although they did fairly well, some "would have been fit only for the duties of a buck private."

He goes on to examine the core issue behind intelligence testing, the notion of "intelligence" itself. Modern tests look for "general intelligence," called "g," which is derived from a mathematical analysis performed on the results obtained on more specific areas of intelligence (verbal, spatial, etc). Gould calls this "reification": this "g" exists only as a statistical concept, but it is treated as if it were a real thing, which can then be used to divide and stratify human beings.[38]

It is not a question of rejecting all notions of intelligence. Gould does not deny that some people are better than other people at some things. But why not simply accept that some people are good at math, or verbally, etc; why try to find some overarching "intelligence?" Nor is it a question of denying that there may be some inherited aspect to people's particular talents. But, first, there is a common confusion in which the claim that, say, 80 percent of intelligence is "inherited" is taken to mean that in each individual there is only about a fifth which is environmentally shaped. In fact, it means that in 80 percent of cases there is a hereditary factor, which is entirely different. Gould was anxious that such statistics be understood. Second, proving that there is an inherited aspect to something tells us very little about how to address it. As Gould liked to point out, short sightedness is 100 percent hereditary, but can be entirely corrected for by wearing glasses.

The second edition of *The Mismeasure of Man* includes a review of *The Bell Curve* by Herrnstein and Murray, that notorious book which claims African-Americans are less intelligent than white. Gould destroys their argument. Simply, and in a few terse pages, he tears apart the very fabric of it. Revisiting the basic arguments of *The Mismeasure*, he concludes:

. . . if Herrnstein and Murray are wrong about IQ as an immutable thing in the head, with humans graded in a single scale of general capacity, leaving large numbers of custodial incompetents at the bottom, then the model that generates their gloomy vision collapses, and the wonderful variousness of human abilities, properly nurtured, reemerges. We must fight the doctrine of *The Bell Curve* both because it is wrong and because it will, if activated, cut off proper nurturance of everyone's intelligence. Of course we can't all be rocket scientists or brain surgeons . . . but those who can't might be rock musicians or professional athletes.[39]

Non-overlapping Magisteria

IN A SENSE, *THE MISMEASURE OF MAN* is a study in the arrogance of science — in this case the presumption of some scientists to be able to quantify something as elusive and delicate as "intelligence." The concern runs through Gould's work. And in one of his last books, he attempts to address more precisely that which is the proper sphere of science, and that which is not. He does so by examining the relationship of science to religion.

His conclusion is that are strict limits to the proper sphere of both, which he calls Non Overlapping Magisteria (NOMA). As he puts it, religion concerns the rock of ages, science the ages of rocks.[40]

Gould was, of course, a foremost opponent of so-called "creation science," and champion of the teaching of Darwin in schools. He was a witness in the so-called Scopes II trial in 1981, which found the Arkansas equal time law unconstitutional. One side to NOMA is to address what's different between fundamentalists who want to impose their superstitions on the whole of society, and the believers (of whatever faith) who have more modest, or personal-spiritual ambitions. The other is to challenge the tendency of modern science (and perhaps in particular in the form of popular science paperbacks) to claim to be providing universal answers to questions which are not really its business. Science, for Gould, can't tell us the meaning of life, and shouldn't try. Religion can't tell us about the natural universe and shouldn't try.

There is, here, an interesting distinction between Gould and his long-time opponent Richard Dawkins. Dawkins is a militant atheist, who champions science as precisely an alternative to any

form of religion. He sees the two as sharply and irreconcilably opposed. Gould is no less atheistic; but his attitude to religion is different nonetheless. For one thing, he sees it much less as a purely intellectual pursuit, as though religious fundamentalists can be understood simply as people who have made bewildering intellectual decisions: they are a *social* phenomenon, requiring a social analysis.

