# Voodoo Science and the Belief Gene

*How do people decide what to believe? And why do some believe while others doubt? Science offers a strategy for sorting out the truth.*

ROBERT L. PARK

In the summer of 1993, more than 5,000 experts in Transcendental Meditation (TM) from around the world spent two-week shifts in the nation's capital as part of the National Demonstration Project to Reduce Violent Crime in Washington, D.C. Mostly young, white, professionals, they were there to create a "coherent consciousness field" by meditating in unison. They expected this to reduce stress and promote tranquility, not just among those meditating, but throughout the city. Organizers of the $6 million project predicted that violent crime in the city would be reduced by 20 percent.

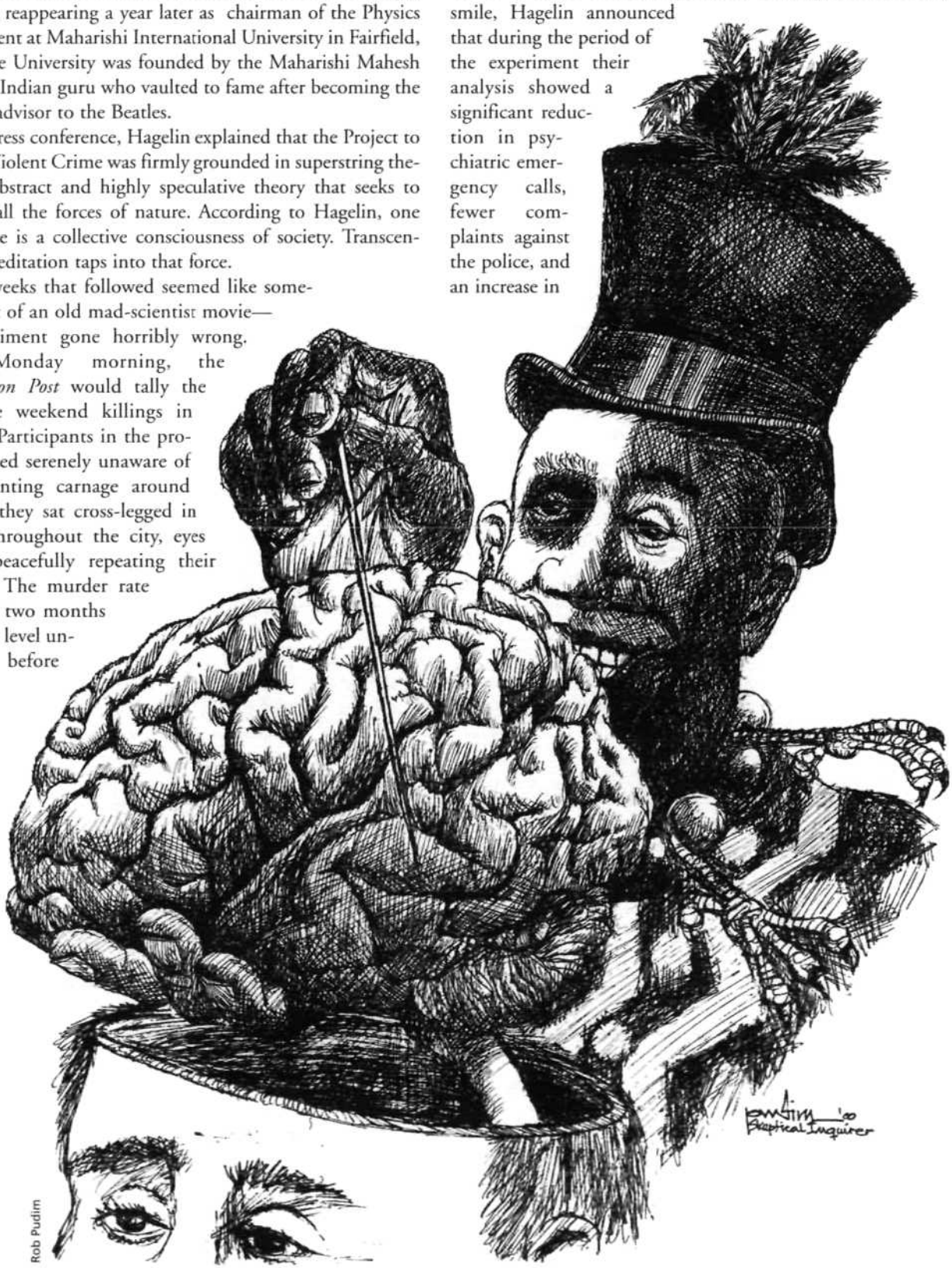
The head of the project was John Hagelin, a 39-year-old physicist with a receding hairline and a perpetual cherubic

