Joys of Teaching Anthropology

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ON RESCUING SCIENCE FROM SCIENTISTS

Jonathan Marks

One of the nicest things about being a biological anthropologist is the great scope of academic issues and data within reach of your opposable thumbs. Biological anthropology sits on the crossroads of academic sciences and humanities, the juncture of the biological-natural and the cultural-historical aspects of the human experience. This sets up a fundamental paradox, however.

We are anthropologists, committed to study and admire the richness of intellectual life across the human species. On the other hand, we are also custodians of a "sacred bundle"—the official, scientific story of who we are, where we came from, and what it means. It falls to us biological anthropologists to present that story to students each semester.

This paradox leaves anthropology fighting a bizarre two-front intellectual war. On the one hand, the creationists are angry at the intellectual hegemony of science, and challenge anthropology's claim to speak authoritatively for human ancestry. On the other hand, the positivists[1] are angry at the cultural relativism promoted within anthropology, and challenge the merits of intellectual diversity. The one thing creationists and the positivists agree on is that anthropologists are blind and misguided, and have got it all wrong.

What I want to explore in this essay is how to reconcile the sides in this war, through the anthropology of science.

What Is Science?

Some years ago I was asked to review grant proposals by graduate students submitted to Sigma Xi, a national science organization. I was given terse instructions: Fund the ones that are testing hypotheses, for they are the ones doing science; and don't fund the ones that are just going on fishing expeditions. Oddly, though, the molecular genetics community was at that very time successfully lobbying Congress for a multi-billion-dollar grant for The Human Genome Project, a mega-fishing expedition. There seemed to be a significant discordance between how Sigma Xi was thinking about science and how the Human Genome Project was thinking about it. If testing hypotheses made something science, then the HGP wasn't science; and if the HGP was science, then the criterion I had been given for evaluating the grant proposals was bogus.

Falsificationism, or hypothesis-testing, taken as the defining attribute of science, itself encodes an odd paradox. If science consists of testing and falsifying hypotheses, and there is more science going on now than ever before, then it follows that most hypotheses that scientists have now, or have ever had, have been wrong. They have been falsified and disposed of, because that is what science does. But if most scientific ideas are wrong, how can we invoke them authoritatively?

Let us back up, then. Why would anyone think that testing hypotheses is what differentiates science from anything else? The answer lies in the influence of the pre-eminent philosopher of science of the first part of the 20th century, Sir Karl Popper. Popper, however, was the **beginning** of modern philosophy of science, not the end of it. Indeed, in the decades since Popper burst on the scene, the field of "science studies" has developed to encompass the issues broader than those implied by "philosophy of science," and this has come with a decidedly anthropological tint.

Thomas Kuhn, for example, used an explicitly anthropological model to contrast the "paradigms" in conflict at particular points in the history of science. Kuhn's interest in science was as a situated cultural activity, not as abstract problem-solving. Problem-solving was the boring part of science, what Kuhn called "normal science"—in contrast to the intellectual ferment that marked periods of scientific revolution. Likewise, Paul Feyerabend, the radical philosophical relativist, invoked anthropological concepts and contrasts throughout his work.[2]

Concurrently, the founder of modern sociology of science, Robert Merton, summarized scientific activity in the 1940s with a famous acronym, CUDOS: Communalism, Universalism, Disinterestedness, and Organized Skepticism. A few decades later, however, he was using CUDOS as an expression not of what science *is*, but of what science strives for. As any student of human behavior knows, what people *say* and what people **do** don't necessarily, or even generally, harmonize.

Scientific behavior is the behavior of a certain community of people in a particular context. Scientific thought is the mode of thought of a certain community of people. Scientific knowledge is what scientific communities have. When C. P. Snow wrote his famous essay contrasting humanists and scientists as "the two cultures," he was again conceptualizing science as a community, using an explicitly anthropological model.[3] Consequently the intellectual tools of anthropology seem particularly appropriate for understanding science.

Relativizing—that is to say, considering alternatives non-hierarchically—allows us to ask some questions about science as practicing anthropologists that we cannot ask as scientists, for we generally cannot recognize them as questions unless we stand partly outside the system we are studying. For example, what other kinds of knowledge are there? What makes scientific knowledge different? How did it come to have a privileged position?

In this anthropological context, the answer is that science developed in the 17th and 18th centuries in Europe as a quite radical and odd way of thinking about the world. In the first place, it was far from evident that the pursuit of new knowledge was a good thing. Consider the widely-reported comment by Francis Collins, head of the Human Genome Project, at the press conference announcing the near-completion of the human DNA sequence: "We have caught the first glimpse of our own instruction book, previously known only to God." This harks back to the original claims of modern science, more-or-less embodied in Isaac Newton, who unlocked the secrets of gravity, light, and motion—once again, previously known only to God.