A good example of this concern to understand, rather than simply condemn, his enemy, comes in Gould's account of the original Scopes trial, in Dayton, Tennessee, in 1925. John Scopes, a high school teacher, was taken to court for teaching Darwin to his students. The prosecution was initially successful, though it marked the end in practice of Tennessee's antievolution law. Attacking Scopes and Darwin was the populist politician William Jennings Bryan. According to Gould, in addition to the more obvious religious objections to Darwin, Bryan had other concerns. He wrote, for example, in *Prince of Peace* (1904): "The Darwinian theory represents man as reaching his present perfection by the law of hate — the merciless law by which the strong crowd out and kill the weak." [41] Later, he told sociologist EA Ross that "such a conception of man's origin would weaken the cause of democracy and strengthen class pride and the power of wealth." (154-5) Examining the textbook on evolution, written by G W Hunter, which Scopes had used for his teaching, Gould found much to support Bryan's concern. For example:

Just as certain animals or plants become parasitic on other plants or animals, these [poor] families have become parasitic on society. They not only do harm to others by corrupting, stealing, or spreading disease, but they are actually protected and cared for out of public money . . . If such people were lower animals, we would probably kill them to prevent them from spreading. [42]

And Hunter goes on:

. . . there exist upon the earth five races . . . of man, each very different . . . These are the Ethiopian or Negro type . . . ; the Malay [etc] . . . and finally, the highest type of all, the Caucasians, represented by the civilised white inhabitants of Europe and America. [43]

Such scientific racism was par for the course in the 1920s (indeed, until after WWII). And perhaps Gould is giving Bryan too much credit. But it is typical of Gould to want to see the other side, to see if what had been involved in Scopes was simply Bible-bashing morons against the forces of enlightenment. The political use to which Darwinism was then, if only partly, being put, is of course another warning for today.

Still, with the concept of NOMA Gould bends over too far in attempting to find some sort of compromise with religion. He spends some time proving that even the Vatican accepts that there is a field of natural science into which theologians should not tread. But this, plainly, is the result of a long battle historically; and it is not only fundamentalists who are inclined to be less compromising than the Catholic hierarchy. Gould wants to preserve "facts" and "values" in separate spheres. But as Kenan Malik puts it: "But if our values do not emerge from the facts of our existence, whence do they derive? Unless we wish to believe that values are simply plucked out of the sky, then we must accept that there must be some relationship between the kind of values that we hold . . . and the kind of world in which we live." [44] If we are to base our view of the universe on the centrality of human inquiry, it is not easy to see how this can be reconciled to notions of "revelation." An individual might choose to leave unanswered the question whether scientific study of the universe

requires a decision about God. But ultimately, it does. It is not an arbitrary, or purely personal issue — whether there is some intelligence responsible for, or guiding, or even as a "first cause" creator of, the cosmos, or not. It cuts to the heart of what science is.

THE CONCERN WITH DEFINING, and limiting, science to its proper place is one of the threads which ties Gould's work together. We live in a period when, in the Western world at least, religion has waned perhaps terminally — although not, of course, in the United States itself. Science, also, has less of the prestige it used to have. As recently as the 1960s, science and technology were seen to carry the promise of progress, expressed for instance in the space program. There had always been another, more suspicious and negative attitude to science — a fear of its dark side that led, among other things, to atomic bombs and Nazi death camps.

In the past couple of decades, the dark side, and the fear, has grown more prominent. While on the one hand, genetic science, the Human Genome Project and all the rest promise great advances, people are afraid: they are afraid of scientists "playing god," of GM foods, of weapons of mass destruction. There is a side to the global justice movement that fears and rejects the dark side of science. At the same time, paradoxically, there is a huge growth in "popular science." Books on cosmology are best sellers — *A Brief History of Time* by Stephen Hawking (who must be the first celebrity cosmologist) is only the best known. Physics and biology fill large shelves in bookshops. Interesting, chemistry doesn't seem to have inspired any blockbuster hits. Perhaps it's too prosaic: while physics can offer insight, or so it claims, into the very origins of the universe, biology can tell us, or so it claims, about how life works. These are big questions, The Big Questions. They help to fill a void.

Gould occupies an interesting place in all this. One of the most popular of science writers, much of his work is a warning against his own disciplines getting too big for their boots, a pooh-poohing of scientific pretension. At the same time, like Dawkins, he offers wonderful, inspiring insight into the power of science to explain great mysteries. Gould's columns for *Natural History* magazine often began from some small biological oddity, gradually moving from there to illuminate a bigger question. He was a consummate teacher.

