



Night Walkers and Mystery Mongers: Sense and Nonsense At the Edge of Science

Carl Sagan

IN GREECE of the second century A.D., during the reign of the Roman Emperor Marcus Aurelius, there lived a master con man named Alexander of Abonutichus. Handsome, clever, and totally unscrupulous, in the words of one of his contemporaries, he “went about living on occult pretensions.” In his most famous imposture, “he rushed into the marketplace, naked except for a gold-spangled loincloth; with nothing but this and his scimitar, and shaking his long, loose hair, like fanatics who collect money in the name of Cybele, he climbed onto a lofty altar and delivered a harangue” predicting the advent of a new and oracular god. Alexander then raced to the construction site of a temple, the crowd streaming after him, and discovered—where he had previously buried it—a goose egg in which he had sealed up a baby snake. Opening the egg, he announced the snakelet as the prophesied god. Alexander retired to his house for a few days, and then admitted the breathless crowds, who observed his body now entwined with a large serpent: the snake had grown impressively in the interim.

The serpent was, in fact, of a large and conveniently docile variety, procured for this purpose earlier in Macedonia, and outfitted with a linen head of somewhat human countenance. The room was dimly lit. Because of the press of the crowd, no visitor could stay for very long or inspect the serpent very carefully. The opinion of the multitude was that the seer had indeed delivered a god.

Alexander then pronounced the god ready to answer written questions

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delivered in sealed envelopes. When alone, he would lift off or duplicate the seal, read the message, remake the envelope, and attach a response. People flocked from all over the Empire to witness this marvel, an oracular serpent with the head of a man. In those cases where the oracle later proved not just ambiguous but grossly wrong, Alexander had a simple solution: He altered his record of the response he had given. And if the question of a rich man or woman revealed some weakness or guilty secret, Alexander did not scruple at extortion. The result of all this imposture was an income equivalent today to several hundred thousand dollars per year and fame rivaled by few men of his time.

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We may smile at Alexander the Oracle-Monger. Of course we all would like to foretell the future and make contact with the gods. But we would not nowadays be taken in by such a fraud. Or would we? M. Lamar Keene spent thirteen years as a spiritualist medium. He was pastor of the New Age Assembly Church in Tampa, a trustee of the Universal Spiritualist Association, and for many years a leading figure in the mainstream of the American spiritualist movement. He is also a self-confessed fraud who believes, from first-hand knowledge, that virtually all spirit readings, séances, and mediumistic messages from the dead are conscious deceptions, contrived to exploit the grief and longing we feel for deceased friends and relatives. Keene, like Alexander, would answer questions given to him in sealed envelopes—in this case not in private, but on the pulpit. He viewed the contents with a concealed bright lamp or by smearing lighter fluid, either of which can render the envelope momentarily transparent. He would find lost objects, present people with astounding revelations about their private lives which “no one could know,” commune with the spirits and materialize ectoplasm in the darkness of the séance—all based on the simplest tricks, an unswerving self-confidence, and most of all on the monumental credulity, the utter lack of skepticism he found in his parishioners and clients. Keene believes, as did Harry Houdini, that not only is such fraud rampant among the spiritualists but also that they are highly organized to exchange data on potential clients in order to make the revelations of the séance more astonishing. Like the viewing of Alexander’s serpent, the séances all take place in darkened rooms—because the deception would be too easily penetrated in the light. In his peak earning years,

Keene earned about as much, in equivalent purchasing power, as Alexander of Abonutichus.

From Alexander's time to our own—indeed, probably for as long as human beings have inhabited this planet—people have discovered they could make money by pretending to arcane or occult knowledge. A charming and enlightening account of some of these bamboozles can be found in a remarkable book published in 1852 in London, *Extraordinary Popular Delusions and the Madness of Crowds*, by Charles Mackay. Bernard Baruch claimed that the book saved him millions of dollars—presumably by alerting him to which idiot schemes he should not invest his money in. Mackay's treatment ranges from alchemy, prophecy, and faith healing, to haunted houses, the Crusades, and the "influence of politics and religion on the hair and beard." The value of the book, like the account of Alexander the Oracle-Monger, lies in the remoteness of the frauds and delusions described. Many of the impostures do not have a contemporary ring and only weakly engage our passions: It becomes clear how people in other times were deceived. But after reading many such cases, we begin to wonder what the comparable contemporary versions are. People's feelings are as strong as they always were, and skepticism is probably as unfashionable today as in any other age. Accordingly, there ought to be bamboozles galore in contemporary society. And there are.