But there is also a case—and a darn good case—to be made for *not* trying to find out what God alone knows. Isn't that the height of arrogance? Shouldn't a good Christian be wondering about how to move into heaven, rather than how motion works on earth? And doesn't the Bible itself make it pretty clear that people should not aspire to divinity? That seems to be why God smote the builders of the Tower of Babel with a confusion of tongues in Genesis 11; for if He hadn't, "nothing will be restrained from them, which they have imagined to do." The moral seems to be that God has big toes, and we shouldn't tread on them.

But by the 18th century this moral had been reversed. What had seemed heretical a couple of centuries earlier actually became a source of piety, stretching up unto the Human Genome Project at the end of the 20th century. God apparently now *does* want us to know His secrets (although He still doesn't make it too easy for us).

The point is that striving to find out how the universe works is not self-evidently a good thing. How light works or how gravity works is not manifestly good knowledge, as long as you are able to see when you need to, and can get up when you fall down. On the other hand, learning how to be a law-abiding citizen, a responsible parent, a sympathetic companion, a persuasive speaker, a polite neighbor—are all good kinds of knowledge, but not of **scientific** knowledge. There are many kinds of knowledge, of varying kinds, and of different value in their appropriate contexts. And as writers from Christopher Marlowe (*Dr. Faustus*) through Mary Shelley (*Frankenstein*) and up to Michael Crichton (*Jurassic Park*) have been trying to tell us, amassing knowledge without wisdom is dangerous.

Dr. Faustus, in particular, was written at the dawn of the age of science (around 1600) and raises a fundamental question: Should ultimate knowledge reside in human hands? For when push comes to shove, all Dr. Faustus really wants to do with his knowledge is smooch with Helen of Troy and see if she really was as hot as all that. An interesting goal, but hardly a noble one.

In other words, scientists accumulate knowledge. But who accumulates wisdom? And how does it get imparted to scientists?

Three Qualities of Scientific Knowledge

Let us **assume**, then, that it is good to seek knowledge of nature. What properties differentiate scientific knowledge from other kinds of knowledge?

Science is in large measure an outgrowth of **Rationalism**, the application of reason to questions of nature. The most fundamental application of reason to nature is the erection of a boundary between the realms of the natural and the supernatural.

Once again, this seems reasonable enough to us, but that is because we have grown accustomed to it. As anthropologists have documented endlessly since Bronislaw Malinowski's *Coral Gardens and their Magic* (1935), people get through life quite happily without making that dis-

tinction. For most people, the esoteric world of spirits and magic permeates the mundane world of people and things. To send them into separate rooms, as science does, is what is weird.[4]

And yet, it is necessary, if you have "finding out how the world really works" as your goal. Spiritual forces are capricious, and science seeks regularity. If you have a prior commitment to establishing uniformities of motion, and have discovered inertia and angular momentum, it becomes increasingly difficult to accept the possibility that the earth stopped rotating for 12 hours and then started up again (as described in the book of Joshua, Chapter 10), without engendering cataclysmic consequences. If you believe that those predictable earthly consequences were squelched by miraculous intervention, then you don't really have a commitment to rationalism, and cannot really do science effectively. After all, how can you study the earth's rotation, if you think the earth might stop rotating tomorrow, and all the things you think you have learned might just be switched off in a cosmic whim?

Rationalism thus implies the withdrawal of miracles as explanatory tools in science. That is the ultimate value of Charles Lyell's contribution in geology, Louis Pasteur's in medicine, and Charles Darwin's in natural history—all in the 19th century. A scientist can still believe in miracles, in non-work-related contexts. But explaining nature by recourse to supernature is like putting on a squeeze bunt during a football game. That's for the domain of baseball, and thus is contextually inappropriate. It's against the rules of football.

Another way of thinking about it involves two different theories of human disease. In the ancient world it was widely believed that evil spirits caused some classes of diseases, but not that tiny bacteria did. Now we know that bacteria do cause diseases, and with the development of antibiotics in the mid-20th century, we are able to treat diseases of that kind. This does not mean that evil spirits don't cause disease, only that the diseases they may cause probably don't respond to antibiotics. Material causes have material effects, but we don't know what kind of effects non-material causes might have. Therefore we cannot deal with them scientifically.

A second quality of science is that it is empirical, that is to say, we match our ideas up against some representations of reality. And where ideas and data don't fit together, we tend to side with the data. This can come through fairly passive observation, or through the controlled manipulation of experiments. Once again, however, there are alternative venues to knowledge—meditation, for example. The insights obtained in such a fashion may be valuable, but just not **scientifically** valuable.