His detractors considered him a self-publicist, and utterly confused. British evolutionist John Maynard Smith once claimed: "the evolutionary biologists with whom I have discussed his work tend to see him as a man whose ideas are so confused as to be hardly worth bothering with." [45] The sheer range of Gould's reading, one imagines, must have infuriated his academic rivals — not to mention the sales of his books. For sure, as in any controversy, there have been exaggerations and misunderstandings in those Gould participated in, and he played his part. But he stood on the side of fighting for democracy and social justice, and against oppression, and educated thousands of his readers in that spirit, and that is not a negligible thing.

Shortly before he died he completed his monumental *The Structure of Evolutionary Theory*, a review of which is outside the scope of this article. Clearly, Gould wanted to be remembered as a theorist, not only a popular essayist and polemicist. His theoretical contribution was surely formidable. But what, I think, will stick most in the mind of the general public is Gould's humanism and humanity. In a review of *Not In Our Genes* by Lewontin, Rose and Leon Kamin (whose book on IQ informed Gould's), he made this final comment, which can stand as a statement on his work, too:

Groucho Marx caught the spirit of academic pettiness well when he delivered his inaugural address in song as president of Darwin (or was it Huxley) College in

Horsefeathers: "Whatever it is, I'm against it." By contrast, Lewontin, Rose and Kamin have entered a prime area of academic debunking and emerged with a positive program. Indeed, they are calling for no less than a revolution in philosophy. They are also not unmindful of that oldest chestnut in the Marxist pantheon (Karl this time), the last thesis on Feuerbach: philosophers thus far have only interpreted the world in various ways; the point, however, is to change it.[46]

Footnotes

1. Andrew Brown, *The Darwin Wars* (New York: Simon & Schuster, 1999). But see also, for example, Kim Sterelny, *Dawkins vs. Gould* (London: Icon, 2001).
2. The precise nature of the ideology of Lewontin and others around him, and Gould for that matter, is an interesting question. There is a soft-Stalinist/Mao-oid drift to some of the work of Lewontin; Gould, politically, seems to have seen himself much more as a left-liberal with socialist leanings.
3. Edward O Wilson, *Sociobiology: the new synthesis* (Cambridge: Harvard University Press, 1975).
4. Richard Dawkins, *The Selfish Gene*, 2nd edition (Oxford University Press 1989, 1st ed published 1976).
5. Group selection theory more recently has made something of a comeback. See Elliott Sober and David Sloan Wilson, *Unto Others: the evolution and psychology of unselfish behavior* (Cambridge: Harvard University Press, 1998).
6. Dawkins.
7. There are many useful introductions to this debate. In addition to the references above, see in particular Ullica Segerstrale, *Defenders of the Truth* (Oxford: Oxford University Press 2000). Although it focuses on more recent evolutionary psychology, Steven Rose and Hilary Rose, *Alas Poor Darwin* (London: Jonathon Cape, 2000), is an excellent introduction. See also Kenan Malik, *Man, Beast and Zombie* (London: Weidenfeld and Nicholson, 2000).
8. Wilson, like Gould and Lewontin, was working at Harvard (he had been Lewontin's sponsor in the past). He probably should have known that these radical scientists, who were involved in protests against the war in Vietnam, who had been radicalized by the civil rights movement, the women's movement, and so on, would detect the resurgence of old-fashioned biological determinism in his speculations. Wilson has always acted the bemused, hurt professor: I don't know how genuine this is. Wilson himself is politically a liberal. See, for instance, *On Human Nature* (Cambridge: Harvard University Press 1978).
9. Sociobiologists are quick to assert, in this context, the "naturalistic fallacy," falsely deriving "ought" from a biological "is." Gould also, in a different context, makes reference to this argument. In much human sociobiology and evolutionary psychology, unfortunately, it is hard to see how ought is not being derived from is (or even is from ought . . .).
10. Stephen Jay Gould, *An Urchin In the Storm* (London: Penguin, 1987).
11. See especially, Steven Rose, *Lifelines*, (London: Penguin, 1997), Richard Lewontin, *The Doctrine of DNA* (London: Penguin, 1991).

