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The Triumph of Stephen Jay Gould, By Richard C. Lewontin

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***The Richness of Life: The Essential Stephen Jay Gould*, edited by Steven Rose, with a foreword by Oliver Sacks; Norton, 653 pp., $35.00**

***Punctuated Equilibrium*, by Stephen Jay Gould; Belknap Press/Harvard University Press, 396 pp., $18.95 (paper)**

Stephen Jay Gould

One of the most interesting developments of the last sixty years in the popularization of intellectual concerns and higher culture has been the appearance of "public intellectuals." They are, for the most part, academics who use a variety of means of access to a wide audience to disseminate ideas that are sometimes an integral part of their expertise, and sometimes very far from their professional field.

There were, indeed, at an earlier time, occasional purveyors of scientific ideas either to a cultured public or as part of a conscious attempt to educate the working class. Thomas Henry Huxley was not only a major popularizer of Darwin for an educated English reading public in the 1860s, but also gave workingmen's lectures on various biological questions. In pursuit of his own ideological program, J.B.S. Haldane, one of the founders of modern evolutionary genetics in the 1930s, wrote on science for the British *Daily Worker*. In the more conventional press, the feuilleton pages of French and Italian newspapers have long been the outlet for occasional articles on scientific and cultural issues by prominent academics. It has only been since World War II, however, that there has arisen a moderately large class of academics for whom a major preoccupation has been the popular explication and interpretation of either their body of technical knowledge or their theories about almost anything.

The rise of the public intellectual as a regular career category, bringing esoteric knowledge and overarching theories to a wide audience, as well as fame and fortune to the practitioner, began when the most esoteric science intruded itself onto the public consciousness with a very loud bang on July 16, 1945. In high school I was a typically nerdy science enthusiast, part of a small, more or less socially isolated coterie that met after school to trade Freudian interpretations of our dreams at the local soda fountain. But when the school year began in the fall of 1946 I found my-self on the assembly hall platform, a public-intellectual-in-training, explaining the mysteries of nuclear physics to an audience of the entire school.

The Manhattan Project and the development of radar during World War II provided the impetus for a major reorientation of the relationship between the state and the academic world. It became obvious to policymakers like Vannevar Bush, head of the wartime Office of Scientific Research and Development, that a regular major investment in scientific research would be necessary for the future security and financial prosperity of the country and that, given the competitive demands for profit, private capital could not be adequate for the purpose.[1] The result has been that the annual federal expenditure for research and development (in constant dollars) has been multiplied by a factor of ten since 1947. The relevance of this immense increase in the funding of science to our understanding of changes in culture is twofold.

First, universities and colleges have been a major beneficiary of the investment in science, their total share having risen from $1.5 billion to $15 billion annually.[2] About one third of the funds do not go directly into particular scientific research, but are paid to the universities and colleges as overhead ("indirect costs," in the official jargon), which the institutions are free to expend as they wish. The result has been an explosion in the budgets of institutions of higher education, resulting in large increases in the size of their faculties and physical plants with a concomitant increase in the number of enrolled students.

In 1946 there were 125,000 faculty members teaching about two million students. At present there are about 975,000 faculty members teaching 15 million students. In 1946 only about 8 percent of the population had a college degree while now nearly 30 percent have one. This very large increase in the number of people who have been exposed to an intellectual and artistic culture has resulted in a concomitant increase in the demand for the promised fruits of that education. Having spent all those tedious hours in the required study of basic science with the promise that the effort would enable them to understand the changing world of technology and medicine, they want to have an informed understanding of those changes. What was the use of sitting through those courses in history if we cannot continue to have an explanation of present developments, or those in art if we cannot experience at first hand the objects that we saw only as two-dimensional projections on a distant screen? Anyone who does not think that there has been a huge increase in the demand for even momentary contact with the artifacts of the past should try getting into the Metropolitan Museum on a weekend.