Although we commonly look to Copernicus as the igniter of what retrospectively came to be known as the Scientific Revolution, in this case his contemporary Vesalius is probably more significant. Copernicus' work, *On the Revolutions of the Celestial Spheres*, was a fairly conservative document, as Copernicus lacked the data to prove his point that the sun, rather than the earth, was at the center of the solar system. On the other hand, Vesalius' *On the Fabric of the Human Body*, also published in 1543, was a work of dogged, in-your-face empiricism. It not only showed what the human body actually looked like inside, but it showed how previous authorities had erred, and dared you to see for yourself. The frontispiece to the book showed Vesalius with his hand inside a woman's corpse, performing a public dissection.[5]

Science evolves to conform to the bulk of the data. One weird dataset is more likely to be wrong than a well thought-out set of ideas is. By being so malleable, science produces knowledge that describes and explains the universe more accurately than other kinds of knowledge do. Science also, of course, privileges accuracy as a criterion for evaluating knowledge. Indeed, that is for all intents and purposes the sole criterion that science uses for evaluating knowledge claims. Whether it is the appropriate scale by which to compare all other theories, of course, may be questioned—as we will see.

Empiricism is also rooted in a basic distrust of received wisdom—a direct inheritance from Vesalius. If what you have been told is reliable, then there is no need to do things to help make new knowledge. By embarking on the production of new knowledge, we implicitly devalue old knowledge. That, obviously, is somewhat disrespectful to one's ancestors; indeed it is such a culturally weird attitude that it would seem to go against the evolutionary history of our species, which presumably depended heavily on the reliability of received wisdom. And along with the distrust of our parents' knowledge, modern science has imparted a paradoxical distrust of knowledge altogether. After all, by constantly matching our ideas up against the real world, science adds an element of instability to the authority of its pronouncements. The knowledge science makes is consequently framed in uncertainties and probabilities, which have become the mental commerce of modern life.

Finally, science is social. It is not just that scientists interact in a certain way, with expectations and obligations according to one's position in the network, which is indeed part of the daily life of scientists. But more fundamentally, science is predicated on a social kind of knowledge—a knowledge that can be accessed by others. One of the early forms of this knowledge involved the public demonstration, but this had obvious limitations, starting with the size of the room. It came to be superseded by a shorthand demonstration—the scientific paper, whose purpose is to summarize the relevant information, so that you could have been there and seen it for yourself, or you can actually do it for yourself and see.

This kind of public social knowledge was again distinct from other kinds of knowledge, notably revelation. Revelation is a source of knowledge, but that knowledge can only be shared by someone who has had a similar revelation. Scientific knowledge, on the other hand, can be shared by anyone who cares to read it (and has the specialized education to understand it, or the equipment to replicate it). Replicability is a property of science, but it is actually just a specific expression of the more general social aspect of scientific knowledge and practice.[6]

Science is thus predicated on the three assumptions we have just outlined: (1) **Naturalism:** That the natural world can and should be separated from the spiritual world, and understood on its own terms; (2) **Empiricism**: That there is a reality, and to the extent that we have access to it—which is itself dependent upon technology, the existing conceptual framework, and language to express that reality—we want to conform our ideas to correspond to it as closely as possible; and (3) **Objectivity**: That the reality is the same to everybody who wishes to experience it.

Once again, each of these is an assumption. We cannot show that evil spirits don't cause disease, but we can successfully treat an ever-widening class of diseases that are *not* caused by evil spirits. Our knowledge of the world is invariably a co-construction of what is really "out there" and of our cultural (technological, conceptual, and linguistic) means of apprehending it; and the closer we get to the scientific study of ourselves, the harder it becomes to tease them apart. And many real things are actually subjectively experienced: the fact that a pain is psychosomatic does not make it less painful; it simply makes it less amenable to scientific treatment.

Relativizing Evolution

As citizens and scholars, we constantly make decisions about what science to accept (e.g., global warming), what science to reject (e.g., racist physical anthropology, sexist evolutionary psychology, medical claims about cigarettes sponsored by tobacco companies), and what science to ignore (e.g., quantum electrodynamics). Nobody accepts all things presented as science, and one would have to be almost unbelievably stupid even to try; at all levels we exercise critical judgments, based on our experiences, education, and values.

Anthropologists have long known that religious systems serve many complex functions: intellectual, social, and politico-legal. Marriage is sanctified; God saves the queen and blesses America; and enjoins the Protestants to oppose the Catholics, the Shiites to oppose the Sunnis, and the orthodox Jews to oppose the reform Jews. The nominal segregation of religion from other facts of human life is the odd invention of a modern, secular society. Religion, however, is where human beings generally find answers to questions about death, justice, family, appropriate conduct, and the meaning of life. Religion binds a person to a community of the like-minded; religion distinguishes right from wrong and enjoins you to embrace the former and to reject the latter.

