The Future of Mind-Science

John Horgan

Anybody who has been seriously engaged in scientific work of any kind realizes that over the entrance to the gates of the temple of science are written the words: Ye must have faith. It is a quality which the scientist cannot dispense with.

—Max Planck

Mind-scientists have their creeds, just as religious believers do. Francis Crick spelled out his reductionist vision at the beginning of his book "The Astonishing Hypothesis."

"You: your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules." As Lewis Carroll's Alice might have phrased it, "You're nothing but a pack of neurons."

In a sense, Crick is right. We *are* nothing but a pack of neurons. At the same time, neuroscience has so far proved to be oddly unsatisfactory. Explaining the mind in terms of neurons has not yielded much more insight or benefit than explaining the mind in terms of quarks and electrons.

There are many alternative reductionisms. We are nothing but a pack of idiosyncratic genes. We are nothing but a pack of adaptations sculpted by natural selection. We are nothing but a pack of computational devices dedicated to different tasks. We are nothing but a pack of sexual neuroses. These proclamations, like Crick's, are all defensible, and they are all inadequate.

In "More Is Different," an essay published in *Science* in 1972, Philip Anderson, a condensed-matter physicist at Princeton, brooded over the limits of scientific reductionism. Anderson had been piqued into writing the essay by the claim of particle physicists that they were performing the most fundamental—and thus most important—scientific research: everything else in science was merely "details" or, even worse, "engineering."

Anderson, who won a Nobel Prize in 1977, acknowledged reductionism's extraordinary successes. Reductionism "is accepted without question" by the great majority of active scientists, he said. "The workings of our minds and bodies, and of all the animate or inanimate matter of which we have any detailed knowledge, are assumed to be controlled by the same set of fundamental laws." Nuclear physics, which addresses the smallest scale of reality, has provided insights into stars, galaxies, and the birth of the entire universe. Molecular bio1ogy, inaugurated by the discovery of the double helix, turned out to be an extraordinarily powerful approach to understanding evolution, heredity embryonic development, and other aspects of life.

But knowledge of the basic laws governing the physical realm, Anderson pointed out, provides little illumination into many phenomena. Particle physics cannot predict the behavior of water, let alone the behavior of humans. Reality has a hierarchical structure, Anderson contended, with each level independent, to some degree, of the levels above and below.

"At each stage, entirely new laws, concepts, and generalizations are necessary, requiring inspiration and creativity to just as great a degree as in the previous one," Anderson argued. "Psychology is not applied biology--nor is biology applied chemistry." If there is any feature of nature that has proved to be more than the sum of its parts, it is human nature.

The Myth of the Scientific Savior

Some mind-scientists, while acknowledging the limitations of all current approaches to the mind, prophesy the coming of a genius who will see patterns and solutions that have eluded all his or her predecessors. "It has happened," the Harvard psychologist Howard Gardner said to me. "It *will* happen." In his own lifetime, Gardner had witnessed the emergence of figures such as Noam Chomsky and Jean Piaget.

Note: This is the final chapter from the book entitled "The Undiscovered Mind," by John Horgan.

"They said really profound things about the mind," Gardner elaborated. "They weren't necessarily right, but they certainly advanced the cause."

One possibility, Gardner suggested, will be that someone finds deep and fruitful commonalities between Western views of the mind and those incorporated into the philosophy and religion of the Far East. But Gardner emphasized that "we can't anticipate the extraordinary mind, because it always comes from a funny place that puts things together in a funny kind of way."

I heard much the same prediction from Eric Kandel, the Columbia neuroscientist. He noted that some philosophers whom he admired, such as Thomas Nagel of New York University, suspected that certain mind-related questions would never be solved. But Kandel had faith in the human mind to produce breakthroughs just when the situation seems bleakest. "There is an occasional person who will have a remarkable insight, that will allow you to see things in a new way, and that will move the field in unexpected directions."

But just how realistic is this myth of the scientific savior? In *Genius,* his biography of the physicist Richard Feynman, the science writer James Gleick addressed the widespread perception that contemporary culture no longer produces geniuses as towering as Newton or Mozart or Michelangelo. Gleick quoted the novelist Norman Mailer lamenting that "there are no large people any more. I've been studying Picasso lately and look at who his contemporaries were: Freud, Einstein."