smile. His high forehead was unfurrowed by negative thoughts. A *summa cum laude* graduate of Dartmouth, Hagelin had gone on to complete a Ph.D. in physics at Harvard. In 1983, he held a postdoctoral research appointment at the Stanford Linear Accelerator. One day he simply vanished, reappearing a year later as chairman of the Physics Department at Maharishi International University in Fairfield, Iowa. The University was founded by the Maharishi Mahesh Yogi, the Indian guru who vaulted to fame after becoming the spiritual advisor to the Beatles.

At a press conference, Hagelin explained that the Project to Reduce Violent Crime was firmly grounded in superstring theory, an abstract and highly speculative theory that seeks to connect all the forces of nature. According to Hagelin, one such force is a collective consciousness of society. Transcendental Meditation taps into that force.

The weeks that followed seemed like something out of an old mad-scientist movie—an experiment gone horribly wrong. Each Monday morning, the *Washington Post* would tally the gruesome weekend killings in the city. Participants in the project seemed serenely unaware of the mounting carnage around them as they sat cross-legged in groups throughout the city, eyes closed, peacefully repeating their mantras. The murder rate for those two months reached a level unmatched before or since.

At the end of the demonstration period, Hagelin promised that over the coming year the results would be carefully analyzed according to strict scientific principles. As promised, he was back in Washington a year later with a 55-page report. It was a clinic in data manipulation. Smiling his unworldly smile, Hagelin announced that during the period of the experiment their analysis showed a significant reduction in psychiatric emergency calls, fewer complaints against the police, and an increase in

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public approval of President Clinton—all consistent with the hypothesis that a coherence-creating group of TM experts can relieve social stress and reverse negative social trends.

More significantly, he said, violent crime in the city had been reduced by a remarkable 18 percent. "An 18 percent reduction compared to what?" asked a puzzled reporter for the *Washington Post*, no doubt recalling the previous summer's dreadful murder rampage. Compared to what it would have been if the meditators had not been meditating, Hagelin explained patiently. "But how could you know what the rate would have been?" the reporter persisted. That had been arrived at, Hagelin responded with just a trace of irritation, by means of a "scientifically rigorous time-series analysis" that included not only crime data, but such factors as weather and fluctuations in Earth's magnetic field.

The belief of the Maharishi's followers in the power of TM had not been influenced in the slightest by the outcome of the "experiment." This was *pseudoscience*—all the talk of "string theory" and "consciousness fields" and "time series analysis" was technobabble, meant to give the appearance of science.

Which is not to say that those involved were not sincere in their belief. They may believe so fervently that they are convinced that, properly interpreted, the data *must* support their belief. But how do people decide what to believe? And why do some believe while others doubt?

## The Great Global Warming Debate

A good place to examine this question is the controversy over global warming. Andre Gide, the great French moralist, wrote in his journal a half-century ago that, "Man's responsibility increases, as that of the gods decreases." Where once people accepted storms and drought as divine will, there is now overwhelming scientific evidence that human activity can affect Earth's climate.

The evidence comes from a revolution in climate research over the past decade, brought about by new observational techniques including satellites, and a prodigious increase in computational and data-storage capabilities made possible by microelectronics. It now seems undeniable that surface temperatures are warmer than they were 150 years ago. There is also little doubt that the burning of fossil fuels since the beginning of the industrial revolution has led to a significant increase in atmospheric carbon dioxide. What is in dispute are the long-term consequences of continued carbon dioxide increases on Earth's climate and the quality of life. To what extent are the interpretations given to the scientific evidence shaped by the world view of the scientist?

