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Abstract Review of *The Demon-Haunted World: Science as a Candle in the Dark* (1996), by Carl Sagan.

Science, Pseudoscience, and Religious Belief

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Jim Holt in *The Wall Street Journal* writes:

> Carl Sagan's "The Demon-Haunted World" [is] a repetitious, cloying, sanctimonious, self-regarding—yet oddly entertaining—sermon on the evils of superstition. The TV astronomer, famous for his plummy pronunciation of "primordial soup," blasts an array of sitting ducks out of the water. If you believe in alien abduction, crop circles, levitating gurus, astrology, telepathy, faith-healing or psychoanalysis, take cover.[1]

It seems that some disillusioned former members of the Church of Jesus Christ of Latter-Day Saints feel that this list of cultist adherents should include Mormons.[2] In this review I will discuss Sagan's polemic against superstition, the relevance of these attacks for traditional religions, and scientific challenges to the validity of religious knowledge.

1. Jim Holt, "Right and Wrong in a Brave New World," *Wall Street Journal,* 26 April 1996, A10.

2. For example, see the review of *The Demon-Haunted World* by Don Mitchell at exmormonfoundation.org (accessed 3 December 2004).

Review of Carl Sagan. *The Demon-Haunted World: Science as a Candle in the Dark*. New York: Ballantine Books, 1996. xviii + 480 pp., with index. $15.00.

On the other side of the coin, recent historical and philosophical studies problematize science's claim to objective truth and its rejection of authority. I will argue that science and religion are both incomplete sets of truths and that they are largely complementary.

On Pseudoscience

Carl Sagan is deeply troubled about our society: "I have a foreboding of an America in my children's or grandchildren's time . . . when the people have lost the ability to set their own agendas or knowledgeably question those in authority; when, clutching our crystals and nervously consulting our horoscopes, our critical faculties in decline, unable to distinguish between what feels good and what's true, we slide, almost without noticing, back into superstition and darkness" (p. 25). Sagan does not fret in vain—a quarter of Americans believe in astrology (p. 303), millions believe in UFOs, alien abductions, magnet therapy, and the power of crystals. Science is under direct attack in some quarters; fundamentalist Christian groups, for example, have successfully lobbied local and state educational boards to prohibit the teaching of evolution.

The prevalence of superstitious beliefs and the increase in anti-scientific rhetoric are accompanied in the latter part of the twentieth century by the decline of the scientific literacy of the American public. Our high school students perform very poorly in international standardized math and science exams. Sixty-three percent of Americans are unaware that the last dinosaur died before the first humans lived, and roughly "half of American adults do not know that the Earth goes around the sun and takes a year to do it" (p. 324). These disturbing trends lend credence to Sagan's nightmare, described above, that our society's critical faculties are in decline. Sagan argues that our ignorance of scientific facts and the scientific method leads to the uncritical acceptance of misguided and potentially dangerous beliefs.

The Demon-Haunted World, Sagan's final book before he died in 1996, is an all-out attack on superstition, irrationality, and unjustified belief. His primary target is *pseudoscience,* beliefs that "purport to use the methods and findings of science, while in fact they are faithless to

its nature" (p. 13). Proponents of pseudoscience desire the "credibility of science, but without being bound by its methods and rules" (p. 184). The superstitions listed above and the creation science literature promulgated by fundamentalists qualify as pseudoscience because they claim the empirical evidence, practical utility, and certainty of scientific proof while making methodological mistakes that invalidate their arguments. In contrast, the cold fusion fiasco (in which two chemists falsely reported creating nuclear fusion) is not pseudoscience, it is simply *bad science* and was corrected as a matter of course within the scientific community.

As a planetary astronomer, in conjunction with his role as a public scientific figure, Sagan became an expert on UFOs and alien abduction reports. These pseudoscientific beliefs bear the brunt of his attack in *The Demon-Haunted World*. If there comes a time when you pick up the *World Weekly News* and believe that you have been abducted by aliens, that a vast government conspiracy has hidden the truth about the Roswell incident, or that aliens left a giant sculpture of a human face on Mars, pick up a copy of Sagan's book as soon as possible. He thoroughly debunks these myths in great historical detail, discussing the original NASA photos of the face on Mars, the many forgeries, the hoaxers who stomped circles in crops in England, the origin of the phrase *flying saucer* and its spread in UFO stories, and the role of gullible therapists in propounding UFO myths. Together with his insights gleaned from government officials and files, these explanations form compelling arguments that there is no hard evidence for aliens visiting the earth.

Sagan then goes a step further, offering a speculative explanation for the UFO phenomenon and its similarities to demonic visitations in the medieval and early modern periods. Reports of alien abduction often include a sense of missing time, flying through the air, a feeling of paralysis and anxiety, and some type of sexual experience. The psychologist Robert Baker has argued that these match a type of hallucination known as "sleep paralysis" that occurs in the "twilight world between being fully awake and fully asleep" (p. 109). Sagan notes that these characteristics fit descriptions of demonic visitations (often sexual in nature)

that were widely reported in early modern Europe and were linked with witch trials. He hypothesizes that the same hallucinatory experience is behind both phenomena, with the details of demons or flying saucers being made to fit the social climate and culture of the times. This hypothesis is speculative and rests, much like the tales it is designed to refute, on little evidence; although an attractive reductionist explanation, it does not carry the same weight as his direct examination of the historical and scientific data behind alien visitations.

Why do such hallucinations take a scientific form today? Sagan argues that they are cast in this mold in an effort to gain legitimacy:

> In the early 1960s, I argued that the UFO stories were crafted chiefly to satisfy religious longings. At a time when science has complicated uncritical adherence to the old-time religions, an alternative is proffered to the God hypothesis: Dressed in scientific jargon, their immense powers "explained" by superficially scientific terminology, the gods and demons of old come down from heaven to haunt us, to offer prophetic visions, and to tantalize us with the visions of a more hopeful future: a space-age mystery religion aborning. (p. 130)

Again, believers in what Sagan considers pseudoscience draw near unto science with their lips, though their methods are far from it. Sagan believes that the best way to combat pseudoscience is to delineate the criteria for knowledge and the methods science uses to achieve sure knowledge. For example, a "baloney detection kit" in chapter 12 outlines common logical fallacies and skeptical and empiricist principles (p. 212). Through clarification of the standards of knowledge in science, Sagan hopes to deny legitimacy to the superstitions he labels pseudoscience.

As a scientist, I recognize the problem of pseudoscientific superstitions and also our limitations in arriving at truth, and I am sympathetic with Sagan's efforts to educate the American public about how scientists achieve useful knowledge. In his zealous attacks on pseudoscience, however, Sagan inflicts collateral damage on religion, even conflating the two. What is the relationship between pseudoscience and tradi-

tional religion, and what are the implications of Sagan's arguments for religious belief?

On Religion and Myth

Central to Sagan's speculative explanation of the UFO and alien abduction phenomenon is the idea that the human brain is prone to making errors of judgment, particularly when we dearly wish for something to be true. He reminds us that we are a gullible species and can easily alter our perceptions, even our memories, through the suggestion of others. Furthermore, hallucinations are the common lot of man: sleep paralysis, sleep deprivation, psychosis-inducing drugs, periods of fasting, epilepsy, and schizophrenia all contribute to altered brain chemistry that results in our being deceived about the reality of the world around us.

It is clear that Sagan believes that these are the causes of religious experience and behavior: "Hallucinations feel real. . . . There are countless instances in the world's religions where patriarchs, prophets, or saviors repair themselves to desert or mountain and, assisted by hunger and sensory deprivation, encounter gods or demons" (p. 105). This naturalistic explanation accounts for more than just alien visitations: "And if the alien abduction accounts are mainly about brain physiology, hallucinations, distorted memories of childhood, and hoaxing, don't we have before us a matter of supreme importance—touching on our limitations, the ease with which we can be misled and manipulated, the fashioning of our beliefs, and perhaps even the origins of our religions?" (p. 188).