Mailer's perception is an illusion, according to Gleick. In fact, Gleick argued, there are so *many* Einsteins and Freuds alive today—so many brilliant scientists—that it has become harder for any individual to stand apart from the pack. This same reasoning explains why it has become harder for baseball players to attain a 400 batting average. (Of course, anomalies still occur, such as the 70 home runs that Mark McGwire hit in 1998.)

Gleick's explanation seems sound to me, but I would add a crucial corollary: the scientific geniuses of our era have less to discover than their predecessors did. No modern scientist can discover gravity or natural selection or general relativity, because Newton and Darwin and Einstein got there first. To put things crudely, they solved the easy problems. The important problems that are left are extremely difficult.

That is not to say that geniuses cannot still have an impact. During the 1950s, particle physics was mired in a crisis that in some ways resembled the plight of neuroscience. Accelerators seemed to generate an exotic new particle almost daily; theorists had no idea how to organize the welter of findings into a cohesive theory. Then a brilliant young theorist named Murray Gell-Mann created a framework—which he jokingly called the Eight-Fold Way, after the Buddhist program for enlightenment—that categorized the particles according to shared properties. Later Gell-Mann and another physicist independently showed that many of these different particles were made of more fundamental particles called quarks.

But in terms of sheer complexity, particle physics is a child's game—a ten-piece jigsaw puzzle of *Snow White*—compared to neuroscience. Freud's ability to construct a unified theory of human nature was in large part a function of science's ignorance during his era. Anyone hoping to construct a unified theory of the mind now must cope with an astronomical number of findings, many of them with contradictory implications. When it comes to the human brain, there may *be* no unifying insight that transforms chaos into order.

The Dangers of Faith

Scientists will never accept that the mind cannot be tamed. Nor should they. It is always possible that they will find not only better remedies for mental illness, but cures. They will learn how nature and nurture interact to produce not only human nature but an individual human. They will understand precisely how natural selection shaped and continues to constrain our minds. They will build machines that equal and surpass us in intelligence. They will solve the mind-body problem and the Humpty Dumpty dilemma.

These outcomes are inevitable, optimists believe, given the steady and even precipitous pace of discovery and innovation in neuroscience, psychiatry, artificial intelligence, and other fields. All that is needed is sustained effort, funding—and a little faith.

But sometimes time, money, and faith are not enough to achieve even apparently reasonable scientific goals. The attempt to harness nuclear fusion, the process that makes the sun and other stars shine, is a case in point. The basic principles underlying fusion were known by the 1930s; physicists designed bombs based on those principles by the late 1940s.

Given sufficient time and money, physicists would surely learn how to build fusion reactors that would generate energy much more cheaply and cleanly than dirty expensive fission reactors. That vision never materialized. Even die-hard fusion enthusiasts are beginning to recognize that their dreams will probably never be realized; the technical economic and political obstacles to fusion energy are simply too great to overcome.

Cancer research provides what is perhaps a more appropriate analogy to mind-science. Unlike fusion

energy a cure for cancer is so compelling a goal that we are unlikely ever to abandon it. But so far a cure for cancer has proved to be just as elusive as fusion energy. Since President Richard Nixon officially declared a "war on cancer" in 1971, the United States has spent more than $3 billion on cancer research. Scientists have taken enormous strides toward understanding how different types of cancer occur, and they lead to appalling bullying on one side and untold suffering on the other. Isaiah Berlin urged us to beware the "terrible simplifiers:" great despotic organizers, men possessed by an all-embracing vision.

Of course, it is our own desire for answers and panaceas that gives the terrible simplifiers their power. To protect ourselves against our will to believe, we need to change the way we think and talk about mind-science. We need to remind ourselves how often mind-science has misled us in the past, and how little it has actually accomplished, while remaining open to the possibility of genuine advances. This is what I mean by the term "hopeful skepticism."