In the past hundred years—whether for good or for ill—science has emerged in the popular mind as the primary means of penetrating the secrets of the universe, so we should expect many contemporary bamboozles to have a scientific ring. And they do.

Within the last century or so, many claims have been made at the edge or border of science—assertions that excite popular interest and, in many cases, that would be of profound scientific importance if only they were true. These claims are out of the ordinary, a break from the humdrum world, and often imply something hopeful: for example, that we have vast, untapped powers, or that unseen forces are about to save us from ourselves, or that there is a still unacknowledged pattern and harmony to the universe. Well, science does sometimes make such claims—as, for example, the realization that the hereditary information we pass from generation to generation is encoded in a single long molecule called DNA, in the discovery of universal gravitation or continental drift, in the tapping of nuclear energy, in research on the origin of life or on the early history of the universe. So if some additional claim is made—for example, that it is possible to float in the air unaided, by a special effort of will—what is so different about that? Nothing. Except for the matter of proof. Those who claim that levitation occurs have an obligation to demonstrate their contention before skeptics, under controlled conditions. The burden of proof is on them, not on those who might be dubious. Such claims are too important to think about carelessly. Many assertions about levitation have been made in the past hundred years, but motion pictures of well-

illuminated people rising unassisted fifteen feet into the air have never been taken under conditions which exclude fraud. If levitation were possible, its scientific and, more generally, its human implications would be enormous. Those who make uncritical observations or fraudulent claims lead us into error and deflect from us the major human goal of understanding how the world works. It is for this reason that playing fast and loose with the truth is a very serious matter.

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One of the most striking apparent instances of extrasensory perception is the precognitive experience, when a person has a compelling perception of an imminent disaster, the death of a loved one, or a communication from a long-lost friend, and the predicted event then occurs. Many who have had such experiences report that the emotional intensity of the precognition and its subsequent verification provide an overpowering sense of contact with another realm of reality. I have had such an experience myself. Many years ago I awoke in the dead of night in a cold sweat, with the certain knowledge that a close relative had suddenly died. I was so gripped with the haunting intensity of the experience that I was afraid to place a long-distance phone call, for fear that the relative would trip over the telephone cord (or something) and make the experience a self-fulfilling prophecy. In fact, the relative is alive and well, and whatever psychological roots the experience may have, it was not a reflection of an imminent event in the real world.

However, suppose the relative had in fact died that night. You would have had a difficult time convincing me that it was merely coincidence. But it is easy to calculate that, if each American has such a premonitory experience a few times in his lifetime, the actuarial statistics alone will produce a few *apparent* precognitive events somewhere in America each year. We can calculate that this must occur fairly frequently, but to the rare person who dreams of disaster, followed rapidly by its realization, it is uncanny and awesome. Such a coincidence must happen to *someone* every few months. But those who experience a correct precognition understandably resist its explanation by coincidence.

After my experience I did not write a letter to an institute of parapsychology relating a compelling predictive dream which was not borne out by reality. That is not a memorable letter. But had the death I dreamt actually occurred, such a letter would have been marked down as evidence of precognition. The hits are recorded, the misses are not. Thus human nature unconsciously conspires to produce a biased reporting of the fre-

quency of such events.

Precognitive dreams are typical of claims made on the boundary or edge of science. An amazing assertion is made, something out of the ordinary, marvelous, or awesome—or at least not tedious. It survives superficial scrutiny by lay people and, sometimes, more detailed study and more impressive endorsement by celebrities and scientists. Those who accept the validity of the assertion resist all attempts at conventional explanation. The most common correct explanations are of two sorts. One is conscious fraud, usually by those with a financial interest in the outcome. Those who accept the phenomena have been bamboozled. The other explanation often applies when the phenomena are uncommonly subtle and complex, when nature is more intricate than we have guessed, when deeper study is required for understanding. Many precognitive dreams fit this second explanation. Here, very often, we bamboozle ourselves.

I make a distinction between those who perpetrate and promote borderline belief systems and those who accept them. The latter are often taken by the novelty of the systems and the feeling of insight and grandeur they provide. These are in fact scientific attitudes and scientific goals. It is easy to imagine extraterrestrial visitors who looked like human beings, flew space vehicles and even airplanes like our own, and taught our ancestors civilization. This does not strain our imaginative powers overly and is sufficiently similar to familiar Western religious stories to seem comfortable. The search for Martian microbes of exotic biochemistry, or for interstellar radio messages from intelligent beings biologically very dissimilar, is more difficult to grasp and not as comforting. The former view is widely purveyed and available; the latter much less so. Yet I think many of those excited by the idea of ancient astronauts are motivated by sincere scientific (and occasionally religious) feelings. There is a vast untapped popular interest in the deepest scientific questions. For many people, the shoddily thought out doctrines of borderline science are the closest approximation to comprehensible science readily available. The popularity of borderline science is a rebuke to the schools, the press, and commercial television for their sparse, unimaginative, and ineffective efforts at science education; and to us scientists for doing so little to popularize our subject.