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Before the industrial revolution, the concentration of atmospheric carbon dioxide represented a natural balance, but in a little more than a century, humans have disrupted that balance by burning fossil fuels that were built up in underground deposits over a period of hundreds of millions of years. If this release of carbon dioxide into the atmosphere continues, climatologists warn, there could be disastrous consequences in this century: many of the world's great cities will be submerged by rising sea levels as the polar ice caps melt, and drastic changes in rainfall patterns could wreak havoc on food production. The nations of the world, many scientists argue, should take immediate steps to control the burning of fossil fuels, at least until we can better predict the consequences. We have no right, they declare, to place future generations in jeopardy.

Not all scientists agree. A number of prominent scientists point out that there were periods of global warming long before man began burning fossil fuels, and $CO_2$ is a relatively minor greenhouse constituent in the atmosphere. They contend that any rise in global temperature since 1850 may simply be the result of natural solar variations. Some go further, describing the increase in carbon dioxide as "a wonderful and unexpected gift of the industrial revolution." The increase in atmospheric $CO_2$ stimulates plant growth, making this a lusher, more productive world, capable of sustaining a much larger population. The more industrial growth we have, including increased burning of fossil fuels, they argue, the better off we will be. They stop just short of telling people they have a moral obligation to burn more hydrocarbons.

If scientists all claim to believe in the scientific method, and if they all have access to the same data, how can there be such deep disagreements among them? What separates the two sides in the climate controversy, however, is not so much an argument over the scientific facts, scientific laws, or even the scientific method. If the climate debate was just about the laws of physics, there would be little disagreement. But the climate is the most complicated system scientists have ever dared to tackle. There are huge gaps in the data for the distant past, which, combined with uncertainties in the computer models, means that even small changes in the assumptions result in very different projections far down the road. Neither side disagrees with that. Both sides also agree that $CO_2$ levels in the atmosphere are increasing. What separates them are profoundly different political and reli-

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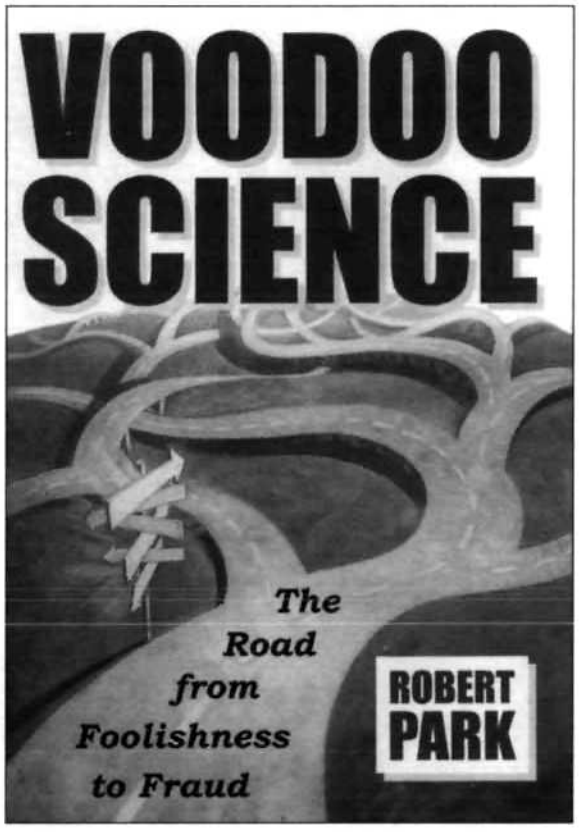
gious world views. They want different things for the world.

The great global warming debate is thus as much an argument about values as it is about science. It sounds like science, with numbers and equations and projections tossed back and forth, and the antagonists believe sincerely that they are engaged in a purely scientific debate. Most scientists, however, were exposed to political and religious world views long before they were exposed in a serious way to science. They may later adopt a firm scientific world view, but earlier world views "learned at their mother's knee" tend to occupy the gaps in scientific understanding.