Howard Gardner, Clifford Geertz, and others have recommended that mind-science be viewed as a quasi-literary rather than strictly scientific enterprise. An exemplar of this literary approach is the neurologist and author Oliver Sacks. In his books and articles, Sacks has provided extraordinarily vivid, empathetic profiles of people afflicted by autism, strokes, tumors, Tourette's syndrome, and other neurological disorders.

While most neuroscientists try to work around the irreducibility of each individual, Sacks has made it the centerpiece of his work.

The poet William Carlos Williams proclaimed "no ideas but in things," violating the precept in stating it. Sacks's philosophy might be described as "no ideas but in people."

Sacks once told me that he tried to follow Wittgenstein's precept that a book should consist of "examples" rather than generalizations. "People keep saying, 'Sacks, where's your general theory?' But I'm rather content to multiply case histories and leave the theorizing to others."

Sacks's compassionate, antireductionist credo is implicit within everything he writes, but occasionally he makes it explicit. In *The Man Who Mistook His Wife for a Hat*, Sacks wrote: "To restore the human subject at the center—the suffering, afflicted, fighting, human subject—we must deepen a case history to a narrative or tale; only then do we have a 'who' as well as a 'what' a real person, a patient, in relation to disease—in relation to the physical." In *An Anthropologist on Mars* he commented:

> *"The realities of patients, the ways in which they and their brains construct their own worlds, cannot be comprehended wholly from observation of behavior, from the outside.*
>
> *In addition to the objective approach of the scientist, the naturalist, we must employ an intersubjective approach too, leaping, as Foucault writes, 'into the interior of morbid consciousness, [trying] to see the pathological world with the eyes of the patient himself.'"*

The problem with case histories is that while they often make compelling reading, they can obfuscate and subvert the truth. The case of Phineas Gage—the nineteenth-century man whose brain was pierced by an iron rod—demonstrated as much. The master of the case history was Sigmund Freud, who constructed psychoanalysis on cases such as Anna 0., the Rat Man, the Wolf Man, and others.

Scholars have shown that Freud's narratives often diverged sharply from the truth. Case histories have also provided distorted views of Prozac and other psychiatric drugs, of the links between genes and personality, and even of the role that natural selection plays in motivating human behavior.

Moreover, the vast majority of mind-scientists have neither the talent nor the inclination to present their results in a literary mode. Perhaps they should consider themselves engineers, as much so as bridge builders and circuit designers and automobile manufacturers. Engineers do not search for The Answer, the absolute, final, definitive Truth; thinking in such terms can even be an impediment to progress. Engineers search, rather, for *an* answer, for anything that helps to solve or ameliorate the problem at hand.

By adopting such a humble stance, mind-science might acquire the same qualities that Prozac is supposed (erroneously) to possess: greatly increased benefits and minimal side effects.

Searching for an Epiphany

Ultimately the future of mind-science belongs to the young, and who knows where they will take it?

In 1998, officials at the Massachusetts Institute of Technology asked me to serve as a judge for a student essay contest. The students were asked to read two books—*Science: The Endless Frontier,* a paean to science's bottomless bounty written in 1945 by the physicist Vannevar Bush, and my gloomy tract, *The End of Science*—and then to set forth their own views of science's future.

The essays were for the most part almost scarily well informed, articulate, and thoughtful. Many stu-

dents singled out mind-science as a particularly promising area of research, but they also acknowledged potential limiting factors. "I have faith in an imminent cognitive revolution," one essayist proclaimed, but he warned that researchers could be stymied by taking too narrow and mechanistic a view of human nature.

Another writer feared that artificial intelligence could be blocked by both the limits of silicon chip technology and a Luddite backlash.

My favorite essay wove together musings about cosmology, artificial intelligence, theology, and the essayist's beautiful but selfish former girlfriend. The author concluded with a prediction that "the future of science lies in mind-altering substances." He quoted from the British author Aldous Huxley, who after ingesting the psychedelic drug mescaline in the mid-1950s declared that such experiences "cannot be ignored by anyone who is honestly trying to understand the world in which he lives." (Although I nominated this essay for a prize, the other judges overruled me.)