Second, just as the demand for continued contact at some level with intellectual life has increased, so has the supply of publicly available intellectual products. Universities have publicity departments that arrange for press conferences and news releases about the latest scientific discoveries or theoretical claims of their faculty members. Television has interview series in which the ideas and findings of academics are given wide public exposure. Universities and colleges themselves have a large number of endowed public lecture series for which a relatively small number of public intellectuals are recruited as lecturers. Newspapers have regular science columns. When I was a boy *The New York Times* had one science reporter, Waldemar Kaempfert, who wrote an occasional column. It now has a staff that produces an entire ten-page *Science Times* every Tuesday. Of the twenty-two contributors to the 2007 Fall Books edition of *The New York Review*, nine were academics. The pages of that edition included twenty-six advertisements from university presses announcing 154 books. Nor are university presses the sole publishers of the work of professional thinkers. Really successful public intellectuals employ a literary agent who places his clients' work with major trade publishers or may even serve as the editor of a collection of articles of his clients,[3] which is then published by a major house.

There is a considerable variation in the degree to which academic public intellectuals stray from their own technical work in their public writings. Even those who begin with both feet planted firmly in their discipline find it hard to resist the seduction of generalizing, especially if they see some relevance of their knowledge to human history and social structure. E.O. Wilson, a great expert on the biology of ants and especially on ant behavior, devoted most of his famous book on sociobiology to the social behavior of "lower" animals, but his status as a public intellectual arose from his extension of those ideas and observations to claims about human nature and human social institutions. After all, *Homo sapiens* is an animal, so why should we not be able to understand human history as just another example of a general theory about animal behavior?

Some depart entirely from their expertise and build a public career with only the slimmest connection to their professional knowledge. It will not be obvious to the readers of Jared Diamond's *Guns, Germs, and Steel* that he is, in fact, a physiologist and an expert in tropical biogeography. Still others are public figures concerned with political questions quite separate from the content of their intellectual accomplishment. Noam Chomsky's politics have nothing to do with his theory of universal grammar, although he might gain attention for his political arguments because we already know that he is very smart. It is even possible to become a public intellectual in science with no institutional home in a technical discipline. Richard Dawkins, who was trained as a biologist and who obviously knows a great deal about genetics and evolution, is Professor of the Public Understanding of Science at Oxford.

Of the best known and most active of active public intellectuals, only two have resisted the impulse to invent and advertise theories of human nature, its evolution, and its manifestation in history and social institutions. One was Carl Sagan, who largely avoided grand theories of humanity and, with the modesty appropriate to an astronomer, stuck to explaining the universe. The other was Stephen Jay Gould.

Gould's activities as a public intellectual, including three hundred essays for the lay reader in *Natural History* magazine reprinted in nine collections, numerous interviews on television and radio, and an extremely busy schedule of invited lectures, would appear to make him typical of the successful public academic. Of his success there can be no doubt. His lecture fees were unimaginable for an evolutionist, being more in the bracket of human genome sequencers. I was once asked, in an invitation to lecture at a midwestern university, what fee I would charge. I replied that I had no particular fee, but that I would expect to be paid as much as anyone else who had done the same service. During my visit I learned that Steve Gould had lectured there and I expressed surprise that he would settle for such a small sum, whereupon my host assured me that a special endowment was tapped for Gould's exceptional case. But he was exceptional in another way. His success as a public intellectual did not seduce him into extending himself far beyond his professional competence and rigor in the service of some general theory of human nature or history or the invention of some overarching principle or direction in the sweep of evolution.

That is not to say that he made no claims about some previously unappreciated properties of the evolution of organisms. But at all times he was tightly constrained by the physical evidence. The collected essays in *The Richness of Life* and the one long argument made in *Punctuated Equilibrium* make us think about important features of the evolutionary process that have been previously ignored or neglected. They are not meant to be the biological or historical equivalent of Unified Field Theory.

Steve Gould was a person of considerable academic breadth. He was a faculty member at Harvard simultaneously in the Departments of Organismic and Evolutionary Biology, of Geophysical Sciences, and of the History of Science. His academic work in evolution was concerned with the sizes, shapes, and forms of animals and with how the functions that were served by the various bits and pieces of the body were related to their anatomical details. The title of one of his essay collections, *The Panda's Thumb*, could not have been more revealing of his intellectual program. *The Richness of Life: The Essential Stephen Jay Gould* combines a selection of his academic essays on various issues in evolutionary biology with a sample of his popular essays on biology taken from those he wrote over twenty-five years for *Natural History*.