This sort of dispute is seized upon by postmodern critics of science as proof that science is merely a reflection of cultural bias, not a means of reaching objective truth. They portray scientific consensus as scientists voting on the truth. That scientists are influenced by their beliefs is undeniable, but to the frustration of the postmodernists, science is enormously successful. To understand how science can rise above the beliefs of its practitioners, we must first understand something of the process by which beliefs are generated.




## Pleistocene Park

To borrow from the premise of the movie *Jurassic Park*, suppose a mosquito gorged on one of our Cro-Magnon ancestors 30,000 years ago and then became trapped in amber, providing science with ancient human DNA. Would a Cro-Magnon clone, raised in today's society, be some dangerous brute that might escape and terrorize society? The movie *Pleistocene Park* would not be that exciting. Far too little time has passed for any genetic adaptation to the modern world. All of recorded history covers a mere 4,000 years—the industrial revolution just 200—the space age barely four decades. So here we are, trying to cope with a world of jet travel and computers with a brain that responds to external stimuli in ways that conferred some sort of survival advantage on our distant human and prehuman ancestors. What offered a survival advantage in a Pleistocene wilderness does not necessarily do so today.

Psychologist James Alcock describes our brains as "belief engines," constantly processing information coming in from our senses and generating new beliefs about the world around us. [See James E. Alcock, "The Belief Engine," SKEPTICAL INQUIRER, May/June 1995.] A belief begins when the brain makes an association between two events of the form: B follows A. The next time A occurs, the brain is primed to expect B to again follow. The survival advantage of such a strategy for our primitive ancestors is obvious. They had scant means for separating causal connections from mere coincidence—better to take heed of every connection and be safe. We avoid some food, for example, because we once got sick after eating it. Our illness may have had nothing to do with the food, but unless we're facing starvation, there's not much to be lost by avoiding it.

Information gathered by the senses is normally routed through the thalamus, a small subsection deep within the brain, to the sensory cortex, which analyzes it in detail to decide how much weight it should be given. An exception is olfactory input, which apparently follows more ancient pathways to reach the cortex. Sensory information finally reaches the amygdala, almond-shaped structures in the temporal lobes. The amygdala contribute the emotional portion of our response to stimuli. Parts of the amygdala, for example, are involved in fear. Animals with damage to these parts are no longer perturbed by stimuli that previously would have terrified them.

Whether a belief is retained depends on how significant B is—how frightened we are for example—and whether the association with A gets reinforced. Without reinforcement, the expectation that B will follow A will usually fade in time. If B again follows A, however, it may still be a coincidence, but it will now be far harder to convince us of that.

The belief may also be permanent if the information entering the thalamus coincides with a high state of emotional arousal, such as fear, or the thrill of victory. The chemical messengers of emotion cause the thalamus to bypass the sensory cortex and route the information directly to the amygdala. This is often the origin of what might be called "personal superstitions"—the golfer who won't play without his lucky hat for example. People develop elaborate rituals in an effort to recreate the conditions that surrounded some rewarding experience, or to avoid conditions their brains associate with fear or pain. We often find ourselves almost compelled to go through these rituals, even when the cerebral cortex is telling us that a causal connection is highly implausible.

This kind of belief generation was going on long before our ancestors began to resemble humans, of course, but the advent of language opened a powerful new channel, both for the formation of beliefs and for their reinforcement. Speech exposes us to the generation of shared beliefs — beliefs based not on personal experience but on experiences related to us by others.

This has the potential to spare us a lot of unpleasantness. Everyone, for example, need not discover the hard way that a particular plant is poisonous. The shared beliefs of a family or tribe are also a powerful force of social cohesion, and are reinforced throughout our lives.

Language makes vicarious experience the dominant source of belief in humans, overwhelming personal experience. The power of language was enormously amplified by the invention of writing, and continues to be amplified by every new advance in communication from the printing press to the World Wide Web. Beliefs now spread around the world in the twinkling of a computer chip. That which allows us to learn from others, unfortunately, also exposes us to manipulation by them.

