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Reflections on Science and Technology

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Abstract

Science and technology are frequently confused. This essay points out the bases for this confusion and then focuses on a basic distinction, namely, that whereas science brings us information that we have little choice but to absorb and relect upon, technology is something that humans elect to do and, hence, can also elect not to do. It is proposed that technological ethics are most cogently undertaken with scientific understanding as the linchpin and religious/artistic sensibilities as the muse.

The General Picture

Nature is out there, doing her thing for some 13.7 billion years at a minimum. In the activity we call science, we very-recent humans have learned to ask questions of Nature and find out how she does things and how she has done things over time.

Once we understand how Nature does things, then this information becomes a resource for a second activity, variously called technology or engineering. It is easy to distinguish technology from science in that technology by definition entails human artifacts or inventions that make use of one or more understandings of Nature's ways. The situation can be confusing to the observer because technology is often developed by persons with Ph.D.s in the basic sciences, but there is rarely any question in a person's mind about whether s/he is engaging in science (asking a question of Nature) or technological development (using an answer from Nature to develop a new way of doing things). The observer can also become confused by the fact that technologies (microscopes, lasers) are often used to ask scientific questions, but this really isn't confusing to the persons engaged in designing or using the equipment. And, of course, while developing a technological application of a scientific understanding, the experimenter often stumbles onto a new scientific insight: computer-chip developers may notice a new and interesting thing about the chemistry of silicon, and should they take time out to explore these observations, they are back to doing science.

I would begin, then, by pointing out that we have in our midst the opportunity for a science/religion dialogue and a technology/religion dialogue, that they are very different things, and that the confusion between them generates much of the confusion about what science and religion are and should be saying to each other. It needs to be recognized that these are two very different sets of potential conversations, with separate agendas that converge in complex ways. In this essay I will offer some observations on the terrain.

What Has Technology Done for Science?

In addition to the enormous contributions that technological tools have made to scientific experimentation, technology has also had an enormous impact on our acceptance of scientific findings. Most persons in developed countries have a basic understanding that things are made of atoms, that creatures are cellular, that brains are the substrate of thought. This comes not from education so much as from the experience of interfacing with the technologies that emerge from these understandings -- each time we learn the results of a medical diagnostic test, we are confronting the physical/chemical/cellular nature of our bodies; each time we turn on an appliance we are experiencing the properties of electricity. Indeed, the importance of technology to our acceptance of science is underscored by the persistent resistance to such historical scientific understandings as the evolution of life by mutation and natural selection. Despite its vast heuristic contributions to biological research, evolutionary theory has yielded no tangible product in the marketplace nor in "ordinary" human experience (save perhaps some science-fiction movies), and its validity can therefore be publicly challenged by the most specious argumentation. Neither the cellularity of our bodies nor the evolution of our bodies is described in the Bible, but whereas the former is "accepted," the latter is claimed to be "open to interpretation" or, all too often, "false."

There is, of course, a heavy price paid for our identification of science with technology.   Once technologies are rushed to market, we frequently discover their limitations, byproducts, and downsides -- refrigeration is a fantastic idea; the hole in the ozone layer is not. Because we primarily learn about science via our experience of its emergent technology, when the technology backfires we hold science, and hence scientists, responsible.

Blaming scientists serves another purpose as well. For all that we love our technologies (when they work) and tell pollsters that we admire "science" for making them possible, there is an impressive anti-intellectual-elite streak in American culture that lurks just beneath the surface. "Those scientists are so arrogant, so know-it-all, so sure they're right about everything. And now look at the mess they've made of things." The tone is triumphant. Curiously, the billionaires of our culture, those who actually take home the profits generated from technological development, are spared this kind of censure. The myth of the billionaire hero, like the myth of the sports hero, is open to self-identification, whereas the myth of the hero-scientist is shrouded in ominous, Jekyll-Hyde fear. Just ask yourself, if assigned to portray a scientist in a game of charades, what would first come to your mind: a greedy eureka leer, freaked-out hair, manic arm movements? Moreover, there would be nothing politically incorrect about portraying a scientist this way, whereas you would presumably hesitate to portray a black person with analogous caricatures. Scientists are fair game.