For Sagan, pseudoscientific superstition and religion both result from altered physiological brain states that lead to delusions in the mind. Both are a result of gullibility and a willingness to believe, combined with deliberate deception on the part of those in authority. "While vast barriers," he argues, "may seem to stretch between a local, single-focus contention of pseudoscience and something like a world religion, the partitions are very thin" (p. 19). The boundary between pseudoscience and religion shifts continually throughout the book; sometimes pseudoscience and religion are construed as separate (p. 20)

and other times as synonymous. If mainstream religions are sometimes treated differently in the book, it is simply because they are older, have more adherents, and are in general seemingly less dangerous than other superstitions. Herein lies the appeal of the book for the skeptically minded and antireligious, including a number of lapsed Mormons. The many knockdown arguments put forth to destroy specific instances of pseudoscience apply to Sagan's concept of religion as well.

Quoting Thomas Hobbes, Sagan writes that "'fear of things invisible is the natural seed of that which every one in himself calleth religion'" (p. 114). It is fear of the outside world and fear and hatred of others that dominates Sagan's characterization of religion. Sagan spends much time detailing the horrors of the witch trials of the early modern period, the tortures of the Inquisition, and the popularity of perceived sexual intercourse with demons. For Sagan the psychological source of religion is fear, and its primary purpose for the religious believer is to gain knowledge of and control over the natural world: "For much of our history, we were so fearful of the outside world, with its unpredictable dangers, that we gladly embraced anything that promised to soften or explain away the terror" (p. 26).

Religion is conceived as a protoscience of our ancient ancestors, which has the same goals as modern science but is much less successful. For Sagan, myth is merely a story or fable told to explain a natural phenomenon, a fable that, due to lack of evidence and neglect of the scientific method, is not scientific. Recognizing no other explicit value for myth, he writes that "the myths and folklore of many premodern cultures have explanatory or at least mnemonic value" (p. 251). The only God he can conceive of is the "God of the Gaps" (p. 8), whose sole purpose is to explain what we in our limited understanding cannot yet explain scientifically.[3] It is important to note that Sagan, champion of empiricism and critical thinking, does not provide any data to back

3. In fact, the Bible contains very few "just-so stories," such as those found in Kipling's children's book by that name, explaining, for example, how the leopard got its spots. Rather than explanations of natural phenomena, it focuses on the dealings of God with his people in and through history.

up his assumptions about the origin of religion or its purpose and meaning for believers. He does not make use of nearly 150 years of academic studies of religion; he condescendingly dismisses the writings of believers and as a result fails to understand what religion is.

The view of religion Sagan espouses in *The Demon-Haunted World* bears resemblance to that of late nineteenth-century anthropologists Edward Tylor and James Frazer,[4] who sought to explain the historical origins of religious thought. Tylor believed that "primitives" explained the phenomena of death and dreams by theorizing that humans are animated by a soul. This naturally led to ascribing souls to other animals, plants, and other objects (a belief system known as animism), an ascription that evolved over time into polytheism, monotheism, and finally scientific atheism. For Tylor, animistic religion was inspired by the same human desire to understand how things work, forming a natural parallel to science.[5] Likewise, Frazer saw religion as evolving from magical practices, in which "savages" sought to control the natural world through rituals. In his view, the savage mind believed in a type of natural law in which objects could be affected by direct action on a second object that is similar, or in some way attached to, the target (for example, voodoo dolls). According to Frazer's chronology, magic was replaced by religion, which in turn was replaced by scientific atheism.

Tylor and Frazer were highly influential in their time, and many practicing scientists today view religion in essentially the same terms: a primitive attempt to understand and control nature through animism and magic, giving way to the more effective and correct scientific method. The work of Tylor and Frazer has been largely discredited by modern anthropology, however, both for methodological reasons (they cut and pasted stories from many cultures, without any fieldwork) and for their problematic evolutionary assumptions (the simple story of progress from magic to religion to science does not match the data

4. See Edward B. Tylor, *Anthropology: An Introduction to the Study of Man and Civilization* (New York: Appleton, 1897); and James Frazer, *The Golden Bough: A Study in Magic and Religion,* 3rd ed. (New York: Macmillan, 1935).

5. Daniel L. Pals, *Seven Theories of Religion* (Oxford: Oxford University Press, 1996), 29.

and imposes self-serving value judgments).[6] Noted twentieth-century British anthropologist E. E. Evans-Pritchard has labeled such speculative reconstructions "just-so stories." Each of these theorists merely "asked himself how he, an educated Westerner, might have come to hold a religious or magical belief if he were walking in the footsteps of some primitive person who one day put his hand to his chin to reflect upon the world around him. . . . They think that primitive people, like themselves, wanted to explain everything and so settled upon religious beliefs as a way of showing how the world works."[7] In contrast, Evans-Pritchard argues that religion and science are complementary configurations, "forms of understanding that are clearly different but equally necessary in all human cultures . . . ; all cultures will always need both science's constructs of the mind and religion's 'constructs of the heart.'"[8]

Like the early anthropologists, Sagan offers speculative theories about the historical and personal sources of religious belief. These theories fail to rise above the level of a "just-so story." In another example, Sagan speculates that religion is maintained through time via an evolutionary mechanism: "cultures that teach an afterlife of bliss for heroes . . . might gain a competitive advantage" (p. 269). These speculations fail to meet the very test that he demands as a scientist—namely, a careful and critical examination of the data. Lacking such testing and data and also personal religious experience, Sagan merely assumes that the purpose of religion is to explain and control the natural world, a task that he as a scientist sees as paramount to the human experience. The only valid questions are scientific ones, and religion is merely primitive, false, and dangerous science. *Sagan equates religion with a straw man that is simply pseudoscience.* I will argue that this is a mistake of categories, that religion is concerned essentially and primarily with questions of purpose, meaning, and ethics.

Mircea Eliade has argued that archaic man lived on two different planes: the sacred and the profane. The questions of modern science

6. Pals, *Seven Theories of Religion,* 46.
7. Pals, *Seven Theories of Religion,* 220–21.
8. Pals, *Seven Theories of Religion,* 222.

belong to the profane category, concerned with the ordinary things of this world. For Eliade, primitive peoples downplayed the shifting, chaotic world of the profane and instead concerned themselves primarily with the transcendent world of the sacred. The sacred is considered to be "eternal, full of substance and reality,"[9] the sphere of order and of the divine. "The man of the archaic societies tends to live as much as possible *in* the sacred or in close proximity to consecrated objects. The tendency is perfectly understandable, because, for primitives as for the man of all premodern societies, the *sacred* is equivalent to a power, and, in the last analysis, to *reality*. The sacred is saturated with *being*."[10]

Eliade describes the source of knowledge of the sacred: an experience of something *wholly different from this world*. "It is like nothing human or cosmic; confronted with it, man senses his profound nothingness . . . [and] is but 'dust and ashes.'"[11] The reality of the sacred is overwhelming and combined with mystery, awe, and beauty. The goal of religion is to mediate and maximize our interaction with the sacred. Rather than primitive scientific explanations of natural phenomena, Eliade sees myths as providing the thought framework and worldview of primitive peoples. Through comparative studies of the world religions, Eliade describes in detail in his work how the patterns of creation and action performed by the Gods outside of our time touch every aspect of human life below. For example, communities are organized radiating from a sacred center, often a pole or other vertical object that marks the *axis mundi,* joining the underworld, earth, and the heavens.[12] (Commentators have remarked on the similarities of Eliade's concept of sacred space to the ordering of early Mormon communities around temples.)[13] Likewise, premodern peoples sought to live in sacred time and surrounded themselves with symbols and

9. Pals, *Seven Theories of Religion,* 164.

10. Mircea Eliade, *The Sacred and the Profane: The Nature of Religion* (San Diego: Harcourt Brace Jovanovich, 1959), 12.

11. Eliade, *Sacred and the Profane,* 10.

12. Eliade, *Sacred and the Profane*, 36.

13. Hugh Nibley, "The Meaning of the Temple," in *Temple and Cosmos* (Salt Lake City: Deseret Book and FARMS, 1992), 15.

objects linked with the divine. Again, the purpose of myth is to order our thinking upon sacred models (especially of creation), to make cosmos out of chaos. This ordering ordains our relation to the world around us, to others, and to a more fundamental reality; unlike scientific explanations, myth provides a strong normative aspect, imbuing experiences with meaning and morality.