Flying saucers, or UFOs, are well known to almost everyone. But seeing a strange light in the sky does not mean that we are being visited by beings from the planet Venus or a distant galaxy named Spectra. It might, for example, be an automobile headlight reflected off a high-altitude cloud, or a flight of luminescent insects, or an unconventional aircraft, or a conventional aircraft with unconventional lighting patterns, such as a high-intensity searchlight used for meteorological observations. There are also a number of cases—closer encounters with some highish index numeral—where one or two people claim to have been taken aboard an alien spaceship, prodded and probed with unconventional medical instru-

ments, and released. But in these cases we have only the unsubstantiated testimony, no matter how heartfelt and seemingly sincere, of one or two people. To the best of my knowledge there are no instances out of the hundreds of thousands of UFO reports filed since 1947—not a single one—in which many people independently and reliably report a close encounter with what is clearly an alien spacecraft.

Not only is there an absence of good anecdotal evidence; there is no physical evidence either. Our laboratories are very sophisticated. A product of alien manufacture might readily be identified as such. Yet no one has ever turned up even a small fragment of an alien spacecraft that has passed any such physical test—much less the logbook of the starship captain. It is for these reasons that in 1977 NASA declined an invitation from the Executive Office of the President to undertake a serious investigation of UFO reports. When hoaxes and mere anecdotes are excluded, there seems to be nothing left to study.

Once I spied a bright, “hovering” UFO, and pointing it out to some friends in a restaurant soon found myself in the midst of a throng of patrons, waitresses, cooks, and proprietors milling about on the sidewalk, pointing up into the sky with fingers and forks and making gasps of astonishment. People were somewhere between delighted and awestruck. But when I returned with a pair of binoculars which clearly showed the UFO to be an unconventional aircraft (a NASA weather airplane, as it later turned out), there was uniform disappointment. Some felt embarrassed at the public exposure of their credulity. Others were simply disappointed at the evaporation of a good story, something out of the ordinary—a visitor from another world.

In many such cases we are not unbiased observers. We have an emotional stake in the outcome—perhaps merely because the borderline belief-system, if true, makes the world a more interesting place; but perhaps because there is something there that strikes more deeply into the human psyche. If astral projection actually occurs, then it is possible for some thinking and perceiving part of me to leave my body and effortlessly travel to other places—an exhilarating prospect. If spiritualism is real, then my soul will survive the death of my body—possibly a comforting thought. If there is extrasensory perception, then many of us possess latent talents that need only be tapped to make us more powerful than we are. If astrology is right, then our personalities and destinies are intimately tied to the rest of the cosmos. If elves and goblins and fairies truly exist (there is a lovely Victorian picture book showing photographs of six-inch-high undraped ladies with gossamer wings conversing with Victorian gentlemen), then the world is a more intriguing place than most adults have been led to believe. If we are now being or in historical times have been visited by representatives from advanced and benign extraterrestrial civilizations, perhaps the human predicament is not so dire as it seems; perhaps the extraterrestrials will save us from ourselves. But the fact that these propositions

charm or stir us does not guarantee their truth. Their truth depends only on whether the evidence is compelling; and my own, and sometimes reluctant, judgment is that compelling evidence for these and many similar propositions simply does not (at least as yet) exist.

What is more, many of these doctrines, if false, are pernicious. In simplistic popular astrology we judge people by one of twelve character types depending on their month of birth. But if the typing is false, we do an injustice to the people we are typing. We place them in previously collected pigeonholes and do not judge them for themselves, a typing familiar in sexism and racism.

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Those skeptical of many borderline belief-systems are not necessarily those afraid of novelty. For example, many of my colleagues and I are deeply interested in the possibility of life, intelligent or otherwise, on other planets. But we must be careful not to foist our wishes and fears upon the cosmos. Instead, in the usual scientific tradition, our objective is to find out what the answers really are, independent of our emotional predispositions. If we are alone, that is a truth worth knowing also. No one would be more delighted than I if intelligent extraterrestrials were visiting our planet. It would make my job enormously easier. Indeed, I have spent more time than I care to think about on the UFO and ancient astronaut questions. And public interest in these matters is, I believe, at least in part, a good thing. But our openness to the dazzling possibilities presented by modern science must be tempered by some hard-nosed skepticism. Many interesting possibilities simply turn out to be wrong. An openness to new possibilities and a willingness to ask hard questions are both required to advance our knowledge.