How Does Technology Influence Our Culture?

We can all make long lists in answer to the "what-has-technology-done-for-us" question: antibiotics, cars, computers, kidney transplants, toasters. We can as well make lists of the negative impacts: pollution, the plight of the family farmer, the loss of species. We need also in our times to ask a third question, namely, to what extent has technology become our culture?

I will be saying nothing new here to say that to have and consume the things produced by technology has become a dominant motivating force in our times and, in that sense, a dominant religious tenet. Nor will I be saying anything new to say that our

entire experience of existence has been technologized. What is particularly interesting to me about this phenomenon, initiated with the invention of arrows and stone tools but clearly accelerating exponentially in our times, is that there has been virtually no public discussion of it in capitalistic cultures. If a product or service is marketable -- if "people want it" -- then it is produced or offered.

There is a growing awareness that this cannot and must not continue, that the ethic of Growth must be replaced by the ethic of Sustainability. But it quite unclear how and when and under what circumstances this transition is going to take place. Meanwhile, we look around and see others consuming and buying so we do the same, resenting while we do so a culture that has "made us" so materialistic, a resentment that all too often comes to roost on "the scientific establishment."

The Dialogues

So how do these observations and distinctions inform our leadership in generating science/religion and technology/religion dialogues?

From my perspective, the science/religion dialogue is centered on responding to the account of Nature brought to us by scientific inquiry. In the work I and others are doing that can be generically called religious naturalism, the account is in itself a resource for religious reflection and orientation. In work that is more theologically oriented, the account is a resource for understanding the nature and action of god, which again then generates resources for reflection and orientation. In work that comes from within traditional frameworks, the account is used to amplify and deepen, and perhaps also modify, traditional religious understandings and interpretations. In all of these projects, the scientific account provides the "given" since the way our universe works is, indeed, a given. Those who feel that they can control the dialogue by rhetorically challenging the validity of established understandings of the universe and its history are basically whistling in the dark, regardless of how much attention their whistles are given by the purveyors of controversy.

Much of our religious quest is focused on existential questions -- how and why are we here? -- and the scientific account certainly gives us fodder for lifetimes of reflection on these matters. But our quest is also to articulate moral codes, ethical guidelines that flow from our cosmological understandings. We cannot form an ethical opinion about how evolution has proceeded or about whether or not the sun should continue to shine. Our one option is to respond to Nature's givens. But what we learn about how Nature does and has done things provides, I believe, key resources for ethical thought. I said resources, not mandates. The naturalistic fallacy holds. The fact that animals kill does not condone killing by humans, but an understanding of the evolution and the neurophysiology of the killing instinct and the psychodynamics of rage and xenophobia can only help to provision us with approaches to deal with the phenomena of murder and genocide in ethical terms.

By contrast, since it is humans and humans alone who engage in the development of technology, it is up to us and us alone to decide which ones to engage in, and why, and at what cost, and for whom, and all those other ethical issues. As noted earlier, there has been surprisingly little dialogue along these lines. An obvious exception has been the imperative that we discuss our ability to manufacture weapons using the principles of nuclear physics. But even these discussions have been sporadic

and premised on issues of National Security rather than ethics. And, of course, the bombs continue to be manufactured.

To bring these points together, imagine that scientific inquiry establishes that a particular dominant allele of a particular gene predisposes humans to violent behavior. We can respond to that understanding with a deeper sense and appreciation of the brain's contribution to our temperaments, but it is not a finding about which we can voice an ethical opinion, or any opinion at all for that matter, assuming the finding is incontrovertible. That's the way things are. But we can and should develop all sorts of opinions about whether to develop technological responses to that finding (gene therapy, prenatal diagnosis, screening of children) as well as, of course, all sorts of social responses as to how to best care for, nurture, and educate persons known to carry that allele should we elect to screen for it.