While Eliade's work highlights the powerful role of myth in ordering our lives, the transformative personal power of religious belief is emphasized in the philosopher and psychologist William James's *Varieties of Religious Experience*. James's study draws on firsthand accounts of religious experience, seeking to define the actual content of religion. His writings on conversion show the effects that experiences of the sacred have on individuals, including, for example, the conversion to religion of Russian novelist Leo Tolstoy. Troubled by the discord between his inner character and outward behavior in what James calls "the superfluities and insincerities, the cupidities, complications, and cruelties of our polite civilization,"[14] Tolstoy came to a point of crisis: "'I felt . . . that something had broken within me on which my life had always rested . . . that morally my life had stopped.'"[15] James explains how, for Tolstoy, "Life had been enchanting; it was now flat sober, more than sober, dead. Things were meaningless whose meaning had always been self-evident."[16] Following two years of struggle, Tolstoy found that happiness lay in belief in God: "'Everything in me awoke and received a meaning. . . . Why do I look farther? a voice within me asked. He is there: he, without whom one cannot live. . . . God is what life is.'"[17]

James shows how conversion can restore meaning and purpose to our lives. He further identifies four components of the saintly life: a feeling of being in a wider life than this world's selfish and petty interests, a sense of self-surrender to a friendly higher power, an immense

14. William James, *The Varieties of Religious Experience* (New York: Simon & Schuster, 2004), 139.

15. Leo Tolstoy, *My Confession,* as cited in James, *Varieties of Religious Experience,* 115.

16. James, *Varieties of Religious Experience,* 114.

17. James, *Varieties of Religious Experience,* 139.

elation and freedom, and a shift of the emotional center toward loving and affection.[18] For James, the truth of religion lies not in testing its supernatural origins or metaphysical claims. In examining the data for these religious experiences, he concludes that the realignment of the subjective and emotional life through religion is a powerful force for renewal and personal transformation. He also suggests, like Evans-Pritchard, that this force needs to be balanced by reason and intellect.

According to James, Eliade, and Evans-Pritchard, three giants in the academic study of religion, religions are not primarily concerned with explaining natural phenomena in a scientific manner, but rather with providing meaning, context, purpose, and the power to change human behavior for the better. It is more a matter of the heart than of the mind. Does Sagan recognize that people long for meaning and purpose in their lives and that his scientism is ultimately not fulfilling this need? He recognizes the demands of the heart but, tone-deaf to religious insights, offers scientific marvels instead. A few examples:

> It's hard for me to see a more profound cosmic connection than the astonishing findings of modern nuclear astrophysics. . . . all the atoms that make each of us up . . . were manufactured in red giant stars thousands of light-years away in space and billions of years ago in time. We are, as I like to say, starstuff. (p. 14n)

> In an infinitely old universe with an infinite number of appearances of galaxies, stars, planets, and life, an identical Earth must reappear on which you and all your loved ones will be reunited. . . . Those with a deep longing for life after death might, it seems, devote themselves to cosmology, quantum gravity, elementary particle physics, and transfinite arithmetic. (p. 206)

> The mystic William Blake stared at the Sun and saw angels there, while others, more worldly, "perceived only an

18. James, *Varieties of Religious Experience,* 202–3.

> object of about the size and colour of a golden guinea." Did Blake really see angels in the Sun, or was it some perceptual or cognitive error? . . . And is not the truth of the Sun's nature as revealed by modern science far more wonderful: no mere angels or gold coin, but an enormous sphere into which a million Earths could be packed, in the core of which the hidden nuclei of atoms are being jammed together. (pp. 329–30)

Sagan admits, "Whenever I think about any of these discoveries, I feel a tingle of exhilaration. My heart races" (p. 330). This sense of wonder makes him an excellent science writer and teacher, but ultimately such wonder does not satisfy the same purpose or meet the same needs as religion. No sense of purpose or meaning, no ethical demands, can be founded solely on the findings of science. Science can only describe the universe, not offer normative statements, for *is* does not imply *ought*.

Sagan writes of a course he taught at Cornell in which he asked students to prepare for a debate and present first the perspective of the opposition "so the opponent will say, 'Yes, that's a fair presentation of my views'" (p. 435). Ask yourself, does Sagan accurately describe the purpose and nature of your religion? He portrays superstitions based on fear of the natural world, pseudoscientific explanations, and a picture of religion full of demonic visitations, alien abductions, witch hunts, and darkness. This is not a book about religion but about refuting pseudoscience, and Sagan occasionally and mistakenly conflates the two in his efforts to stamp out what he considers unjustified belief. Sagan draws on little data to support his assertions about religion. Those like Evans-Pritchard, James, and Eliade, who have studied religion from very different approaches, conclude that it is essentially about meaning, purpose, and ethics.[19] While some religious traditions may incorporate superstition and pseudoscientific beliefs, most do not

19. This is not to say that religion can be reduced to ethics—metaphysical claims about the soul and life after death play crucial roles in Christianity. Religion's claims about the world seem to be mainly of this metaphysical rather than scientific character. Any distinctly scientific claims are of secondary importance.

appeal to scientific authority, have very different aims and methods than modern science, and have nothing to fear from this book.

Science and the Modern Mind

Having clarified that there is no *necessary* relation between true religious belief and pseudoscience, it is useful to examine the religious character of the examples of pseudoscience identified by Sagan. It is his hypothesis that the alien phenomenon is a modern attempt to fulfill the spiritual needs of humanity as religiosity wanes in the Western world. He writes, "in an age when traditional religions have been under withering fire from science, is it not natural to wrap up the old gods and demons in scientific raiment and call them aliens?" (p. 115). But is religion under "withering fire" from science? I believe there is no necessary conflict between science and religion. Perhaps Sagan is right that the mythic worldview of our ancient ancestors has given way to a modern, Enlightenment-based worldview. Religions have struggled to adapt, and many in the Western world have abandoned organized religion to become thoroughly secularized. Others have sought to satisfy their longing for belonging and meaning through adapting religions to a more modernist character. One such response includes UFO cults and the alien phenomena generally.

A striking aspect of modern thought is the emphasis on certainty, on being completely free from error. This theme comes through very strongly in the philosophical writings of Descartes, who championed the use of *a priori* and therefore certain knowledge in the study of the natural world. He made great contributions in mathematical physics, and his philosophy reflects this love of deductive certainty. For modern societies, the scientific method has become the mark of certainty and empirical data the hallmark of truth. This craving for certainty is manifest in the searching for signs of UFO visitations; proponents claim that there is hard evidence, including photographs, movies, physical marks on abductees, and a crashed flying saucer stored in Area 51. These physical data relieve the UFO believer of the difficulty of developing faith in an unseen God, offering instead a cheap certainty. Rather than cultivating personal experiences of the sacred,

UFO cults replace faith with credulity and blind trust in supposed scientific evidence.

Not only can science supposedly prove the existence of these alien or higher beings, but it can to some extent explain their powers. Superficially scientific terminology is used to describe their spacecraft, space travel, and technologically advanced civilizations. For moderns, with an implicit faith in progress, it is not difficult to believe that there are societies that have advanced beyond our own. Science and technology allowed the aliens to overcome the troubles that haunt us and gave them power to travel freely among the stars. Compare this to the difficulty of explaining who God is or the physical mechanism of Jesus's miracles in the New Testament. The emphasis on supposed scientific explanations reflects a modern obsession with what Aristotle called material and efficient causes—the actual physical mechanism of a process or event—which science excels at explaining. Contrast this with the emphasis on final causes in the mythic religion and thought of premoderns. Medieval thinkers, for example, conceived of the purpose or final goal as fundamental to explanations, an idea explicitly rejected by early modern philosophers and scientists. The UFO phenomenon reflects both this emphasis on efficient cause and the faith in science and linear progress through time.

Alien cults display faith in science—a kind of scientism—to the point of a near worship of technology. Humans now love new toys: shiny new cars, MP3 players, flat-screen televisions, and cellular phones. Our love of change, of newness, and of material things would be baffling to the otherworldly European at the turn of the first millennium. The alien phenomena confirm in the minds of believers that scientific and technological progress correlate with superior ethical and spiritual abilities. They display higher beings in a sleek, shiny package that is attractive to the future-minded, materialistic Westerner—far more appealing than a Galilean Jewish peasant who lived two millennia ago.

