THE TRUTH IS OUT THERE

Michael Shermer

The 1990's über conspiracy-theory television series *The X-Files* was a decade-defining and culture-reflecting mosh pit of UFOs, extraterrestrials, psychics, demons, monsters, mutants, shape-shifters, serial killers, paranormal phenomena, urban legends turned real, corporate cabals and government cover-ups, and leakages unveiled by a deep-throat-like 'cigarette smoking man' character played, ironically, by real-life skeptic William B. Davis. Gillian Anderson's skeptical FBI agent Dana Scully played off David Duchovny's believing character Fox Mulder, whose slogans became posterized pop-culture catch-phrases 'I want to believe' and 'The truth is out there'.

As the show's creator-producer Chris Carter developed the series narrative arc, Scully and Mulder came to symbolize skeptics and believers in a psychological tug-of-war between reality and fantasy. So popular was *The X-Files* that it was parodied in a 1997 episode of *The Simpsons* entitled 'The Springfield Files,' in which Homer has an alien encounter in the woods after imbibing ten bottles of Red Tick Beer. The producers ingeniously employed Leonard Nimoy to voice the intro as he once did for his post-Spock run on the television mystery series *In Search of*. . ., that was a 1970's nonfiction version of *The X-Files*. Nimoy: 'The following tale of alien encounters is true. And by true, I mean false. It's all lies. But they're entertaining lies, and in the end isn't that the real truth? The answer is no.'

No squared. The postmodernist belief in the relativism of truth, coupled to the clicker culture of mass media where attention spans are measured in New York Minutes, leaves us with a bewildering array of truth claims packaged in infotainment units. It must be true – I saw it on television, the

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movies, the Internet. *The Twilight Zone, The Outer Limits*, *That's Incredible, The Sixth Sense, Poltergeist, Loose Change, Zeitgeist the Movie*. Mysteries, magic, myths, and monsters. The occult and the supernatural. Conspiracies and cabals. The face on Mars and aliens on Earth. Big Foot and Loch Ness. ESP and PSI. UFOs and ETIs. OBEs and NDEs. JFK, RFK, and MLK – alphabet conspiracies. Altered states and hypnotic regression. Remote viewing and astroprojection. Ouija Boards and Tarot Cards. Astrology and palm reading. Acupuncture and chiropractic. Repressed memories and false memories. Talking to the dead and listening to your inner child. It's all an obfuscating amalgam of theory and conjecture, reality and fantasy, non-fiction and science fiction. Darken the backdrop. Cast a shaft of light across the host's face. Cue dramatic music. *Trust no one. The truth is out there. I want to believe*.

I believe that the truth is out there but that it is rarely obvious and almost never full-proof. What I want to believe based on emotions and what I should believe based on evidence do not always coincide. I'm a skeptic not because I do not want to believe, but because I want to *know*. How can we tell the difference between what we would like to be true and what is actually true?

The answer is science. We live in the Age of Science where beliefs are supposed to be grounded in rock solid evidence and empirical data.

Science and the Null Hypothesis

Science begins with the *null hypothesis*. Although statisticians mean something very specific about this (having to do with comparing different sets of data), I am using the term *null hypothesis* in its more general sense that the hypothesis under investigation is not true (null) until proven otherwise. A null hypothesis states that X does not cause Y. If you think X does cause Y then the burden of proof is on you to provide convincing experimental data to reject the null hypothesis.

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The statistical standards of proof needed to reject the null hypothesis are substantial. Ideally, in a controlled experiment, we would like to be at least 99 percent confident that the results were not due to chance before we offer our provisional assent that the effect may be real. Everyone is familiar with the process already through news stories about the FDA approving a new drug after extensive clinical trials. The trials to which they refer involve sophisticated methods to test the claim that Drug X (say a statin drug) causes Disease Y (say heart disease linked to cholesterol) to decrease. The null hypothesis states that statins do not lower heart disease by lowering cholesterol. Rejecting the null hypothesis means that there was a statistically significant difference in rates of heart disease between the experimental group receiving the statins and the control group that did not.