His rhetorical powers were such that it is not always clear which, if any, of the essays in *The Richness of Life* are beyond the ability of a generally educated lay reader to comprehend. To some extent, of course, we owe this transparency to the good judgment of Steven Rose, the editor of the collection. One may even forgive the self-indulgence of the six introductory autobiographical essays because they contain some streaks of real meat inserted into the alternating layers of the fat of personal narrative. In particular, the essay on Joe DiMaggio's famous record of hits in consecutive games, "The Streak of Streaks," meant to display Gould's knowledgeable love of baseball, contains an important lesson about long runs of events that is almost never appreciated by the layperson: "Long streaks always are, and must be, a matter of extraordinary luck imposed upon great skill."

There is hardly a chapter in the main body of *The Richness of Life* that does not repay a careful reading. Of all the essays in it the one that is most important to the public understanding of science is "Measuring Heads: Paul Broca and the Heyday of Craniology," for it deals with an issue that is so discomfiting for scientists that they avoid it when they can. Despite the myth of detached objectivity that scientists propagate, their motivations are as messy as everyone else's. In particular, they have political, social, and personal concerns that may influence what they do, how they do it, and what they say about it. Putting aside deliberate fraud, of which we have an embarrassment of examples, the gathering of data, their statistical representation, and their interpretation offer many opportunities for unconscious bias toward conclusions that we already "knew" to be true.

In particular, scientists have repeatedly reported that whites have larger brains than blacks. Gould shows that when the preserved brain is measured before the race of its former owner is revealed, this difference disappears completely. Similarly, claims of larger heads of professionals as compared to laborers are not statistically significant because of very large variation from individual to individual. What is important about this essay is not that it reveals what we already know to be true about the existence of racism and sexism, but that it shows how any claim that something is "scientifically demonstrated" should be treated with the same skepticism that we invoke when there is any reason to think that the investigator has something to gain, either ideologically or professionally, as we do when financial gain is involved.

Gould's interest in form and function led him to revive interest in what was for some time a neglected aspect of evolution, the change in relative size of different body parts. It was well known in the nineteenth and early twentieth centuries that during the course of evolution different parts of similar organisms changed their relative size. So, for land vertebrates, as bodies grow larger in evolution, limbs get relatively thicker, but cranial size grows larger more slowly than the rest of the body so that heads get relatively smaller.

A major change in this relation of head size to body size occurred, however, in the immediate ancestors of humans. In the human line, cranial size has grown larger more rapidly than body size so we have, compared to apes, heads too big for our bodies. On the other hand our teeth have become much smaller. In recent years this regularity of differential growth, or allometry, of body parts is sometimes neglected because of a fashion for adaptive explanations of evolutionary change. A famous example is the Irish elk, a very large deer with grotesquely enlarged antlers. It was common to explain these huge appendages as the result of natural selection favoring males with the largest antlers, who would then win out in head-on struggles with other males in the competition for females. It was further imagined that the Irish elk as a species went extinct because it was too much of a strain to carry all that weight around on their heads.

Steve Gould neatly deflated this just-so story by showing that the antlers of the very large Irish elk were exactly the size that one would expect from the general differential growth rate of body and antlers in deer. As for the Irish elk's extinction, their more modestly antlered ancestral species also became extinct, so it is not clear why we should pick out their extravagant headgear as the cause. The important point is that it is easy to make up adaptive stories out of one's imagination for any feature of any organism, but that there are concrete realities of growth and physiology that need to be taken account of before lapsing into unchecked fictions. A chapter in *The Richness of Life*, coauthored with David Pilbeam, develops this theme for human evolution.

The phenomenon of allometry is only one of a number of possible factors that need to be considered in explaining particular evolutionary changes. It is a vulgar error to reduce the explanation of all evolutionary changes to the action of natural selection. It is not only in everyday language, however, that evolution is made synonymous with the effect of the higher reproductive fitness of some forms. Within the profession of evolutionary biology during the last thirty years there has developed an overwhelming fashion for adaptive explanations of every feature of organisms. This has been encouraged by the development of theories of kin selection and group selection in which it can be shown formally that a trait may spread in a population even though it is a disadvantage to its carrier, provided that close relatives or the population as a whole may have an increased reproductive rate. This form of reasoning, easy to do in theory but extremely difficult to demonstrate convincingly in nature, has swept through evolutionary biology.