How Can "Nature's Way" Inform our Ethical Decisions about Technology?

Having cleared away the brush, we come to the trees. Assuming that we are motivated, or commissioned, to initiate technology/religion dialogues, how would they work?   On what basis would we develop opinions about whether to develop technologies that emerge from scientific understandings? How, that is, do we do technological ethics? Let me propose a model, a model offered in general rather than rigorous terms, and then consider its challenges.

Just as our religious ethics have been based on truths whose authority derives from the belief that they are divinely inspired, so would I suggest that our technological ethics might be anchored in our scientific understandings of who we are and how we got here. The idea is to first identify what we know to be "natural," that is, what we know to be anchored in scientific understanding; to then ask whether a given technology is natural or unnatural; and to then determine whether the technology should or should not be developed given that evaluation. I will mock up six examples from the sphere of biotechnology. During the process I will offer my own opinions about whether or not a technology is ethical, thereby illustrating the kinds of responses that might be engendered.   These opinions may or may not jibe with those of my reader, and they may or may not be those that I continue to hold after listening to the opinions of others.

1) It is natural that we are mortal. Some non-material afterlife may indeed await us, but there is no reason other than faith to expect such an outcome, and in any case we are dealing here with planetary and not supernatural issues. Therefore, while we can embrace the technologies that help us lead healthy lives, it is natural to let go of immortality as a goal. This would mean, for example, that human cloning as a means to immortality would be disallowed under any circumstance: if a child dies, it would be necessary to conceive another child rather than clone the first. It would also mean establishing a moratorium on technologies that would prolong human life genetically, technologies that may soon emerge from an understanding of the aging process. A key insight from the psychological sciences is that our natural life cycles are integral to who we are.

2) It is natural that we try to heal ourselves from diseases and injuries and psychological trauma. We have evolved robust immune systems and blood-clotting cascades and mechanisms of wound repair and strategies for hope, and technologies

that abet these processes are natural and should be developed. Our understanding of human evolution also tells us that all humans are members of the same lineage, meaning that, biologically, our lives are all equally valuable. Therefore, it is natural that health technologies be made available to all persons.

3) It is natural to reproduce ourselves sexually. Reproductive technologies that allow healthy gametes to bypass physiological obstacles to fertilization are technologies that abet this process and can therefore be considered natural. On the other hand, our success in keeping children alive has generated a reproductive surfeit that mandates that birth-control technologies be vigorously developed and disseminated, even though this is not natural.

4) It is natural that each born offspring has an opportunity for survival and reproduction. "In the wild," this opportunity is dependent on genetics and environment, with the environment changing rapidly as medical technologies are developed. Technologies that identify and terminate the life of fetuses whose genes clearly disallow such an opportunity are natural -- death comes via abortion rather than via later suffering -- although their use must of course be the prerogative of the family. In contrast, the use of such technologies to select, for example, the sex of a child is not natural and should not occur.

5) It is natural that we must eat. Our inherited method of dealing with this necessity is to kill other animals and plants, a method that has put huge pressures on our planet. Cloning technologies can be envisioned that would generate animal and plant lineages that produce the best nutrition with the least environmental impact and, in the case of animals, with the least suffering. These organisms would be "unnatural," but their development would have such a positive impact on the ecosphere as a whole that the project could be supported in the name of restoring some measure of "natural" balance. The cloned plants and animals would experience life in a different way from their forebears, but their lives would in any case be ones that we humans give them (as is in fact the case for the lives of our current crops and livestock).