In these three aspects—scientific evidence, explanation, and technology worship—I believe that Sagan's thesis is correct: the UFO phenomenon is an Enlightenment-based, scientific veneer for

the worship of higher beings. Men and women thoroughly indoctrinated in the modern worldview can satisfy their religious needs without the supposed mystic mumbo-jumbo of traditional religion. Better yet, it's rather easy. No faith is required, and the aliens don't ask much in return. It is clear that the UFO cults qualify as pseudoscience, according to Sagan's definition, in that they use the language of science, pay homage to the dominant ideas of the Enlightenment, and appeal to scientific certainty, but they use the scientific method in a manner inconsistent with obtaining scientific truth. They appear to apply the scientific method, strictly construed, to religious beliefs and, in the process, fail both as a religion and a branch of science.

Sagan's second religious target is the creation science of Protestant fundamentalists in the United States. This is another clear example of a religion adapting to modern ways of thinking. Fundamentalists often adopt Enlightenment concepts of truth, including the meaning of texts, the purpose of explanations, and the role of physical evidence in epistemology. Instead of reading the Bible as a text written by premoderns who held a mythic worldview primarily concerned with establishing God's relation to his chosen people, they read it literally, in a modern sense, as science. The creation story is construed as offering a scientific explanation and meaning; the seven days must accordingly be twenty-four hour periods. The story of creation, they assume, can and must be proved scientifically, and creation scientists seek to show how evolutionary findings can be explained by reference to Noah's flood and other biblical events. In this, fundamentalists implicitly agree that science has become the arbiter of truth. Like the UFO cults, this modernist "religion" can rightly be labeled pseudoscientific.

Science in the modern world holds power and authority similar to that of the medieval church in its time. Pseudoscience makes an appeal to this scientific authority, as evidenced by the UFO cults and fundamentalist rhetoric. One recurrent theme in *The Demon-Haunted World* and in the writing of scientists and early moderns in general is that authority is not to be trusted. Let us inquire then, what are the consequences of the scientific hegemony? It may come as a surprise to scientists, but the critics of the modern world are legion, both from

philosophical and ethical viewpoints as well as from social and political. How do these criticisms bear on the relationship of science and religion?

Sagan maintains that science is morally neutral, that it is only a way to develop tools and technologies that can be used in any way, for either good or evil. Yet it is hard to image how a thermonuclear bomb could be used for good, and Sagan devotes a chapter to demonizing Edward Teller, father of the H-bomb, as a scapegoat for all scientists (pp. 284–89). I am willing to grant for the sake of argument that science as the ground for technology is morally neutral—guns don't kill people; people do. The problem is that science entails much more than merely making tools. Science should not be reduced to technology. Science involves a number of commitments that also serve as a foundation for modern thought; it is a way of knowing. These include metaphysical commitments such as "there is only physical matter in the universe" and epistemological commitments like "empirical data from the senses is the only certain source of knowledge." The application of these philosophical commitments and the reduction of phenomena to "physical" explanations has profound consequences, some of them moral in character.

The scientific metaphor of choice in the early modern period was the clockwork universe, the idea that everything could be explained in terms of the physical workings of a machine. In the words of philosopher and theologian Martin Buber, modern minds see the universe as an "it," as an object, a thing to be explained mechanically. In contrast, the religious worldview of premoderns saw the universe as a "thou," as an organic being full of purpose and life, to whom we *relate,* instead of explaining it away. As this enchanted worldview is lost, it becomes natural to see humans as mechanical cogs in the wheel, part of the industrial machinery. Although for the most part people still treat each other as conscious subjects rather than objects, there are attempts to describe consciousness in physical terms; the dominant trend is toward treating humans like mere machines—to be drugged if tired, unhappy, or rowdy at school. Anything to maximize the work efficiency, the pleasure, and so forth.

Much is made in our modern secular society about the tendency of religions to lead to conflict and war. It is true that the Crusades, the Inquisition, and the current strife in the Middle East have religious roots, though they also have cultural and economic dimensions. The reduction of humans to machines, however, has had a dramatic impact on the twentieth century, where millions of people died in two great world wars that had nothing to do with religion. Armed with the technologies of the day, the Nazis efficiently gassed millions. What struck observer Hannah Arendt about Eichmann, architect of the Nazi death industry, was the "banality of evil"—this bland and impersonal bureaucrat destroyed millions of lives with machinelike precision and efficiency. In the Soviet Union, followers of Marx covertly tortured and killed at least twenty million of their fellow citizens. There is plenty of darkness in the human heart, as Sagan amply demonstrates in this book, but it is not unique to religion, nor has it been cured by scientific atheism or other modernist ideologies.

The ancient idea of knowledge included the idea that knowledge is virtue, understood as human excellence. To know something in a mechanical universe, however, is to learn how to control it. Thus we have the famous phrase of Francis Bacon: "knowledge is power." This idea has profoundly impacted the modern world. For centuries, the primary selling point for scientific research has been that it will help us control the world to our own ends and develop weapons to destroy our enemies. This imperialist urge has led to tragic consequences, including our destruction of the environment and the Western domination, during the colonial period, of nearly the entire world's population. Sagan argues that science is linked with freedom and democracy; this may be true for the European cultures freed from tyranny in the modern era, but the same emancipated Europeans then used scientific knowledge (including racist biology) to enslave the rest of the world. The production of scientific knowledge is so tightly linked to the imperialistic view that it is nearly certain to be used for domination first, rather than for building people up.

In keeping with a skeptical view of authority, we might question Sagan's motives in writing this book. His passionate attack on

superstition and religion and his promotion of scientific thinking can be seen as the latest salvo in a war for the worldview of the Western mind that has been ongoing for four centuries. The stakes have been raised recently by the postmodern movement and the failure of religion to disappear as a force in society. The modernist consensus is breaking down. In response, Sagan argues that scientists—with the end of the cold war—need to appeal more to the public to maintain the flow of research funding (p. 334); he urges public support for basic science (curiosity-based research, p. 397), and he argues strongly for more science education for American children (p. 327). I am not arguing that Sagan is dishonest or insincere, only that he has an agenda and that his powerful rhetoric seeks to convert the minds of the public for science's gain.

I argue that although technology may be neutral, science comes with some unchallenged philosophical baggage that has been damaging at several levels. What then forces us into these philosophical commitments? Absolutely nothing. We only accept them because science works.[20] Scientists accept the materialist metaphysics on faith. Some accept it as a methodological assumption, useful for building consensus and focusing on data all can agree on. Others take a strong metaphysical stance and deny that anything else exists. This latter extreme view is "'*scientism,* the philosophical belief . . . that we are *nothing but* material beings,'" as an article of faith, held with the emotional tenacity of born-again fundamentalism (p. 267). As explained by Harvard biologist Richard Lewontin:

> We take the side of science *in spite* of the patent absurdity of some of its constructs, *in spite* of its failure to fulfill many of its extravagant promises of health and life, *in spite* of the tolerance of the scientific community for unsubstantiated just-so stories, because we have a prior commitment, a commitment to materialism. It is not that the methods and institutions of

20. Philosopher E. A. Burtt argues in *The Metaphysical Foundations of Modern Science* (Atlantic Highlands, NJ: Humanities, 1980) that the concepts of time, space, matter, and causality forged by Galileo and codified in Newton's work are philosophically problematic and unchallenged due to the successes of science.

> science somehow compel us to accept a material explanation of the phenomenal world, but, on the contrary, that we are forced by our *a priori* adherence to material causes to create an apparatus of investigation and a set of concepts that produce material explanations, no matter how counterintuitive, no matter how mystifying to the uninitiated.[21]

Lewontin argues that there is nothing that compels us to accept science's philosophical commitments, such as materialism. Rather, these commitments are taken *a priori,* as it were, on faith.