One essay, "The Spandrels of San Marco," reprinted in *The Richness of Life*, has itself become the subject of a very considerable literature. It argues that there are multiple possible explanations for evolutionary change besides direct natural selection for a trait.[4] Steve Gould was enamored of early Italian church architecture and familiar with spandrels—the triangular spaces between a series of arches and the straight cornices running above them. He suggested the spandrel as a metaphor for anatomical features of organisms that were not themselves adaptive, but were the architectural consequences of building another feature, just as the spandrels filling in the space surrounding a church dome are a necessary outcome of placing a circular object on a square base. As the church spandrels may then incidentally become the locus for decorations such as portraits of the four evangelists, so anatomical spandrels may be co-opted for uses that were not selected for in the first place.

Gould's favorite example is the human chin, whose presence is an incidental consequence of the differential growth rate of two bones in the lower jaw. The dentary bone which carries the teeth elongates more slowly than the jawbone itself, so the chin juts out. In our ape-like ancestors the jawbone grows more slowly so no chin develops. Of course one can always try to invent a story about why having a chin confers more reproductive potential, but that is a parlor game, not science.

All scientists have held up before them the lives of their great predecessors who provide idealized images of what it is to be a scientist. For physicists this is Newton. In the case of evolutionists it is Darwin. For most scientists these figures, while revered, do not represent realistic models for their own careers. Devout Christians may revere saints, but they hardly expect their own eventual canonization. There are, however, unusually ambitious scientists who, while not expecting to become another Newton or Darwin, hope to show that some important element of the standard that they have inherited from their sainted predecessors is in need of correction or even rejection. After all, didn't Einstein become famous by showing that Newtonian physics was only an approximation of a more general truth?

Steve Gould was ambitious. In the introduction to *Punctuated Equilibrium* he writes that "punctuated equilibrium stands for a larger and coherent set of mostly iconoclastic concerns." While he could not hope to smash utterly the Darwinian icon, he certainly wanted to put a noticeable crack in it. There is, however, not a single model icon, copies of which sit on the desk of every evolutionary biologist, but a large number of individually modeled figurines, some made of thinner and more fragile materials than others. Gould's model was of delicate porcelain.

Darwin's theory can only be understood against the background of other theories of evolution with which it disagreed. The reigning pre-Darwinian evolutionary theory was the saltational one that we associate with the name of Jean-Baptiste Lamarck. In this theory some change in the environment of a species would cause all the individuals in that species to undergo a distinct change in shape or function, which was an adaptive response. This alteration would then be inherited by all the individuals in the succeeding generation so that species adaptation occurred in discrete steps. Darwin's theory was radically different. It assumed that in every generation one or a few individuals in a species underwent small heritable changes in form or function by chance that were independent of the requirements of the environment.

Any species would then contain at any time a large amount of variation from individual to individual. If, when the environment changed, some of these random variants were more reproductively fit, individuals with those variants would have more offspring and slowly, generation by generation, in the new environment these favorable heritable variants would increase in number until they characterized the species as a whole. The picture then was of a slow and steady change in characteristics over long periods of time as a result of small inherited changes that increased in the population because, by sheer chance, they conferred slightly greater success in the struggle for existence. Unfortunately Darwin did not always stick to this picture and in later editions of the *Origin* allowed for the possibility of Lamarckian inheritance of acquired characteristics.

The two contrasting theories of evolution make contrasting predictions about what we ought to find in the fossil record. If Lamarck were right, then fossils should show distinct jumps separated by long periods of constancy in successive layers of rock, while ideally, if Darwin were right, there should be a slow continuous change in form in successive layers. The inconvenient truth is that although Darwin was certainly right and Lamarck wrong about the inheritance of acquired characteristics and the presence in any species of a very large number of inherited small variations, the fossil record is mainly characterized by distinct jumps in form between successive strata.