6) It is natural that our behavior, like the behavior of other creatures, is to a great extent set up by genetic programs that we inherit, programs that display flexibility during development and are then influenced by experience and learning. To return to our earlier example, it is likely that the human gene pool contains alleles that predispose to violence (and other "negative" behaviors) in the same way that there are alleles that predispose to breast cancer. I would favor screening for such alleles once they are identified, but would argue that it would not be natural to abort carrier children since they have the natural potential for survival and reproduction; moreover, the same allele that predisposes to violence may also participate in the generation of all sorts of "positive" traits. Instead, the challenge would be to work therapeutically with these children to help them deal with their violent tendencies in the same way that we work therapeutically with children whose organ systems other than brains are known to be susceptible to disease (we keep children at risk for inherited skin cancers out of the sun and give sickle-cell children transfusions). This would challenge our social systems in the same way that disease susceptibilities challenge our medical systems, and it would challenge as well our toxic fear that to acknowledge the existence of inborn behavioral predispositions will somehow take us down the road to becoming automatons.

And now, let me stop and point out explicitly what it is that I have been doing. In each of these 6 bioethical examples, I started with the way Nature does things. I then gave my opinion as to how I would bring my understanding of Nature's way to the ethical question. In some cases I conclude that I would let what is natural dictate the ethics; in other cases I conclude that I would not.

Whoa! you say at once. Who would be this "I" who makes such calls? Well of course in reality it would not be me, nor any one person. In reality it would be a dialogue between many persons who bring diverse cultural and religious and scientific and philosophical and political sensibilities to the table. But the key point is that in this model, all the participants would be scientifically literate -- each would bring to the table a deep familiarity with the way Nature works.

So how would this differ from any other ethical dialogue? It would differ because all the people in the conversation would begin from the same starting point, their scientific understanding of the natural, a starting point that acknowledges both our finitude and our splendor. They would begin with shared knowledge and not simply a cacophony of poorly understood or shared premises, knowledge that they would not be constrained to "follow" but rather knowledge that they could push off from and go back to and orient themselves within as the choices were considered.

And so at last we have come full circle. Because in fact one of the enormous impediments to having these kinds of conversations is the public mistrust of science and scientists. To have such conversations without scientists at the table would make no sense, but as long as we demonize scientists, their presence becomes problematic. Why, it might well be asked, would we imagine that anything could possibly emerge from such dialogue other than support for the technologies that the scientific establishment is being paid to develop? Why would anyone want to have ethical questions addressed by guys with freaky hair and flapping lab coats, with godless materialism as their credo and pockets stuffed with stock options in pharmaceutical companies?

Scientists are human, and I can probably list examples of unethical scientists more rapidly than most of my readers. But the dubious general status of scientists in our culture represents a deep misunderstanding. Their work has generated technologies, and some scientists have participated directly in the development of these technologies. A few have even profited financially from technological manufacture. But their basic contribution to our times, and certainly to our religious lives, has been their explication of what Nature is and does. Those who are uncomfortable with these explications blame the messengers for the message. Those who are uncomfortable with the emergent technologies blame the scientists for making them possible. Those who are uncomfortable with hierarchy seem particularly satisfied when they have the opportunity to lambaste scientific elitism. It is not a good situation. And meanwhile, the decisions as to which technologies get developed go right on being made in a market context.

How to change things? Education, of course. As usual. Whether we are working at the science/religion interface or the technology/religion interface, there is no more important, or difficult, point to make than that the peoples of the planet need to understand their planet so that they can participate in making decisions about its future, and that, along the way, they need to accord the purveyors of this understanding -- the scientists -- something akin to respect and gratitude.

<u>Coda</u>

Composer Carl Smith recently offered me the following aphorism: "There are 3 kinds of truth: Empirical truth (evolution happened); Consensual truth (it is good to be nice to each other); and Revealed truth (the "unknown" truth that emerges unbidden, for example, in the creation or apprehension of art)."

The quest for a technological ethic, like the quest for any ethic, is a search for consensual truth. To reach a consensus, an ethic must ultimately be advised by both empirical truth and unbidden truth: it must cohere with reality and it must resonate with our spiritual sensibilities. At the table, then, must also be the artists, whose sensibilities have for eons stimulated and guided our own, cajoling us to remember that what is really important is often something that we only implicitly grasp.