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Small children are particularly open to new beliefs, accepting whatever they are told by adults without question. Their belief engine runs freely, finding few previous beliefs to contradict what they are told. For a small child who must quickly learn that stoves burn and strange dogs bite, this sort of credulity is important to survival. Because a child's beliefs are not enmeshed in a network of related beliefs, however, children seem able to cast them off almost as easily as they are adopted. Fantastic stories about Santa Claus and tooth fairies, which are accepted uncritically, are dropped just as uncritically when someone, often a playmate, explains that it isn't really so. Nor do children appear to develop doubts about other things they've been taught, just because the Santa Claus story was taken back.

As the store of beliefs grows, conflicts with existing beliefs become more likely, and the child becomes more selective in accepting new beliefs. By adolescence, beliefs tend to be enmeshed in an insulating matrix of related beliefs. Once people become convinced that a rain dance produces rain, for example, they do not lose their belief in years the drought persists. They are more likely to conclude that they have fallen out of favor with the Rain God.

The result is that most of us wind up with beliefs that closely resemble those of our parents and community. Society, in fact, often holds it to be a virtue to adhere to certain beliefs in spite of evidence to the contrary. Belief in that which reason denies is associated with steadfastness and courage, while skepticism is often identified with cynicism and weak character. The more persuasive the evidence against a belief, the more virtuous it is deemed to persist in it. We honor faith.

Faith can be a positive force, enabling people to persevere in the face of daunting odds, but the line between perseverance and fanaticism is perilously thin. Carried to extremes, faith becomes destructive—to the residents of Jonestown, for example, or the Heaven's Gate cult. In both cases, the faith of the believers was tested, and in both cases they passed the test.

The wonder then is not that we can be easily fooled, but that we function as well as we do on an alien planet that does not at all resemble the wild planet on which our genes were selected. If this sounds hopelessly gloomy, be patient, we are coming to the good news: We are not condemned to suffer the tyranny of the belief engine. The primitive machinery of the belief engine is still in place, but evolution didn't stop there. It provided us with an antidote.

## What Is Science?

How can it be, we ask, that brains designed for finding food and avoiding predators in a Pleistocene forest enable us to write sonnets and do *integral calculus? We invent poetry and* higher mathematics because our brains hunger for patterns. The wonderful pattern-recognition equipment residing in the higher centers of the human brain allowed our ancestors to adapt to changing conditions with remarkable ease, by quickly picking up the patterns that are characteristic of the new environment.

Animals with much smaller brains than ours also rely on pattern recognition. The desert *Cataglyphis* ant, for example, whose brain contains perhaps 100,000 brain cells, compared to a million times that many for a human, forages over enormous expanses of seemingly featureless terrain, wandering to and fro in search of food. When they finally encounter some wind-blown seed, they return with it at once to their nest in an almost straight line. They navigate by the position of the Sun—even if obscured by clouds—using patterns of polarized light. But the ability of *Cataglyphis* to recognize patterns, as marvelous as it is, is very specialized. Transplanted to a different environment, such as the forest floor where landmarks abound, but where the sky cannot be seen, *Cataglyphis* would be lost.

In humans, the ability to discern patterns is astonishingly general. Indeed, we are driven to seek patterns in everything our senses respond to. So far, we are better at it than the most powerful computer, and we derive enormous pleasure from it. Pattern recognition is the basis of all esthetic enjoyment, whether it is music, or poetry, or chess, or physics. As we become more sophisticated, we seek out ever more subtle patterns. So intent are we on finding patterns that we often insist on seeing them even when they aren't there, like constructing familiar shapes from Rorschach blots. The same brain that recognizes that tides are linked to phases of the Moon may associate the positions of the stars with impending famine, or victory in battle.

That is again the belief engine at work. But once we recognize how easily we can be fooled by the workings of the belief engine, we can use the higher centers of the brain to consciously construct a more refined strategy that combines our

aptitude for recognizing patterns with the accumulation of observations about nature made possible by language.

Such a strategy is called "science." Richard Feynman described science as what we have learned about how not to fool ourselves. Its success and credibility are anchored in the willingness of scientists to expose their ideas and results to the scrutiny of other scientists.