Professional scientists generally have to make a choice in their research goals. There are some objectives that would be very important if achieved but promise so small a likelihood of success that no one is willing to pursue them. (For many years this was the case in the search for extraterrestrial intelligence. The situation has changed mainly because advances in radio technology now permit us to construct enormous radio telescopes with sensitive receivers to pick up any messages that might be sent our

way. Never before in human history was this possible.) There are other scientific objectives that are perfectly tractable but of entirely trivial significance. Most scientists choose a middle course. As a result, very few scientists actually plunge into the murky waters of testing or challenging borderline or pseudoscientific beliefs. The chance of finding out something really interesting—except about human nature—seems small, and the amount of time required seems large. I believe that scientists should spend more time in discussing these issues, but the fact that a given contention lacks vigorous scientific opposition in no way implies that scientists think it is reasonable.

There are many cases where the belief system is so absurd that scientists dismiss it instantly but never commit their arguments to print. I believe this is a mistake. Science, especially today, depends upon public support. Because most people have, unfortunately, a very inadequate knowledge of science and technology, intelligent decision-making on scientific issues is difficult. Some pseudoscience is a profitable enterprise, and there are proponents who not only are strongly identified with the issue in question but also make large amounts of money from it. They are willing to commit major resources to defending their contentions. Some scientists seem unwilling to engage in public confrontations on borderline-science issues because of the effort required and the possibility that they will be perceived to lose a public debate. But it is an excellent opportunity to show how science works at its murkier borders, and also a way to convey something of its power as well as its pleasures.

There is stodgy immobility on both sides of the borders of the scientific enterprise. Scientific aloofness and opposition to novelty are as much a problem as public gullibility. A distinguished scientist once threatened to sic then Vice-President Spiro T. Agnew on me if I persisted in organizing a meeting of the American Association for the Advancement of Science in which both proponents and opponents of the extraterrestrial-spacecraft hypothesis of UFO origins would be permitted to speak. Scientists offended by the conclusions of Immanuel Velikovsky's *Worlds in Collision* and irritated by Velikovsky's total ignorance of many well-established scientific facts successfully and shamefully pressured Velikovsky's publisher to abandon the book—which was then put out by another firm, much to its profit—and when I arranged for a second AAAS symposium to discuss Velikovsky's ideas, I was criticized by a different leading scientist who argued that any public attention, no matter how negative, could only aid Velikovsky's cause.

But these symposia were held, the audiences seemed to find them interesting, the proceedings were published, and now youngsters in Duluth or Fresno can find some books presenting the other side of the issue in their libraries. If science is presented poorly in schools and the media, perhaps some interest can be aroused by well-prepared, comprehensible public discussions at the edge of science. Astrology can be used for discus-

sions of astronomy; alchemy for chemistry; Velikovskian catastrophism and lost continents such as Atlantis for geology; and spiritualism and Scientology for a wide range of issues in psychology and psychiatry.

Scientists are, of course, human. When their passions are excited they may abandon temporarily the ideals of their discipline. But these ideals, the scientific method, have proved enormously effective. Finding out the way the world really works requires a mix of hunches, intuition, and brilliant creativity; it also requires skeptical scrutiny of every step. It is the tension between creativity and skepticism that has produced the stunning and unexpected findings of science. In my opinion the claims of borderline science pall in comparison with hundreds of recent activities and discoveries in real science, including the existence of two semi-independent brains within each human skull; the reality of black holes; continental drift and collisions; chimpanzee language, massive climatic changes on Mars and Venus; the antiquity of the human species; the search for extraterrestrial life; the elegant self-copying molecular architecture that controls our heredity and evolution; and observational evidence on the origin, nature, and fate of the universe as a whole.

But the success of science, both its intellectual excitement and its practical application, depends upon the self-correcting character of science. There must be a way of testing any valid idea. It must be possible to reproduce any valid experiment. The character or beliefs of the scientists are irrelevant; all that matters is whether the evidence supports his contention. Arguments from authority simply do not count; too many authorities have been mistaken too often. I would like to see these very effective scientific modes of thought communicated by the schools and the media; and it would certainly be an astonishment and delight to see them introduced into politics. Scientists have been known to change their minds completely and publicly when presented with new evidence or new arguments. I cannot recall the last time a politician displayed a similar openness and willingness to change.