12. See, for instance, "Natural Selection and the Human Brain: Darwin vs Wallace, in *The Panda's Thumb*.
13. The standard text is Jerome H Barkow, Leda Cosmides and John Tooby, *The Adapted Mind* (Oxford: Oxford University Press, 1992). But there is a stack of other stuff; see especially, Steven Pinker, *How the Mind Works* (London: Penguin, 1997), and *The Blank Slate* (London: Penguin, 2002). For a critique, see Rose and Rose. An interesting critique from a different perspective is in Steven Mithen, *The Pre-History of the Mind* (London: Thames and Hudson, 1996).
14. Daniel Dennett, *Darwin's Dangerous Idea* (London: Allen Lane, 1995).
15. Rose and Rose.
16. A feminist critique can be found in Lynn Segal, *Why Feminism?*
17. Segerstrale.
18. Stephen Jay Gould, "More Things in Heaven and Earth," in Rose and Rose, p 98. A taste of the loathing for Gould in some quarters can be gained from an incident involving the founders of Evolutionary Psychology, Tooby and Cosmides. In 1997, in response to articles by Gould, they wrote an attack so blistering and abusive that the *New York Review of Books* refused to print it. Quote: "his essays become revealed as mini-theatricals carefully staged for purposes of self-aggrandizement" etc. Brown, pp 150-151.
19. More interesting and sophisticated version of evolutionary psychology include Geoffrey Miller, *The Mating Mind* (New York: Random House, 2001). There are also attempts to "reclaim" evolutionary psychology and sociobiology for the left. See especially Chris Knight, *Blood Relations: menstruation and the origin of culture* (New Haven: Yale University Press, 1991), and Marek Kohn, *As We Know It: coming to terms with an evolved mind* (London: Granta, 1999).
20. Pinker, *The Blank Slate*.
21. Randy Thornhill and Craig Palmer, *A Natural History of Rape* (Cambridge: MIT Press, 2000).
22. Niles Eldredge, *Reinventing Darwin* (Phoenix: Giant, 1995).
23. Dennett.
24. Eldredge, p 100.
25. Dawkins, *The Selfish Gene*, 2nd edition, p 287.
26. Brown, p 63.
27. Richard Dawkins, *The Blind Watchmaker* (London: Longman, 1986).
28. Stephen Jay Gould, "The Episodic Nature of Evolutionary Change" in *The Panda's Thumb* (London: Penguin, 1980), pp 153-4.
29. Eldredge, p 102.
30. Stephen J Gould and Richard C Lewontin, "The Spandrels of San Marco and the Panglossian Paradigm: a critique of the adaptationist program," in *Proceedings of the Royal Society of London, Series B, Vol. 205, no. 1161* (1979).

31. Stephen Jay Gould, *Wonderful Life: The Burgess Shale and the Nature of History* (London: Penguin, 1991); originally published by Century Hutchinson in 1989.
32. Gould, *Wonderful Life*, pp 48-50.
33. Stephen Jay Gould, *Life's Grandeur*, Jonathon Cape 1996, published in the United States as *Full House*.
34. Among the work in this field, see Stuart Kauffman. *At Home in the Universe* (New York: Viking, 1995), and for an excellent survey of this and other debates, George Johnson, *Fire in the Mind* (London: Penguin, 1997).
35. Stephen Jay Gould, *The Mismeasure of Man*, 2nd edition (London: Penguin, 1996).
36. As an interesting aside, Lewontin, in his review of *The Mismeasure* . . . criticized it for being too untheoretical, and for drawing too heavily on American experience, which overemphasized the specifically racist content of intelligence testing. See Lewontin, "The Inferiority Complex" in *It Ain't necessarily So* (London: Granta, 2000).
37. Lewontin, "The Inferiority Complex," p 226.
38. There is an important issue here of more general applicability. In behavior genetics, many attributes, from intelligence to homosexuality to obesity to violence, are treated as "things" in this way, easily definable quantities for which a gene can be identified. But what, for example, is "violence?" The term covers many things.
39. Lewontin, "The Inferiority Complex," pp 377-8.
40. Stephen Jay Gould, *Rocks of Ages: Science and Religion in the Fullness of Life* (London: Jonathan Cape, 1999).
41. Quoted in Gould, *Rocks of Ages*, p 154-155.
42. Gould, *Rocks of Ages*, pp 167-8.
43. Gould, *Rocks of Ages*, pp 168.
44. Kenan Malik, review of *Rock of Ages* in *New Statesman*, February 19, 2001.
45. Quoted in Brown.
46. Stephen Jay Gould, "Nurturing Nature" in *An Urchin in the Storm*, p 154.