My own sojourns into altered states have left me convinced that they cannot solve the mystery of consciousness. Far from it. I suspect that the more intelligent or aware or enlightened we become—whether through drugs or meditation or genetic engineering or artificial intelligence—the more we will be astonished, awestruck, dumbfounded by consciousness, and life, and the whole universe, regardless of the power of our scientific explanations. Wittgenstein captured this notion when he wrote, "Not *how* the world is, is the mystical, but *that* it is."

That is not to say that I don't still yearn for the epiphany that will make sense of everything. I briefly teetered on the verge of such a revelation at the consciousness conference in Tucson in 1994. It was my last night at the meeting, and I was consuming burritos and beers at an open-air restaurant with a half-dozen other conference goers, most of them science writers like me.

Although the day had been blazingly hot, the night was cool. Discussing the meeting, we concurred that no one really knew what he or she was talking about; the scientists and philosophers were all lost and confused.

Some lectures were more interesting than others, of course. A favorite was Andrew Weil's tale of his toad-smoking exploits. My dinner partners seemed to agree with the alternative-medicine guru that consciousness would only be truly understood not from the outside but from the inside, not through science but through *experience.*

We began trading stories about our own encounters with exotic mind-expanding substances: LSD, magic mushrooms, mescaline, peyote. A journalist who wore a chin braid and nose ring assured us that ketamine, sometimes called vitamin K, delivered the most mind-blowing trips of all. Ketamine was the drug that had enabled the neuroscientist John Lilly—pioneer of dolphin research and sensory-deprivation methods—to discover the extraterrestrial Beings who control our reality. Lilly described the Beings as solid-state machines who inhabit a dimensionless hyperspace consisting of pure consciousness and who are concerned about humanity's maltreatment of dolphins and other animals.

As our conversation unraveled, a tall moustached man wearing a collarless shirt splashed with blue flowers approached the table. He was carrying a contraption that consisted of goggles and headphones. He called it VARS, for Visual/Auditory Relaxation and Sedation.

The man identified himself as a physician at the University of Arizona Health Sciences Center. He and a group of colleagues had invented the device and were testing its ability to soothe patients in physical or psychological distress.

Promotional literature that I saw later described the gadget as a "non-invasive, non-pharmacological means of inducing relaxation and/or a hypnogogic state....VARS employs the use of a programmable pulse generator that pulsates signals to an audio headphone and LED [light-emitting diode] fitted eyepieces. Synchronized visual and auditory stimulation (flashing lights and pulsating tone) is delivered to the patient at varying frequencies."

When he asked if anyone would like to try it, I volunteered. After helping me pull the headphones over my ears and the goggles over my eyes, the man turned on a switch. Globules of sound and color rushed at me, welling up from subterranean depths. The tones swooped up and down, and the colors kept changing too from red to blue to purple to yellow and back to red again. The sounds and colors merged; they became in some sense indistinguishable, two aspects of the same essential sensation.

I heard voices, faint laughter. But they seemed to come from far away, from another world, another dimension. I focused only on these elemental sensations in my head, pulsing and transmuting, like the jewel of creation, ever changing and never changing, indescribably beautiful.

I was looking into the heart of consciousness—not just my consciousness but all consciousness. The key to everything was there. Waiting to be found, if I just looked hard enough. I felt an epiphany coming. A great revelation that would make everything clear.

"Take a photograph of him and send it to his boss at *Scientific American!"* someone shouted, followed

by hoots and guffaws. I realized that my mouth was open. And closed it. Slowly, reluctantly, I took off the goggles and headphones and reentered the world.

About the Author

Horgan is a freelance writer and author of *The End of Science,* a U.S. best-seller that has been translated into ten languages. His awards include the Science Journalism Award of the American Association for the Advancement of Science (1992 and 1994) and the National Association of Science Writers Science-in-Society Award (1993). He has written for the *New York Times, London Times, Washington Post, New Republic, Slate, Discover, The Sciences,* and other publications in the United States and Europe. He was a staff writer at *Scientific American* from 1986 to 1997 and at *IEEE Spectrum* from 1983 to 1986. He graduated from Columbia University's School of Journalism in 1983. He lives in Garrison, New York, with his wife, Suzie Gilbert, a childrens' book author, and their two children.