Sagan defends his own materialist commitment or "faith": "If a given phenomenon can already be plausibly understood in terms of matter and energy, why should we hypothesize that something else—something for which there is as yet no other good evidence—is responsible?" (p. 301). When the ideas in this sentence are unpacked, however, it is clear that "a given phenomenon" only includes the kind of physical phenomena that science explains with material and efficient causes. If I were to accept an explanation of the purpose of my life in terms of matter and energy, the second law of thermodynamics demands that my understanding be very bleak indeed. Can science account for everything we would wish to explain and understand? It seems that "understanding" for Sagan is synonymous with "mechanistic understanding." Finally, his reference to evidence raises the question of what exactly is admissible as evidence for a given claim.

Sagan and the Philosophy of Science

What counts as evidence? Everyone agrees that evidence should be important in determining (or testing) our beliefs and actions. The problem is that the notion of evidence can be very slippery and hard to pin down. This is particularly true for constructs such as electrons or deity that cannot be perceived immediately by the senses.

21. Richard Lewontin, "Billions and Billions of Demons," *The New York Review of Books* (9 January 1997): 13, as quoted in Dan Burton and David Grandy, *Magic, Mystery and Science: The Occult in Western Civilization* (Bloomington: Indiana University Press, 2004), 328.

After considering what Sagan would consider evidence of spiritual or religious tenets, I will review some insights from twentieth-century philosophy of science about the relationship between theory and evidence.

Here is one experiment that Sagan suggests to test the validity of religion: "Is the Eucharist, as the [Catholic] Church teaches, in fact, and not just as productive metaphor, the flesh of Jesus Christ, or is it—chemically, microscopically, and in other ways—just a wafer handed to you by a priest?" (p. 275). What about the effects of prayer? "The Victorian statistician Francis Galton argued that—other things being equal—British monarchs ought to be very long-lived, because millions of people all over the world daily intoned the heartfelt mantra 'God Save the Queen.' . . . Yet, he showed, if anything, they don't live as long as other members of the wealthy and pampered aristocratic class. . . . These collective prayers failed. Their failure constitutes data" (pp. 276–77). And my personal favorite: "Are there humans populating innumerable other planets, as the Latter Day Saints teach?" (p. 275). It is clear throughout the text that Sagan expects to test (and refute) religious ideas on scientific grounds, admitting only what he thinks of as scientific evidence: quantitative data of physical objects collected through the senses and reliable instrumentation.

Sagan argues that all religious claims are literally nonsense if they are not supported by his kind of scientific evidence. He describes a scenario in which an invisible dragon is in his garage. The experiments suggested by a skeptic are met with reasons why they would fail to detect the dragon. "If there's no way to disprove my contention, no conceivable experiment that would count against it, what does it mean to say that my dragon exists?" (p. 171). In the absence of experimental, hard evidence, the claim is simply meaningless. This idea stems from a group of philosophers in the early part of the twentieth century in Europe who called themselves logical positivists.[22] They sought to give a logical foundation to science, rebelling against the perceived deficiencies of all the earlier philosophical traditions. A scientific philosophy of

22. Peter Godfrey-Smith, *Truth and Reality* (Chicago: University of Chicago Press, 2003), 19–38.

language was crucial to their approach; according to their "verification principle," a sentence is meaningful if and only if it can be empirically verified. "What gives one the right to believe in the existence of a certain material thing is simply the fact that one has certain sensations: for, whether one realises it or not, to say that the thing exists is equivalent to saying that such sensations are obtainable."[23] Thus language itself was directly tied to observation in the scientific sense.

The logical positivist movement was extinct by the 1960s. One reason was the development of different ideas in the philosophy of language. Another was that the positivists were unable to create a logical foundation for science that would solve the problem of induction: no finite number of observations can logically warrant a statement true since we have no guarantee that it will not be different in the future. For example, in order for the statement "all ravens are black" to have meaning, every possible raven would have to be examined to inspect its color. Merely checking the color of ten ravens is insufficient, because the eleventh may be white, disproving the thesis. There is no logical guarantee that the sun will rise tomorrow—pragmatically, of course, it would be silly to assume that it would not, but we do not have deductive certainty in the matter. The problem of induction snowballed into further problems for the logical positivists: observations cannot be held to confirm a statement or give it meaning. Ultimately they were forced to back down from their strong views about language and sensory experiences, such as Sagan endorsed above.

Karl Popper came up with a solution to their dilemma that is immensely popular with scientists: observation can never confirm a theory, but it can disprove it. Merely seeing one white raven will disprove the theory that all ravens are black. He used this idea as a criterion to determine what is scientific and what is not. A scientific theory is one that is potentially "falsifiable"—that is, it exposes itself to risk by proposing experiments that can directly refute it.[24] Marxism

23. Alfred J. Ayer, *Language, Truth and Logic* (New York: Dover, 1952), 50.

24. Karl R. Popper, "The Problem of Demarcation," in *Popper Selections,* ed. David Miller (Princeton: Princeton University Press, 1985), 118–30, quotation on 128. See also Godfrey-Smith, *Theory and Reality,* 57–74.

and Freudian psychoanalysis, according to Popper, are nonscientific because they are not open to being falsified. If you are sexually attracted to your mother, that is an Oedipus complex, says Freud, but if not, that is a repressed Oedipus complex. Either way Freud can explain the phenomenon.

Sagan is completely taken in by Popper's falsifiability theory. In his baloney detection kit he includes the directive "Always ask whether the hypothesis can be, at least in principle, falsified. Propositions that are untestable, unfalsifiable are not worth much" (p. 211). Regarding the UFO phenomenon, he writes that their "'explanations' can explain anything, and therefore in fact nothing" (p. 181).

The reason for the failure of the falsifiability theory is instructive. It turns out that there is no sound way to falsify a theory, in the same way that no amount of evidence can logically confirm a theory. One major trouble that Popper runs into is holism about testing. We cannot test hypotheses in isolation—one sentence and sense datum at a time—but only complex networks of claims and assumptions.[25] Should the experiment give a negative result, it does not identify the point in the chain of reasoning and assumptions where the problem lies. If, for example, I produce a white raven, you might argue that it is an albino raven, that it fell into a vat of bleach, or that it is not a raven at all but another species entirely. There is no logical step that compels you to refute your theory that all ravens are black; you can merely deny the reliability of instrumentation, the accuracy of the observation, or the relevance of it to your theory. You could even alter the theory slightly to accommodate the new finding. W. V. Quine wrote that our theories "face the tribunal of sense experience not individually but only as a corporate body."[26] These ideas about holism played an important role in the eventual rejection of Popper's ideas by philosophers, as well as the decline of logical positivism.

Admittedly, discounting the white raven observation in the example above does seem like special pleading. What constitutes special

25. Godfrey-Smith, *Theory and Reality,* 31–32.

26. W. V. Quine, "Main Trends in Recent Philosophy: Two Dogmas of Empiricism," *Philosophical Review* 60 (1951): 38.

pleading is not nearly so clear in most cases, in which the theory does not involve objects that are directly visible. In many cases, science now asks us to ignore the evidence of our own eyes in favor of abstract theories. Consider for a moment what evidence you have that the earth goes around the sun. It looks to my eyes like the sun comes up in the morning and goes down at night while the earth is at rest. I have never experienced anything with my own senses that would convince me that the earth revolves around the sun. Should this evidence refute or falsify the Copernican hypothesis in my mind? Should I reject the authority of the learned doctors of science in favor of my own observations?

Galileo famously wrote of Copernicus how he admired the fact that Copernicus let "'reason so conquer sense that, in defiance of the latter, the former became the mistress of [his] belief.'"[27] In other words, he admired that Copernicus ignored the sensory evidence and was guided by simplicity, parsimony, and reason. The weight of evidence of the day was against the Copernican hypothesis, and it was not until sixty years after his death that evidence was obtained to confirm the heliocentric model. New theories often conflict with some evidence, and scientists work hard to explain the outliers away. As Sagan writes, "Everything hinges on the matter of evidence" (p. 69)—but what evidence, and who decides?