Here is a relatively simple example of how this method of statistical significance works in relation to the null hypothesis to answer this question: can a psychic using ESP alone determine whether a playing card from a deck is red or black? Psychics typically claim that they can do this, but in my experience what people *say* they can do and what they can *actually* do are not always the same. How can we test this claim? Thumbing the cards down onto a table one by one with the psychic stating either red or black for each card, how many correct hits would the psychic need in order for us to conclude that the card color determinations were not due to chance? In this scenario, the null hypothesis is that the psychic will do no better than chance, and thus to reject the null hypothesis we will need to establish a figure for the number of correct hits needed in each round. By chance, we would expect the psychic to get about half correct. In a deck of 52 cards, half of which are red and half of which are black, random guessing or flipping a coin will produce, on average, 26 correct hits.

Of course, as anyone who has flipped coins for fun knows, 10 flips do not necessarily always result in 5 heads and 5 tails. There are streaks and deviations from

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symmetry – 6 heads and 4 tails, or 3 heads and 7 tails – all within the realm of chance. Or as anyone who has gambled at a roulette wheel knows, sometimes red comes up more than black, or vice versa, without any violations of chance and randomness. In fact, we count on such asymmetrical streaks in our betting schemes and hope that we're disciplined enough to walk away from the table during a temporary deviation from chance in our favor before it swings the other way.

So we can't just test our psychic on one short series of card guesses, because by chance the psychic may be expected to get a series of hits. We need to run multiple trials, in which some rounds may result in slightly below chance (say, 22, 23, 24, or 25 hits) and other rounds may result in slightly above chance (say, 27, 28, 29, or 30 hits). The variation may be even greater and still due to nothing but chance. What we need to determine is the number by which we can confidently reject the null hypothesis. In this example, that number is 35. The psychic would need to get 35 correct hits out of a 52-card deck in order for us to reject the null hypothesis at the 99 percent confidence level. The statistical method by which this figure is derived need not concern us here. The point is that even though 35 out of 52 doesn't sound like it would be that hard to obtain, in fact by chance alone it would be so unusual that we could confidently state ('at the 99 percent confidence level') that something else besides chance was going on here.

What might that something else be? It could be ESP. But it could be something else as well. Perhaps our controls were not tight enough. Maybe the psychic was getting the red/black information by some other normal (as opposed to paranormal) means of which we're not aware (such as the reflection of the card face in the table surface). Possibly the psychic was cheating and we don't know the method. I've seen James Randi do this very experiment with an entire deck of cards, resulting in two perfect piles of all red and all black cards. The magician Lennart Green shuffles and

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scrambles a deck of cards, fumbles with them for awhile as if he's all thumbs, clumsily pushes them back together, then proceeds to deal out four winning poker hands or an entire sequence of a suit in order, all while blindfolded. But Randi and Green are magicians and these are magic tricks. That I do not know how they are done does not make them real (paranormal) magic, and the fact that most scientists do not know how such magic tricks are done means we need to be even more vigilant in our controls when testing psychics, perhaps even attaching a magician to our research team. The argument from personal incredulity – if I can't explain it, then it must be true – does not hold water in science.

Even with all these controls in place, certainty still eludes science. The scientific method is the best tool ever devised to discriminate between true and false patterns, to distinguish between reality and fantasy, and to detect baloney, but we must always remember that we could be wrong. Rejecting the null hypothesis is not a warranty on truth, yet failure to reject the null hypothesis does not make the claim false. We must keep an open mind, but not so open that our brains fall out. Provisional truths are the best we can do.

Science and the Burden of Proof

The null hypothesis also means that the burden of proof is on the person asserting a positive claim, not on the skeptics to disprove it. I once appeared on *Larry King Live* to discuss UFOs (a perennial favorite of his), accompanied by a table full of UFOlogists (a 5-to-1 ratio of believers to skeptics seems to be the norm in television shows that cover such topics). Larry's questions for us skeptics typically miss this central tenet of science. ('Dr. Shermer, do you have an explanation for Mr. X's UFO sighting at three in the morning in Nowhere, Arizona?' If I don't, the assumption is that it must be extraterrestrial.) The burden of proof is not on the skeptics to disprove UFOs, it is on the UFO claimant to prove that it is extraterrestrial.

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Although we cannot run a controlled experiment that would yield a statistical probability of rejecting (or not) the null hypothesis that aliens are not visiting Earth, proof would be simple: show us an alien spacecraft or an extraterrestrial body. Until then, keep searching and get back to us when you have something. Unfortunately for UFOlogists, scientists cannot accept as definitive proof of alien visitation such evidence as blurry photographs, grainy videos, and anecdotes about spooky lights in the sky. Photographs and videos are often misperceived and can be easily doctored, and lights in the sky have many prosaic explanations: aerial flares, lighted balloons, experimental aircraft, helicopters, clouds, swamp gas, or even the planet Venus which, if you are driving on an undulating highway away from city lights, really does appear to be a bright light following your car. Nor will government documents with redacted (blacked out) paragraphs count as evidence for ET contact, because we know that governments keep secrets for a host of reasons having to do with military defense and national security. Yes, governments lie to their citizens, but lying about X does not make Y true. Terrestrial secrets do not equate to extraterrestrial cover-ups.