The standard reaction by paleontologists to this annoying fact is that it is a consequence of the rarity of fossilization. If most generations of most organisms never get fossilized, then what we are seeing is instantaneous snapshots taken only once in a long while, so of course we miss most of the action. What evolutionists generally ignored was that reasonably often one also found fossil series in which virtually no change had occurred. In 1972 Niles Eldredge and Steve Gould[5] proposed that we should take these jumps and periods of constancy seriously and that, in fact, most changes in form occur during the relatively short time that it takes to form new species from old ones. This was neither a rebirth of Lamarckism nor a fundamental challenge to the Darwinian theory but an application to the fossil record of particular elements of the modern theory of how the more or less continuous process of evolution gives rise to distinct species. What began as a joint proposal of two fellow graduate students became, for Steve Gould, his "coordinating centerpiece."[6]

Gould's claim to iconoclasm, to a radical revision of some aspects of Darwin's thought, rests on Darwin's usual characterization of evolution as being marked by a "slowness and smoothness of rate" giving rise to an "insensibly graded series." The problem with making an agreed-upon image of Darwinian evolution is that the *Origin of Species* is not a technical paper appearing in a modern scientific journal after having been dissected line-by-line by a panel of technical referees. It is a nineteenth-century document, in several editions, with some contradictions within and between successive versions. Most important, it was written as a refutation of the Lamarckian theory of jumps, replacing a Lamarckian image of a staircase-like sequence of levels with an equally idealized metaphor of an inclined plane. In fact, evolutionists have long recognized that neither of these metaphors fits the real process of alternating episodes with different speeds of change. The importance of the varying tempo of evolutionary change was already emphasized over sixty years ago by the famous paleontologist George Gaylord Simpson.[7] The reader might best think of evolutionary change neither as a staircase nor a ramp, but as a road winding up and down through the Catskills.

The theory of punctuated equilibrium is Steve Gould's main claim to professional fame as distinct from his prominence as a public intellectual. While acknowledging what he characterized as his fellow scientists' legitimate disagreements with the theory, he devotes the last pages of *Punctuated Equilibrium* to a discussion of what he regards as purely personal sources of criticism[8] :

Given the vehemence of many deprecations, combined with a weakness or absence of logical or scientific content, I must conclude that the primary motivating factor lies in simple jealousy....

What he calls "the most unkindest cut of all" is the dismissive characterization of the theory as "trivial" by two of his fellow public intellectuals, Daniel Dennett and Richard Dawkins, who, after all, have no particular claim to evolutionary expertise. Whether Dawkins is right that punctuated equilibrium is a "minor wrinkle on the surface of neo-Darwinian theory" depends, of course, on the distance from which it is viewed. From outer space even the Himalayas will appear as a minor wrinkle on the surface of the earth.

At his premature death after the recurrence of a cancer we all thought had long ago been extirpated, Steve Gould was a success. He had the public renown he craved, a professional stature in his field that was out of the ordinary, and a very long list of honors, medals, degrees, and elections. What was most extraordinary about him, however, was the unresisting ease with which he faced his own imminent extinction. Perhaps, in the end, he was satisfied.

Notes

[1] See *Science, the Endless Frontier*, a report to the President by Vannevar Bush (Office of Scientific Research and Development, 1945).

[2] For a detailed analysis of these developments and their relationship to the cold war see R.C. Lewontin, "The Cold War and the Transformation of the Academy," in Noam Chomsky et al., *The Cold War and the University: Toward an Intellectual History of the Postwar Years* (New Press, 1997).

[3] See, for example, *What We Believe But Cannot Prove: Today's Leading Thinkers on Science in the Age of Certainty*, edited by John Brockman (HarperPerennial, 2006).

[4] While I contributed to this paper, the metaphor of the spandrels and the development of the idea of anatomical spandrels to which the paper owes its fame were entirely Gould's.

[5] Niles Eldredge and Stephen Jay Gould, "Punctuated Equilibria: An Alternative to Phyletic Gradualism," in *Models in Paleobiology*, edited by T.J.M. Schopf (Freeman, Cooper, 1972).

[6] *Punctuated Equilibrium*, p. 1.

[7] George Gaylord Simpson, *Tempo and Mode in Evolution* (Columbia University Press, 1944).