An event or observation counts as a fact—as evidence—only within the context of a theory, only when supported by a whole complex network of other evidences and assumptions. This point was clearly articulated by Thomas Kuhn in his book *The Structure of Scientific Revolutions*. Kuhn argues that successful scientific achievements act as models for future researchers. These models consist of both an experimental exemplar and the associated social norms of what constitutes good science. Within a group of researchers guided by a single paradigm, scientists largely agree on what constitutes evidence and what questions are worth addressing. With agreement on these methodological issues, they can spend their money and time addressing the remaining troublesome

27. Quoted in Steven Shapin, *The Scientific Revolution* (Chicago: University of Chicago Press, 1996), 93.

details. But between two paradigms, researchers cannot agree on common values or questions or even on what constitutes evidence. When one paradigm fails in a scientific revolution (as did Newtonian physics at the beginning of the twentieth century), there is no logical argument that compels a scientist to adopt one paradigm or another. The very "facts" that count as evidence in one paradigm may very well not count as evidence in another. The concept of evidence is dependent on theory in deciding between two competing paradigms.[28]

Our knowledge is necessarily perceived through our senses and our minds, cobbled together in a complex network of ideas, sensory data, and beliefs. Scientists create theories to explain a vast array of phenomena, and what is really important is the description and predictive power, not the correlation between theoretical constructs like the electron and reality. We can never *see* the electron as it really is, but can ascertain its characteristics only indirectly through experiments and inferences. Many examples throughout the history of science reveal that scientific progress has been slowed by reliance on metaphors or assumptions. For example, the clockwork metaphor and the philosophical commitment to mechanism made it very difficult for seventeen-century physicists to accept Newton's law of gravitation. Although his mathematical laws describe the phenomena quite well, the mechanists were furious that he would suggest that two bodies can act on each other at a distance. Such an idea was associated with the hermetic tradition and was anathema to mechanical philosophers.[29] In more recent times, a controversy surrounded the propagation of light in a vacuum. Many physicists still demanded a mechani-

28. Though many have read Kuhn as a relativist, his later writings seem to suggest that Kuhn respected science and believed that it can make progress—not growing closer and closer to the "truth" of what is really "out there," but by ensuring that the number of problems solved increases, particularly the ones that we practically want answered at a given time. This pragmatic increase in problem-solving power is a kind of progress guaranteed by the social structure of the scientific community: "the nature of [scientific] communities provides a virtual guarantee that both the list of problems solved by science and the precision of individual problem-solutions will grow and grow." Thomas Kuhn, *The Structure of Scientific Revolutions,* 3rd ed. (Chicago: University of Chicago Press, 1996), 170.

29. Burton and Grandy, *Magic, Mystery and Science,* 40–41.

cal model. The great twentieth-century American physicist Richard Feynman wrote, "'Today, we understand better that what counts are the equations themselves and not the model used to get them. We may only question whether the equations are true or false'" (p. 391). Science works best, then, when it doesn't concern itself too much with metaphysics but focuses on developing theories that are descriptively useful.

Sagan and Authority

One component that helps determine our worldview—our complex web of assumptions, thoughts, and beliefs about ourselves and the world around us—is knowledge gained from other human beings, or knowledge from authority. Hilary Putnam has argued against the positivist conception of language, the idea that we cannot represent objects with words unless we have a direct, immediate sensory experience of them. Although I know that there are trees called elms and other trees called birches, I could not tell you what the difference is between them. Putnam writes, "This shows that the determination of reference is social and not individual. . . . you and I both defer to experts who can tell elms from beeches."[30] Putnam argues that someone with knowledge of the two varieties of trees can instruct us, taking advantage of the distinction between the two that our minds have already made. The fact that we can obtain knowledge from our ancestors and do not require that it be hardwired into our genes is one of the key innovations that sets humans apart from other animals. Although not a foolproof marker, authority is a very useful shortcut to gaining knowledge.

Sagan's *The Demon-Haunted World* is a no-holds-barred attack on trusting authority. He wishes that every foreigner taking the oath to become a U.S. citizen would be required to pledge "'I promise to question everything my leaders tell me'" (p. 427). Why should we take a skeptical attitude toward all authority? Sagan repeatedly reminds

30. Hilary Putnam, Reason, *Truth and History* (Cambridge: Cambridge University Press, 1981), 18.

us that if we do not, we will be taken advantage of: "Credulous acceptance of baloney can cost you money; that's what P. T. Barnum meant when he said, 'There's a sucker born every minute'" (p. 209). If we don't adopt skepticism, "we risk becoming a nation of suckers, a world of suckers, up for grabs by the next charlatan who saunters along" (p. 39). Or most pointedly, "Gullibility kills" (p. 218). The whole book resonates with this rhetoric of fear of manipulation. Latter-day Saints may be reminded of similar teachings of Korihor: "I do not teach this people to bind themselves down under the foolish ordinances and performances which are laid down by ancient priests, to usurp power and authority over them" (Alma 30:23). Sagan clearly thinks that religious believers are "suckers" and intends to frighten them out of religious belief and into his scientism—a set of truths which are somehow demonstrable.

Sagan writes, "One of the great commandments of science is 'Mistrust arguments from authority'" (p. 28). In this deliciously ironic sentence, Sagan offers us an argument from authority that attempts to refute arguments from authority. Sagan probably means by this that science requires us to mistrust certain kinds of authority. Certainly the early modern scientific writers dwelt on this theme extensively in their battle with the entrenched scholastic philosophers.

What role does skepticism play within science, and why do scientists write about it so often? (Note that whenever someone advises you to disregard authority, they really mean that you should trust them and their authority instead of whatever authority you were previously trusting.) Skepticism is a methodological tool that is essential to science, a way of thinking that is at the front of scientists' minds continually. Yet scientific training is very authoritarian, demanding, and rigid. Students are indoctrinated with a paradigm developed by past researchers in their field. They learn the vocabulary, the key experiments, the right questions to ask—not from firsthand experience but by relying on the authority of professors and textbooks. Ninety-nine percent or more of all the scientific truths I know were learned in this manner. Then, suddenly, students are thrust into graduate school and expected to set up novel experiments and produce new data, theo-

ries, and knowledge. In order to do this effectively and to test new ideas produced by others, graduate students and professional scientists learn to be skeptical of new findings. The thing that a scientist fears the most is being thought stupid by her peers (which is clearly reflected in Sagan's writing).

What makes this methodological skepticism possible?—the shared background of scientists working within an authoritarian paradigm. They read the same textbooks, use the same jargon, agree on the same questions. Scientists achieve consensus better than any other field of knowledge; this is done by limiting the sphere of reality to be studied to the material world under very specific constraints. If these methodological problems were not shelved from discussion, science would never progress. Branches of science that agree about fundamentals can move on to solving problems. The key point is that this social structure (including the indoctrination of students) and the common paradigm shared by scientists in a field of research are what make methodological skepticism possible. As historian Steven Shapin writes, "It should, therefore, be obvious that each act of distrust would be predicated upon an overall framework of trust, and, indeed, all distrust presupposes a system of takings-for-granted which make *this instance* of distrust possible."[31]

It is natural for scientists to try to apply methodological skepticism outside the realm of testing novel discoveries. By expanding this methodological tool into a global epistemological one, however, scientists make a serious philosophical mistake. This mistake is analogous to one discussed above—namely, conflating methodological materialism with a global "metaphysical" stance. Tools that were intended to build consensus and test knowledge in studying the natural world become uncritical philosophical commitments in the writings of Sagan and other scientists. I am not saying that these are bad methodological stances, only that it is a mistake to assume they will have the same effect outside of the context of scientific experiments and theories. For without the social ties of consensus, skepticism can backfire.

31. Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago: University of Chicago Press, 1994), 19.

There are people willing to disbelieve nearly any truth imaginable. Some groups deny the existence of the Holocaust, the reality that astronauts landed on the moon, and even the fact that the world is round. And why not? What immediate knowledge do the majority of people have of these events? Our knowledge of them is based on trust; skepticism is always a possible move. No doubt Sagan would consider these acts of skepticism absurd, or even dangerous. But consistency demands it—mistrust of authority applies equally to history and science, not just religion.