And what binds these diverse cultural aspects of religion together is the deployment of their origin myths. Origin myths not only tell you how you came to exist, they tell you **why** you came to exist, where you fit in, and why you should be good.

Now consider what bio-science has asked of the public for the last century and a half. It imagines that, far from being an organic cultural system, an origin myth can be thought of as a module that can be snapped out and replaced—without affecting other elements of the cultural system. That is exceedingly poor anthropological thinking. Worse yet, it commonly arrives with the message that religion is dead, and that we should all become scientists now[7] as aggressively evangelical a message as that carried by any Jehovah's Witness!

So let us, once again, step back and take an anthropological look at the situation. We are delegitimizing the idea that our species was created *ex nihilo* by miracle in the Garden of Eden, and saying instead that we arose naturally from monkeys.[8] That is more accurate, but less meaningful. Does it tell us about good and evil? Does it make us feel good about things we can't control? Does it affirm that we live in universe governed by benevolence and justice?

Obviously not. Yet those are probably more important questions to most people than whether or not we came from monkeys. Consequently, they are worthy of consideration when teaching citizen-students what science has to say about who we are and where we came from. To simply ignore the issues is to demonstrate the flaccidity of evolution in the face of the issues of real significance.

The Other Side of Science

As science struggled to bracket itself apart from the spiritual forces on the one side, it also constructed a parallel boundary on then other side, to seal itself off from human forces as well. Science would not only be distinct from the supernatural realm, but it would also be distinct from the political, esthetic, and moral realm. Science would be regarded as "value-neutral". There would not be good or bad science, only good or bad applications.

This distinction has not worked quite so well. Can we really separate science from its applications? It takes lots of scientists to build weapons of mass destruction, yet there seems to be an ample supply of them. Clearly, scientists have other kinds of interest—personal, financial, ideological, political—that can coexist and sometimes conflict with their interests as scientists. This began to be visible around mid-century, with the implications of the Manhattan Project in the U.S., and the Final Solution in Germany.

J. Robert Oppenheimer, the father of the atomic bomb, quoted the Bhaghavad-Gita on seeing the results of his work: "Now, I am become Death, the destroyer of worlds." On the biomedical front, after World War II it became crystal clear that the advancement of science is a good goal, but not when it comes into conflict with human rights, which science has tended to undervalue. The field of bioethics gradually developed to protect human rights when they lay in the path of science. By the 1990s, the Human Genome Project ultimately devoted about 4% of its budget to Ethical, Legal, and Social Implications. Or, to see the glass half-empty, about 25times more funding went into collecting genomic data than into trying to ensure that it be used benignly.

What we have somewhat belatedly come to appreciate is that there are not good or bad applications of value-neutral science, but that ***science itself is both good and bad***, amazingly powerful yet unguided and minimally constrained.[9]

In such a situation, obviously, the need to distinguish good from bad is paramount. If science is neither good nor bad, then scientists themselves cannot be held accountable or responsible for anything but its applications. But if science, like any other human enterprise, is **both** good and bad, then scientists incur an obligation they did not have under the older view. They must learn the difference between good and bad, and side with the good, or risk the consequences.

And that, paradoxically enough, is exactly the point of the Garden of Eden story.

Footnotes

[1] I use this to refer to the adherents of the idea that science is superior to all other modes of thought, and that it has superseded, or is destined to supersede, them.

[2] Popper, K. (1959 [1934]) *The Logic of Scientific Discovery [Logik der Forschung]*. New York: Basic Books. Kuhn, T. (1962) *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press. Feyerabend, P. (1975) *Against Method*. London: Verso.

[3] Snow, C. P. (1959) *The Two Cultures and the scientific revolution*. London: Cambridge University Press.

[4] Even in modern society. If you don't believe me, visit Las Vegas.

[5] Vesalius was plagued his whole life by accusations of grave-robbing, which probably had at least an element of truth. As physical anthropologists of the modern age have also learned, most people think that studying dead people is morbid and disgusting.

[6] And often more honored in the breach. Very little replication actually goes on in science, for scientific finding is driven by the perception of novelty, and novelty is the very opposite of replication.

[7] Dawkins, R. (2006) *The God Delusion*. New York: Bantam. Dennett, D. (2006) *Breaking the Spell:Religion as a Natural Phenomenon*. New York: Viking.

[8] Some anthropologists resist saying "we came from monkeys" as nebulously vulgar. If by "monkey" we mean a tailed, arboreal, quadrupedal, anthropoid, then we most certainly did come from monkeys.

[9] Proctor, R. N. (1991) *Value-Free Science?Purity and Power in Modern Knowledge*. Cambridge, MA: Harvard University Press. Collins, H. and Pinch, T. (1993) *The Golem:What Everyone Should Know About Science*. New York: Cambridge University Press.