In practice, the process can be noisy and unpleasant. Heated arguments break out at scientific conferences. Reviewers are sometimes accused of obstructing the publication of results that contradict their own work, and editors are accused of bias. Rivalries develop that are as intense as anything that takes place on the playing field. Foolish work sometimes finds its way into print, while a spectacular insight becomes mired in some petty dispute. And yet, overall, the system works amazingly well; good work eventually rises to the top, while the clutter of shoddy science remains manageable. The process transcends the human failings of individual scientists.

Scientists must also be prepared to abandon their most cherished notions. When better evidence becomes available, science textbooks are rewritten with hardly a backward glance. Many people are uneasy standing on such loose soil; they seek a certainty that science cannot offer. For these people the unchanging dictates of ancient religious beliefs, or the absolute assurances of zealots, have a more powerful appeal. Paradoxically, however, yearning for certainty is often mixed with respect for science. People long to be told that modern science validates the teachings of some ancient scripture or New Age guru. The purveyors of pseudoscience have been quick to exploit this ambivalence. Scientists generally believe the cure for pseudoscience is to raise science literacy. We must ask, however, what it is we would want a scientifically literate society to know. There are a few basic concepts—Darwinian evolution, conservation of energy, the periodic table—that all educated people should know something about, but the explosive growth of scientific knowledge in the last half of the twentieth century has left the scientists themselves struggling to keep up with developments in their own narrow specialties. It is not so much knowledge of science that the public needs, as a scientific world view—an understanding that we live in an orderly universe, governed by physical laws that cannot be circumvented by any amount of piety or cleverness.

Although the old belief-generating machinery of the brain is still in place, habits of critical thinking can be adopted that subject each fledgling belief to skeptical analysis before continued reinforcement renders the belief hopelessly resistant. For example, does B really follow A any more frequently than we would expect from chance? Any such analysis must be consciously imposed by the higher centers of the brain. The belief engine knows nothing of the laws of probability.

## Back to the Carbon Dioxide War

Which brings us back to the global climate change debate. The Malthusian pessimists argue for the "precautionary principle." Changing human behavior takes time, they contend, and if we don't start now it may be too late to prevent a catastrophe. On the other side, the technological optimists insist that to make policy before we understand the problem, if indeed a problem exists, is to invite failure. To have followed such a policy in the past, they argue, would have denied the world the unquestioned benefits of industrialization. They remind us that science has always found solutions to the problems generated by population growth and industrialization.

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The numbers, when science finally learns them, will determine the winner. Meanwhile, each side knows that every flaw in their data or oversight in their analysis will be seized upon by their opponents. Both sides strive to produce better data and better analysis in the conviction that the truth will favor their prejudice. The ideological passion of Malthusian pessimists at one extreme and technological optimists at the other provides a powerful motivation for better climate science—as long as both sides adhere to the open scientific process.

## Transcendental Superstrings

Pseudoscience is never open to scientific challenge. In the spring of 1999, John Hagelin was back in Washington. He held a press conference to announce a plan to end the violence in Kosovo. Citing the "demonstrated success" of the 1993 Project to Reduce Violent Crime in Washington, Hagelin proposed sending an elite corps of 7,000 Yogic flyers into Kosovo to meditate in unison.

Yogic flyers, of course, are the most highly trained followers of the Maharishi, reportedly having developed the ability to levitate. Should anyone doubt it, mattresses were spread on the floor of the National Press Club and a dozen young men seated themselves in the usual meditation position. After several minutes of silent meditation, one of them abruptly levitated—then another. Soon they were all levitating. Well, not exactly floating. It looked more like corn popping, as they repeatedly flexed their muscles and became briefly airborne. It was clearly hard work. I had the definite impression they were following parabolic trajectories.

Hagelin seemed perplexed that Secretary of State Albright had declined his offer. I must admit that I felt the plan had a good chance of working. The sight of 7,000 Yogic flyers popping up and down would surely have rendered the Serbian troops helpless from laughter. □