Skepticism is particularly dangerous because it breaks the moral order of trust that makes our lives possible. Consider the experiments done by sociologist Harold Garfinkel:

> Garfinkel asked some of his graduate students to go away and perform some skepticism with respect to their everyday lives. Put another way, they were requested to act on the assumption that another person was attempting to lie to them about a reported state of affairs. . . . [S]tudents reported that convincing displays of distrust were extremely difficult to perform and maintain. One student distrusted a bus driver's assurance about the route that would be taken, while a "housewife" student distrusted her husband's account of why he was home late the night before. Both situations immediately "turned serious"—reaction to even the most straightforward and apparently inconsequential distrust was often hostility of a quite explosive kind.[32]

These experiments show how closely linked knowledge is with the moral order, through trust. An epistemological act, an act of skepticism, is perceived as a personal attack.

In the mythology of the early modern scientists, "'there was no need for any man to appeal to authority in matters of truth because each man carried the sources of knowledge in himself,'" writes Popper.[33] But there is no such thing as an individual knower. Our very

32. Shapin, *Social History of Truth*, 34–35.
33. Shapin, *Social History of Truth,* 16.

thought, our very language, is a phenomenon completely dependent upon a social context; it is only through comparing our experiences with those of others, with the world, and with our thoughts that we can achieve any knowledge at all.[34] According to Shapin, "It is incorrect to say that we can ever have experience outside a nexus of trust *of some kind*."[35]

All knowledge is social. Ironically, the scientific and industrial revolutions have so fragmented knowledge that the individual knower is further from determining the truth herself than ever before. The amount of available information is overwhelming and the founts of new knowledge are too far removed from any given individual. The modern seeker for truth must therefore rely far more heavily on trust than the medieval peasant did. The appeals for skepticism of authority in Sagan's *The Demon-Haunted World* should be read as demands for empirical, physical evidence for claims that can be tested scientifically. If someone tells you that magnet therapy can cure your bad back, appeal to the *New England Journal of Medicine,* a trustworthy authority on empirical medical science. If instead someone you trust tells you that God exists and he loves you, the claim needs to be tested or examined in a different way. Skepticism and demands for physical evidence, methods appropriate to scientific communities and descriptions of the natural world, cannot be used to address moral and religious claims.

On Religious Knowledge

According to Sagan, religious knowledge is not possible. He explains religious experiences as the mere misfiring of neurons in the brain or as hallucinations, induced by drug use, starvation, or insomnia. Perhaps Sagan believes that by explaining the mechanism used by some cultures to achieve mystic states, he can explain away all the phenomena that constitute religious experience.

Researchers in the natural sciences are committed to certain methodological assumptions, including the materialist commitment

34. Donald Davidson, "Three Varieties of Knowledge," in *A. J. Ayer Memorial Essays,* ed. A. Phillips Griffiths (Cambridge: Cambridge University Press, 1991), 153–66.

35. Shapin, *Social History of Truth,* 21.

that causes and effects must be explained in purely physical terms. Furthermore, scientific knowledge must be expressed as objectively as possible, following logical arguments based on empirical observations. Arguments based on emotional, moral, or authoritarian considerations have no place in a scientific study. Outside the context of scientific discussion of the natural world, however, these commitments are highly problematic. Sagan argues so passionately for science that he refuses to admit that any other mode of knowledge is possible.[36] Science, for Sagan, is the sole source and arbiter of truth—recall his proposed scientific tests of religious belief; everything else is simply hallucination and wishful thinking. However, this belief, often referred to as scientism or positivism, is simply untenable.

The fact is that we are not purely rational beings solely interested in describing and controlling the natural world around us. One insight of Freud and the psychologists is that much of our motivation is hidden below the surface in the subconscious. When these currents surface to alter our behavior, we construct a rational framework to explain why we acted in a certain way. Our nonrational nature includes varied emotional, moral, ethical, religious, and biological components. To assert that science is the only source of knowledge is to deny the validity of contributions of these parts of our character and nature. Answers to problems such as "Does she love me?" and "Should I give my own resources to help the less fortunate?" require emotional or moral knowledge not obtainable by scientific means. The notion that these types of knowledge do not belong in scientific explanations does not mean that they do not have other valid uses.

Religion consists of "constructs of the heart" distinct from science's constructs "of the mind," writes anthropologist Evans-Pritchard.[37] The substrate for religious knowledge is experience of a different character than science—the experience of the sacred described by Eliade rather

36. This was essentially the church's dispute with Galileo—his belief that science was the only source of knowledge. For a highly readable review of the Galileo affair, see Wade Rowland, *Galileo's Mistake: A New Look at the Epic Confrontation between Galileo and the Church* (New York: Arcade, 2003).

37. E. E. Evans-Pritchard, *Theories of Primitive Religion* (Oxford: Oxford University Press, 1965), 115.

than the use of the senses to study the physical world. These experiences have a transcendent character to them, seeming otherworldly, contrasting the reality and majesty of the sacred with the nothingness of man. As Moses remarked following his vision of all of creation: "Now, for this cause I know that man is nothing, which thing I never had supposed" (Moses 1:10). The emotions that accompany religious experiences vary from person to person: some people feel an emotional warmth associated with spiritual experiences, the so-called "burning in the bosom," and many report a feeling of calm and peace even in trying situations. Joseph Smith wrote about "pure intelligence" and "sudden strokes of ideas" coming into one's mind from inspiration;[38] God can reveal truths to the whole being, both to the mind and to the heart.[39]

Apart from the empirical data of religious experience, several a priori arguments have been proposed for the necessary existence of God. Catholic thinkers, for example, often follow Thomas Aquinas in maintaining that God is a logical necessity. However, the relationship between the "God of the philosophers" and the God of the Bible is tenuous at best. Recent philosophy has shied away from such arguments. William Paley at the turn of the nineteenth century offered a natural theology based on the argument from design: just as we can infer from finding a watch on the beach that there must be a watchmaker, so the complexity and fine-tuning of the universe for human habitation are evidence of a divine will and purpose. This argument has been refuted by the explanation of evolution by natural selection first put forth by Darwin and Wallace; many fundamentalist religions that still put stock in the argument from design are therefore rabidly anti-evolution. A third argument for God is a modern historical interpretation of the Bible, arguing that the miracles of Jesus were proof of the truth of Christianity. David Hume, in his *Dialogues concerning Natural Religion,* had already written an effective rebuttal to this line of thinking: extraordinary claims require extraordinary evidence,

38. Joseph Smith Jr., *Teachings of the Prophet Joseph Smith,* comp. Joseph Fielding Smith (Salt Lake City: Deseret Book, 1976), 151.

39. "Yea, behold, I will tell you in your mind and in your heart, by the Holy Ghost" (D&C 8:2).

and it is more reasonable to assume that there were errors or exaggerations in the witnesses' testimony of Jesus's miracles than to posit supernatural events. Although these three arguments for God's existence strengthen believers at times, they do not ultimately convince skeptics, nor do they serve as the real basis of faith for believers.

Believers recognize the source of their belief as experiential—based on direct involvement with the sacred. Among Latter-day Saints, the traditional arguments for God are practically nonexistent. However, we find in the writings of Joseph Smith an argument for the existence of God—he obtained that knowledge from direct experience. This emphasis on experience has carried over into our time: Elder Boyd K. Packer responded to a skeptic's inquiry, "Tell me *how* you know," with descriptions of his experiences, using words like Spirit, witness, prayer, and faith. When the skeptic responded, "I don't know what you are talking about," Elder Packer asked him if he knew what salt tasted like. "He could not convey, in words alone, so ordinary an experience as tasting salt. . . . [I said] 'My friend, spiritually speaking, I have tasted salt. I am no more able to convey to you in words how this knowledge has come than you are to tell me what salt tastes like.'"[40] This experience highlights the difficulty in bridging the gap between atheists and believers, for without the experiences as a referent, words mean different things to the two groups.