So many claims of this nature are based on *negative evidence*. That is, if science cannot explain X, then your explanation for X is necessarily true. Not so. In science lots of mysteries remain unexplained until further evidence arises, and problems are often left unsolved until another day. I recall a mystery in cosmology in the early 1990s whereby it appeared that there were stars older than the universe itself – the daughter was older than the mother! Thinking that I might have a hot story to write about that would reveal something deeply wrong with current cosmological models that I could publish in the inchoate days of *Skeptic* magazine, I first queried the Caltech cosmologist Kip Thorne, who assured me that the discrepancy was merely a problem in the current estimates of the age of the universe and that it would resolve itself in time with more data and better dating techniques. It did, as so many

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problems in science eventually do. In the meantime, it's okay to say: 'I don't know', 'I'm not sure', and 'Let's wait and see'.

Science and the Convergence Method

To be sure, not all claims are subject to laboratory experiments and statistical tests. There are many historical and inferential sciences that require nuanced analyses of data and a *convergence of evidence* from multiple lines of inquiry that point to an unmistakable conclusion. Just as detectives employ the convergence of evidence technique to deduce who most likely committed a crime, scientists employ the method to deduce the likeliest explanation for a particular phenomenon. Cosmologists reconstruct the history of the universe through a convergence of evidence from cosmology, astronomy, astrophysics, spectroscopy, general relativity, and quantum mechanics. Geologists reconstruct the history of the Earth through a convergence of evidence from geology, geophysics, and geochemistry. Archeologists piece together the history of a civilization from pollen grains, kitchen middens, potshards, tools, works of art, written sources, and other site-specific artifacts. Environmental scientists reconstruct climate history through the environmental sciences, meteorology, glaciology, planetary geology, geophysics, chemistry, biology, ecology, and others. Evolutionary biologists uncover and explain the history of life on earth from geology, paleontology, botany, zoology, biogeography, comparative anatomy and physiology, genetics, etc.

Even though these inferential sciences do not fit the model of experimental laboratory sciences, hypothesis testing can be employed nevertheless. Indeed, scientists working within such historical sciences must test hypotheses in order to avoid the confirmation bias, the hindsight bias, and many other cognitive biases that will surely color their interpretations of the data. As Frank Sulloway noted at

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the end of his scientific treatise on the psychology of history: 'When the mind is confronted with more information than it can absorb, it looks for meaningful (and usually confirmatory) patterns. As a consequence, we tend to minimize evidence that is incongruous with our expectations, causing the dominant worldview to bring about its own reaffirmation.' In fact, Sulloway suggests that Charles Darwin may well be the greatest historian who ever lived because he went out of his way to test his hypotheses about the history of life, and this became the foundation of his work culminating in *On the Origin of Species*, which revolutionized his field, changing it from genteel speculations by amateur naturalists to the rigorous science it is today. Darwin even employed his new science to the history of his own life, as Sulloway explains: 'Charles Darwin understood this human predilection for reaffirming the status quo. In his *Autobiography* he noted how quickly he tended to forget any fact that seemed to contradict his theories. He therefore made it a 'golden rule' to write this information down so that he would not overlook it. Like Darwin's golden rule, hypothesis testing overcomes certain limitations in how the human mind processes information.'

Science and the Comparative Method

How do you test a historical hypothesis? One way is through the *comparative method*, which was brilliantly employed by the U.C.L.A. geographer Jared Diamond in his book *Guns, Germs, and Steel*, in which he explains the differential rates of development between civilizations around the globe over the past 13,000 years. Why, Diamond asks, did Europeans colonize the Americas and Australia, rather than Native Americans and Australian Aborigines colonize Europe? Diamond rejects the hypothesis that inherited differences in abilities between the races precluded some groups from developing as fast as others. Instead Diamond proposes a biogeographical theory having

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to do with the availability of domesticated grains and animals to trigger the development of farming, metallurgy, writing, non-food-producing specialists, large populations, military and government bureaucracies, and other components that gave rise to Western cultures. Without these plants and animals, and a concatenation of other factors, none of these characteristics of our civilization could exist.