[8] This chapter, together with the initial autobiographical appendix, "A Largely Sociological (and Fully Partisan) History of the Impact and Critique of Punctuated Equilibrium," occupies almost one fifth of the book.

Posted by Doug at 2:16 PM

Labels: Biology, Earth Science, Evolution/Genetics, History of Science, Journalism, Lewontin, Philosophy, Psychology, Race, Stephen Jay Gould

2 comments:

Doug said...

> As for the insight into Gould's personality and science, this is about as perceptive a comment as I've ever read:
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Pretty much right on the money, IMO. To those "in the know," it not only properly, if indirectly, criticizes Gould's overblown claims to have obliterated at least neo-Darwinism around 1980-1982 (in which Goldschmidt -- or rather "Goldschmidt" -- played a key role) but also quite cleverly (it's pure Lewontin) relativizes (or, if you like, perspectivizes) the importance of Gould's work, as is only fair -- and accurate.

Gould would not have agreed with that last bit on Dennett and Dawkins being the careful reader he was. First, Lewontin has already stated what Gould eventually had to retreat to -- that punkeke (standing for all of his related evolutionary ideas) did not overthrow Darwin, Darwinism, or even neo-Darwinism. Second, if D&D are unfair to pick an interstellar vantage point from which to evaluate Gould's notions, and dimiss them as "wrinkles," so too would, say, the Gould of the early '80s (and even in his last work, in places) be unwarranted in claiming to have thrust up "a range of his own" outside of Darwin's country. One man's mountain is another man's molehill; quite right! What matters is deciding which vantage point is warranted by the evidence; and that's the hard part.

Everyone agrees in principle on that -- Dawkins, Gould, et al. Why that agreement in principle didn't and doesn't mean much in practice says a lot about the still-underestimated "irrationality," for lack of a better word, of that paradoxically rational method of inquiry -- when viewed from a vantage point at which individuals blur into institutions and other social groupings -- modern science.

Scientists are not wholly driven by rational thought any more than any other human being is, some training to be rational aside. Yet at the level of social interaction (checking of others; lack of deference to authority; etc. -- all imperfect but still real), which is the essence of science, one finds rationality.

30 January, 2008 16:16

Anonymous said...

For over 150 years Darwinism and neo-Darwinism haven't been able to account and explain culture. Despite the failures of eugenics, Social Darwinism, memetics and the structural frailties of evolutionary psychology and sociobiology Stephen Jay Gould continually showed his 'science mind' by saying 'I don't know' about cultural evolution, and even cautioned against using the term evolution. We could refer to cultural emergence, cultural history, but its name would have to convey what Gould significantly referred to as 'the Lamarckian juggernaut' in accounting for culture's speed in relation to evolution.

To say "I don't know" or "We don't know that right now" (he used the phrase "in as much as we can say that" quite a lot) may well appear un-expert but that is the very question that drives science. Read Gould and you'lll read the 5 year old whose Dad took him to the museum coming through the words of someone much more learned than the young boy, but with the wonder still there, and wonder for the reader as well. Reading Gould and Lewontin science is an ongoing endeavour, challenges realised but more to learn. The balance of knowledge and yet humble deference to the unknown, not known and even unknowable sets them apart from a more corrosive hue of thinking: ultra-Darwinism.

In Dawkins, Dennett, etc they promote a perspective of science that is often detached from social considerations, a science that is not only aloof but in a real sense pure. Moreover, they write generally as if Darwin's work wasn't the beginning of an exciting new way of looking at the world, but the end. Read that back, it's worth taking in a second time. Any 'science' that comes at you overpromoting the past over the future is more dogma of the past, than discovery of the future.

Gould's impressive body of work is perhaps the most rounded contribution to knowledge of natural and social sciences in the late 20th Century. That's quite a statement, but thats fine, it's quite a body of work. I am writing this at a time when the science milieu of gene-centrism is unravelling as a 'trend' (science hates the term 'bandwagon') from and through the 1970s which has dominated the pages of popular science to date.

The triumph of Stephen Jay Gould is that his writing, his understanding of science as one way of knowing the world around us is the best body of provisional truth we have had to date. It's something to herald.

26 May, 2009 12:17