Many of the belief systems at the edge or fringe of science are not subject to crisp experimentation. They are anecdotal, depending entirely on the validity of eyewitnesses, who in general are notoriously unreliable. On the basis of past performance most such fringe systems will turn out to be invalid. But we cannot reject out of hand, any more than we can accept at face value, all such contentions. For example, the idea that large rocks can drop from the skies was considered absurd by eighteenth-century scientists; Thomas Jefferson remarked about one such account that he would rather believe that two Yankee scientists lied than that stones fell from the heavens. Nevertheless, stones do fall from the heavens. They are called meteorites, and our preconceptions have no bearing on the truth of the matter. But the truth was established only by a careful analysis of dozens of independent witnesses to a common meteorite fall, supported by a great body of physical evidence, including meteorites recovered from the

eaves of houses and the furrows of plowed fields.

Prejudice means literally pre-judgment, the rejection of a contention out of hand, before examining the evidence. If we wish to find out the truth of the matter we must approach the question with as open a mind as we can, and with a deep awareness of our own limitations and predispositions. On the other hand, if after carefully and openly examining the evidence, we reject the proposition, that is not prejudice. It might be called "post-judice." It is certainly a prerequisite for knowledge.

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Critical and skeptical examination is the method used in everyday practical matters as well as in science. When buying a new or used car, we think it prudent to insist on written warranties, test drives, and checks of particular parts. We are very careful about car dealers who are evasive on these points. Yet the practitioners of many borderline beliefs are offended when subjected to similarly close scrutiny. Many who claim to have extrasensory perception also claim that their abilities decline when they are carefully watched. The magician Uri Geller is happy to warp keys and cutlery in the vicinity of scientists—who, in their confrontations with nature, are used to an adversary who fights fair—but is greatly affronted at the idea of performances before an audience of skeptical magicians—who, understanding human limitations, are themselves able to perform similar effects by sleight of hand. Where skeptical observation and discussion are suppressed, the truth is hidden. The proponents of such borderline beliefs, when criticized, often point to geniuses of the past who were ridiculed. But the fact that some geniuses were laughed at does not imply that all who are laughed at are geniuses. They laughed at Columbus, they laughed at Fulton, they laughed at the Wright brothers. But they also laughed at Bozo the Clown.

The best antidote for pseudoscience, I firmly believe, is science:

- There is an African fresh-water fish that is blind. It generates a standing electric field, through perturbations in which it distinguishes between predators and prey and communicates in a fairly elaborate electrical language with potential mates and other fish of the same species. This involves an entire organ system and sensory capability completely unknown to pretechnological human beings.

- There is a kind of arithmetic, perfectly reasonable and self-contained,

in which two times one does not equal one times two.

- Pigeons—one of the least prepossessing animals on Earth—are now found to have a remarkable sensitivity to magnetic-field strengths as small as one hundred thousandth that of the Earth's magnetic dipole. Pigeons evidently use this sensory capability for navigation and sense their surroundings by their magnetic signatures: metal gutters, electrical power lines, fire escapes and the like—a sensory modality glimpsed by no human being who ever lived.

- Quasars seem to be explosions of almost unimaginable violence in the hearts of galaxies which destroy millions of worlds, many of them perhaps inhabited.

- In an East African volcanic-ash flow 3.5 million years old there are footprints—of a being about four feet high with a purposeful stride that may be the common ancestor of apes and men. Nearby are the prints of a knuckle-walking primate corresponding to no animal yet discovered.

- Each of our cells contains dozens of tiny factories called mitochondria which combine our food with molecular oxygen in order to extract energy in convenient form. Recent evidence suggests that billions of years ago the mitochondria were free organisms which have slowly evolved into a mutually dependent relation with the cell. When many-celled organisms arose, the arrangement was retained. In a very real sense, then, we are not a single organism, but an array of about ten trillion beings and not all of the same kind.

- Mars has a volcano almost 80,000 feet high which was constructed about a billion years ago. An even larger volcano may exist on Venus.

- Radio telescopes have detected the cosmic black-body background radiation, the distant echo of the event called the Big Bang. The fires of creation are being observed today.

I could continue such a list almost indefinitely. I believe that even a smattering of such findings in modern science and mathematics is far more compelling and exciting than most of the doctrines of pseudoscience, whose practitioners were condemned as early as the fifth century B.C. by the Ionian philosopher Heraclitus as “night-walkers, magicians, priests of Bacchus, priestesses of the wine-vat, mystery-mongers.” But science is more intricate and subtle, reveals a much richer universe, and powerfully evokes our sense of wonder. And it has the additional and important virtue—to whatever extent the word has any meaning—of being true. •

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