Employing the comparative method, Diamond compares Australia and Europe and notes that Australian Aborigines could not strap a plough to or mount the back of a kangaroo, as Europeans did the ox and horse. As well, indigenous wild grains that could be domesticated were few in number and located only in certain regions of the globe – those regions that saw the rise of the first civilizations. The East-West oriented axis of the Euro-Asia continent lent itself to diffusion of domesticated grains and animals as well as knowledge and ideas, so Europe was able to benefit much earlier from the domestication process. By comparison, the North-South oriented axis of the Americas, Africa, and the Asia-Malaysia-Australia corridor, did not lend itself to such fluid transportation, and thus those areas already not well suited biogeographically for farming could not even benefit from diffusion. In addition, through constant interactions with domesticated animals and other peoples, Euro-Asians developed immunities to numerous diseases that, when brought by them in the form of germs to Australia and the Americas, along with their guns and steel, produced a genocide on a hitherto unseen scale. A final comparative test is seen in the fact that in less than one generation modern Australian Aborigines can learn to fly planes, operate computers and do anything that any European inhabitant of Australia can do. Comparatively, when European farmers were transplanted to Greenland they went extinct when their environment changed, not because their genes devolved.

Such comparative methods are the result of *natural experiments of history*, numerous examples of which Diamond presents in his 2010 book of that title, including a

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timely study comparing Haiti to the Dominican Republic, both countries of which inhabit the same island but because of geopolitical differences one ended up dirt poor while the other flourishes. What happened? This is a *natural experiment of borders*. For example, adding a border between North and South Korea in 1945 resulted in dictatorship and poverty for North Korea and by 2008 an annual GDP of $13.34 billion and $555 per capita income, compared to South Korea's annual GDP of $929.1 billion, or $19,295 per capital income. Compare what the difference would be in your life between making $555 a year and $19,295 a year, and you can feel the power of the comparative method. The border that divides the island of Hispaniola is striking: on one side of the border the land is green and forested while on the other side the land is brown and treeless. This border is symbolic of many factors to compare, starting with geography. Rain-loaded weather fronts come from the east and dump their watery load on eastern Dominican Republic side of island, leaving the western side drier and with less fertile soils for agricultural productivity. Deforestation of the fewer trees on the Haitian side led to soil erosion, decreased soil fertility, loss of timber for the building industry and wood for charcoal fuel, heavier sediment loads in rivers and decreased watershed protection leading to lower hydroelectric power. This set up a negative feedback cycle of environmental degradation for Haiti.

Comparing the political history of the two sides of the island reveals a second set of factors at work. Christopher Columbus's brother Bartolomeo colonized Hispaniola in 1496 for Spain, establishing the capital at Santo Domingo on the egress of the Ozama River on the eastern side of the island. Two centuries later, during tensions between France and Spain, the Treaty of Ryswick in 1697 granted France dominion over the western half of the island, and the border was permanently established by the Treaty of Aranjuez in 1777. Because France was richer than Spain by this time and slavery was a integral part of its economy,

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it turned western Hispaniola into a center of slave trade with a population consisting of 85 percent of slaves, compared to the eastern half under Spain with only 10–15 percent slaves. The raw numbers are staggering: about 500,000 slaves in the western side of the island compared to only 15,000 to 30,000 slaves in the eastern side. For a time, despite the geographic difference that would have given Haiti a disadvantage, this economic difference resulted in Haiti being richer than the Dominican Republic. For a time. This prosperity led to a significantly greater population density which, when coupled to France's hunger for more timber being imported from Haiti, led to rapid deforestation and subsequent environmental squalor. Add to all of this the fact that the Haitian slaves developed their own Creole language spoken by no one else in the world, further isolated Haiti from the type of economic and cultural exchange that leads to prosperity.