Sagan quotes Morris Cohen regarding the openness and willingness to experiment in science and religion: "'To be sure, the vast majority of people who are untrained can accept the results of science only on authority. But there is obviously an important difference between an establishment that is open and invites every one to come, study its methods, and suggest improvement and one that regards the questioning of its credentials as due to wickedness of heart'" (p. 251). I believe that this sense of openness and testing of knowledge for oneself is one way in which Mormonism emphasizes its empirical or experiential epistemology. The founding narratives of Mormonism—Joseph's first vision, the coming forth of the Book of Mormon, the early conversion stories—emphasize the importance of individual experiences of

40. Boyd K. Packer, "The Candle of the Lord," *Ensign,* January 1983, 51.

the sacred. These experiences open up access to spiritual or sacred knowledge. In a church that is growing rapidly and is concerned with sharing the gospel, the missionary program focuses on creating sacred experiences for those investigating the church, so that they can know for themselves if a principle is true. This is especially the case in testing Moroni's promise regarding the Book of Mormon, found in Moroni 10:3–5.[41]

The idea of experimenting to obtain spiritual confirmations and knowledge occurs both in the Bible and the Book of Mormon. "My doctrine is not mine, but his that sent me. If any man will do his will, he shall know of the doctrine, whether it be of God, or whether I speak of myself" (John 7:16–17). Alma's oft-quoted sermon on faith to the Zoramites likewise advises the people to "experiment upon my words" (Alma 32:27) to know of their surety. In the first edition of the Book of Mormon, Alma chapters 30–35 were contained in a single chapter (chapter XVI). These verses would have immediately followed the challenges by Korihor that the priests were taking advantage of the people and that they had no sure knowledge of the gospel or of Christ. The sermon on faith can be seen as a response to these challenges, perhaps inserted in the narrative by Alma or Mormon for this purpose. Alma compares the word unto a seed:

> Now, if ye give place, that a seed may be planted in your heart, behold, if it be a true seed, or a good seed, if ye do not cast it out by your unbelief, that ye will resist the Spirit of the Lord, behold, it will begin to swell within your breasts; and when you feel these swelling motions, ye will begin to say within yourselves—It must needs be that this is a good seed, or that the word is good, for it beginneth to enlarge my

41. There are undoubtedly some who will argue with this premise and insist that the Church of Jesus Christ of Latter-day Saints is strongly authoritarian. But it is exactly this church structure and vertical authority system that allows such epistemological freedom. If each individual was free to receive revelation from God with no checks and balances, the community would fly apart into anarchy. Contrast this arrangement with the situation in Judaism: the Jews have little formal structure to their religious community, but their rules of religious epistemology are very strict (e.g., interpretations of the Torah). This idea was suggested to me by Nathan Oman.

> soul; yea, it beginneth to enlighten my understanding, yea, it beginneth to be delicious to me. (Alma 32:28)

One of Alma's conditions for the successful testing of his words is to not cast it out by unbelief. The importance of faith in testing religious propositions is underscored in Moroni's exhortation, "Dispute not because ye see not, for ye receive no witness until after the trial of your faith" (Ether 12:6). We can only receive a witness of spiritual truths after we demonstrate our willingness to test them with believing hearts. The scientific skeptic might rebut that this is a convenient way out, proving that religion is not falsifiable.[42] After all, if the experiment fails and the investigator is unconvinced of the truth of a principle, a believer could always argue that the experiment was not conducted correctly. Perhaps the investigator did not exercise enough faith. As noted above, this skeptical move is always possible, even in science, and is one of the prime reasons for the failure of Popper's falsifiability theory. At some point, both in science and in religion, we abandon propositions that we cannot verify, once they are no longer tenable in the complex web of assumptions and evidences surrounding them. One's emotional stance toward a proposition, while not included in scientific debates, is a crucial part of a methodology of gaining religious knowledge and in building constructs of the heart. Faith—a believing heart—is a prerequisite for religious experience.

Faith is a concept that is highly misunderstood by skeptics and believers alike. Many people seem to have in mind some kind of passive cognitive or emotional assent to a proposition in the absence of any evidence for that proposition. The content of the proposition (dogma) is passed down from on high by some authority and is accepted because it would be convenient or fulfilling if it were true. As Sagan writes, "At the heart of some pseudoscience (and some religion also, New Age and Old) is the idea that wishing makes it so" (p. 14). Perhaps this

42. A skeptic may likewise complain that experiments in religion are not scientific as they do not include control groups or statistical analysis of meaningful sample sizes. I am not claiming that these are scientific experiments, only that they are compatible with an empiricist epistemology. In matters of religion and morals, it may be unethical and impossible to perform true control experiments.

passive view comes from the familiar scripture, "Now faith is the substance of things hoped for, the evidence of things not seen" (Hebrews 11:1). In a more recent translation, however, the passage reads, "Now faith is the assurance of things hoped for, the conviction of things not seen."[43] As noted in the footnotes therein, "*Conviction* is not simply a subjective attitude; unseen realities are tested and 'proved' by experience."[44] The remainder of Hebrews 11 contains stories from the Old Testament of such proving experiences: Noah's faith in building the ark, Abraham's faith in sacrificing Isaac, Moses in defying Pharaoh, and so on, ultimately culminating in the beginning of chapter 12 with Jesus, "the author and finisher of our faith," who endured the cross and now sits at the right hand of God (Hebrews 12:2). These acts of faith are as much man testing God as they are God testing man. *To act with faith is to put your religious theory at risk*—the same core concept that Popper identified as characterizing good scientific theories.

The new translation and context of these verses in Hebrews give a much different picture as to the nature of faith. Faith is a conviction that spurs us on through hope to action and experimenting on the word. Mormon describes faith as the power by which we "may lay hold on every good thing" (Moroni 7:21)—a power of action, of discerning truth from error and increasing our collection of truth as we grow in faith. Faith breaks down into two components: an emotional trust in God and a willingness to experiment and try his word. These are not altogether different from the trust required for the cohesion of scientific communities and the experimental commitment of scientists. The added value of learning by faith is that the emotional commitment and requirement to act ensure that faith is a transformative power. We are changed by acts of faith in a way that mere intellectual assent to a scientific proposition can never achieve.

This experimental aspect of religion, highly emphasized in Mormonism, is neglected completely by Sagan and by many scientific thinkers. Sagan seems to think that religious belief is only supported

43. *The HarperCollins Study Bible: New Revised Standard Version,* ed. Wayne A. Meeks (New York: HarperCollins, 1993), 2263.

44. *HarperCollins Study Bible,* 2263.

by emotion, that we persist because it feels good and we wish it to be true. To the contrary, the results of experiments of faith provide the same kind of rational basis for belief as science. This point is made clearly in James's *Varieties of Religious Experience*. As an empiricist philosopher sympathetic to religion but not personally religious, James argues that an emotional state or appeal to the origin of a proposition is not a sign of its truth.[45] Just because an idea was revealed to me in an amazing transcendental experience does not make the idea true. For James, the pragmatist, it is the result of experimenting on the idea that marks truth, the change in the believer's life. "By their fruits ye shall know them" (Matthew 7:20) applies to truths as well as to people. Henry Eyring, a leading physical chemist in the early twentieth century, made this comment about his Mormon faith: "I have often met this question: 'Dr. Eyring, as a scientist, how can you accept revealed religion?' The answer is simple. The Gospel commits us only to the truth. The same pragmatic tests that apply in science apply to religion. Try it. Does it work?"[46]

Conclusion

Science and religion are two incomplete ways of approaching truth, both based on metaphysical and methodological assumptions that have no logical warrant. Both are always changing as we desire new practical results and as our values and desires change. There is no room for absolutism from either camp, for as individuals we do not have immediate access to reality—there is always an interpretive overlay. We perceive the world through our spiritual and sensory experiences in an individual, subjective manner. We can attempt to corroborate our experiences with others and cobble together a consensus based on our collective experiences. In both science and religion, we are aided in our search for truth by experiment, reason, and the insights of those that we trust.

45. James, *Varieties*, 15–16.
46. Henry Eyring, *The Faith of a Scientist* (Salt Lake City: Bookcraft, 1967), 103.

The thesis that science and religion are necessarily in conflict has been disproven by historians and philosophers of science.[47] Sometimes they do conflict because one or the other is dogmatic and absolutist; take, for example, the literal and absolutist readings of the Bible of the fundamentalists or the rabid positivism of those like the late Carl Sagan who avow scientism. Although I appreciate the reminders of the need for clear thinking and evidence, ultimately Sagan's *The Demon-Haunted World* offers little positive contribution to current dialogue concerning religion and science.

47. For an excellent historical characterization of their relations, see John H. Brooke, *Science and Religion: Some Historical Perspectives* (Cambridge: Cambridge University Press, 1991).