When both the Haitians and Dominicans gained their independence in the nineteenth century we see unfolding yet another comparative difference. Haitian slave revolts were violent and Napoleon's intervention to try to restore order resulted in the Haitians distrusting Europeans and wanting nothing to do with future trade and investments, imports and exports, immigration and emigration, and coupled to the language barrier meant that Haiti did not benefit from these and other factors that build prosperity. By contrast, Dominican independence was relatively nonviolent and they shuttled back and forth for decades between independence and control by Spain, who in 1865 decided that it did not want the territory. Throughout this period the Dominicans spoke Spanish, developed exports, traded with European countries, attracted European investors and a diverse émigré population of Germans, Italians, Lebanese, and Austrians, who helped build a vibrant economy. Finally, even when both countries succumbed to the power of evil dictators in the mid 20th century, Rafael Trujillo's control of the Dominican Republic involved considerable economic growth because of his desire to

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personally enrich himself, and this led to a vibrant export industry (most of which he owned) along with importing scientists and foresters to help preserve the forests for his own personal use and profiteering through his logging companies. By contrast, Haiti's dictator François 'Papa Doc' Duvalier did none of this and instead further isolated the Haitians from the rest of the world.

Employing the comparison method with such natural experiments of history is no different from what sociologists and economists do in comparing natural experiments of society today. We cannot intentionally impoverish one group of people and then observe if their health, education, and crime rates change. But we can look around and find pockets of impoverished peoples in inner cities and then measure various factors and compare those to other socio-economic classes. The process is as rigorous a scientific methodology as any to be found in the experimental sciences. Once an inferential or historical science is well established through the accumulation of positive evidence it becomes a testable science.

Science and the Principle of Positive Evidence

The convergence of evidence method and the comparison method are routinely used by paleontologists and evolutionary biologists to test hypotheses about evolution, and the results accumulate in the form of positive evidence in support of the theory of evolution. For creationists to disprove evolution, they would need to unravel all these independent lines of evidence as well as construct a rival theory that can explain them better than the theory of evolution. They haven't, and instead employ only *negative evidence* in the form of 'if evolutionary biologists cannot present a natural explanation of X, then a supernatural explanation of X must be true'. Not so. The *principle of positive evidence* states that you must have positive evidence in favor of your theory and not just negative evidence against rival theories.

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The principle of *positive evidence* applies to all claims. Skeptics are from Missouri, the Show Me state. Show me positive evidence for your claim. Show me a Sasquatch body. Show me the archaeological artifacts from Atlantis. Show me a Ouija Board that spells words with securely blindfolded participants. Show me a Nostradamus quatrain that predicted World War II or 9/11 *before* (not after) the fact (postdictions don't count in science because of the hindsight bias). Show me the evidence that alternative medicines work better than placebos. Show me an ET or take me to the Mothership. Show me the Intelligent Designer. Show me God. Show me and I will believe.

Most people (scientists included) treat the God question separate from all these other claims. They are right to do so as long as the particular claim in question cannot – even in principle – be examined by science. But what might that include? Most religious claims are testable, such as prayer positively influencing healing. In this case, controlled experiments to date show no difference between prayed-for and not-prayed-for patients. What would compel me to believe would be something unequivocal, such as growing a new limb for an amputee. Amphibians can do it. The new science of regenerative medicine appears on the verge of being able to do it. Surely an omnipotent deity could do it.

Science and Belief

Homo rationalicus – that species of human who carefully weighs all decisions through cold hard logic and rational analysis of the data – is not only extinct but probably never existed. Mr. Spock is science fiction. And it's a good thing it is, because people who have suffered brain damage to the emotional networks in their brains – particularly their limbic system – find it nearly impossible to make the even simplest of decisions about the most mundane choices in life – which toothpaste to buy, for example: with so many brands and sizes and qualities and prices to consider, reason alone

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will leave you standing there in the store aisle frozen in indecision. Analysis paralysis. An emotional leap of faith beyond reason is often required to just to get through the day, let alone make the big decisions in life.

In the end, all of us are trying to make sense of the world, and nature has gifted us with a double-edged sword that cuts for and against. On one edge, our brains are the most complex and sophisticated information processing machines in the universe, capable of understanding not only the universe itself but of understanding the process of understanding. On the other edge, by the very same process of forming beliefs about the universe and ourselves, we are also more capable than any other species of self-deception and illusion, of fooling ourselves even while we are trying to avoid being fooled by nature.

In the end I want to believe. I also want to know. The truth is out there, and although it may be difficult to find, science is the best tool we have for uncovering it.

Ad astra per aspera!

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Dr. Michael Shermer is the Founding Publisher of Skeptic *magazine, a monthly columnist for* Scientific American*, and an Adjunct Professor at Claremont Graduate University and Chapman University. His latest book is* The Believing Brain*. His last book was* The Mind of the Market*, on evolutionary economics. He also wrote* Why Darwin Matters *and is the author of* The Science of Good and Evil*.*

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