

James Randi Educational Foundation



MAGIC IN THE CLASSROOM

USING EXTRAORDINARY CLAIMS TO TEACH CRITICAL THINKING

Edited by Robert Blaskiewicz

Magic in the Classroom: Using Extraordinary Claims to Teach Critical Thinking

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For D.J., Sharon, Barb, and Eve, from whom I've learned a lot.

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Introduction

It's New Year's Day 2015, and I have just completed teaching a freshman seminar about "alternative medicine." For their final project, my students invented new alternative treatments and produced websites that used the persuasive selling strategies that we see on established alt med sites all the time. They invented a wide variety of products, services, health regimens, diets, and modalities. And then they did what charlatans do--flogged their wares mercilessly (though always with the prominent caveat to the effect that their websites and other pitches were satirical).

It turns out they are scarily good mimics. After acquiring the appropriate certification at Thunderwood College (<http://thunderwoodcollege.com/>) (a diploma generating site established by Skeptoid (<http://skeptoid.com/>)'s Brian Dunning), they set to work establishing inspirational backstories, generating unqualified praise for themselves, and greenwashing absolutely everything. I made sure that nobody actually made any claims about specific diseases--I did not want another fake cancer cure to slip out onto the web--and the students soon became very adroit at generating meaningful-sounding health patter. My favorite example was a group whose product "enhanced the healing properties of water." Another group promised that they would "stimulate your body's natural healing processes" by beating you up and taking your money. (The glowing testimonials in their infomercial, delivered by satisfied customers who happened to be sporting black eyes and missing teeth, were hilarious.)

In order to pull this mimicry off, of course, the students not only had to analyze websites' content, design, audiences' expectations, persuasive tactics, and use of media, and but also had to adopt them for their own websites. I dare say that I have either inoculated these students to the most pernicious and dangerous types of alternative medicine or have unleashed an alternative medicine juggernaut that will bring the country to its knees. Either way, I'd rather students encounter these extraordinary claims in a classroom, where critical thinking is encouraged, than out on the mean streets.

That's what this book is about.

These essays came out of a feature on the James Randi Educational Foundation's SWIFT blog that brought together skeptical educators from across the curriculum to write about how they are using extraordinary claims in their classes. In this collection, English teachers, an astronomer, a medievalist, a pair of physicists, a scholar of the Renaissance, a

geologist, a linguist, a couple of psychologists, a historian, a rhetorician, and a pair of philosophers offer course and lesson summaries, discuss experimental teaching methods, and explain how key concepts of skepticism translate to the classroom.

It is my sincere hope that these essays will inspire teachers at all levels and in all disciplines to incorporate these fun and fascinating topics into their classes.

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1. Using Fiction to Teach Critical Thinking: Carl Sagan's *Contact*

Written by Robert Blaskiewicz

Carl Sagan's 1985 novel *Contact* is a potentially powerful but currently undervalued contribution to both skepticism and education. It is the story of Eleanor Arroway, a radio astronomer of high caliber who has a longstanding professional interest in SETI, the search for extraterrestrial intelligence. When the radio telescope she manages detects a strong artificial signal from a relatively nearby star, Vega, the discovery electrifies humanity, spurring social change on a global scale. The Message, as it comes to be called, is instructions for building a machine of great complexity and unknown purpose. But it has chairs. An international team of five scientists, which includes Arroway, is selected to sit in those chairs when the Machine is turned on. When it is, the team finds itself hurtling through a transdimensional transit system to the center of the galaxy, where they are told by the intelligences who sent the Message that humanity has a lot of promise.

Contact is a highly readable novel, appropriate, I think, for students at the high school level and above. Sagan is not overly concerned with novelistic elements like character development; he makes it agonizingly clear that Arroway needs a father figure, and the romance is almost physically painful to behold. Sagan's treatment of characters reminds me a little of *Uncle Tom's Cabin*, whose characters discuss every possible argument for and against slavery, a valuable contemporary catalog of the slavery debate. In *Contact*, Sagan has assembled a compendium of arguments about the place of science and reason in society.

Throughout *Contact* one encounters a number of what skeptics will recognize as "extraordinary claims," claims that, if they prove true, will transform our understanding of and relationship to the world, other people, and ourselves. An example of this type of claim that does not appear in the novel is David Icke's claim that the world is controlled by a cabal of evil, shape-shifting, interdimensional, mind controlling reptilian aliens who live in the hollow moon (which is also a spaceship) and who feed off of human misery while carrying on in the guise of the British Royal family. If Icke is correct, we will have to fundamentally revise our understanding of history, government, economics, psychology, physics, and every other field of human knowledge. A large number of similarly extraordinary claims appear in the novel, including transcendental meditation, flying saucers and millenarian UFO cults, near death experiences, counterfeit holy relics, young-earth creationism and biblical literalism, conspiracies of scientists/ Jews/ communists, astrology, psychic claims,

doomsday devices, Lysenkoism, and, my favorite, space Nazis.

A wonderful way to teach this novel is to use it to illustrate the difference between scientific and pseudoscientific approaches to evidence. For instance, when Arroway gets exactly what she wants despite all odds, a radio signal from another civilization, she submits her discovery to a series of tests that could show that the signal is NOT from aliens. She considers whether her equipment is malfunctioning (it's not), whether it moves with the background stars (it does), whether satellites or other manmade objects could mimic such a signal (it's hard to see how). Even when the signal passes every test she can think of, she still invites the objections of the others in her lab, and they raise objections as to the age of Vega (too young to have evolved life) and the presence of a debris disk. At all points, Arroway's team assumes that the most extraordinary explanation is also the least likely.

In contrast to the careful and methodical process of vetting that Arroway's team invites is the manner in which pseudoscientists focus on only that evidence they believe supports a desired outcome. An example of this appeared in the media in 2006, when Bob Cornuke, the founder of the Biblical Archaeology Search and Exploration (BASE) Institute publicized what he suggested was (yet another) successful search for Noah's Ark. His initial summary of evidence excludes any possible contradictory evidence:

The object consists of dark rock with an uncanny beam-like appearance in several places [which he interprets as petrified wood].

The object fits the approximate dimensions of Noah's Ark.

The object is at 13,120 feet but the nearest tree is at about 8,000 feet (and there are very few trees even at that level).

We found sea life at an adjacent summit.

We found microscopic sea life in a rock from the object (a foram, which is normally only found at the depths of the sea).

All major climates are close by along with all ecosystems. [He feels that this feature is important so that, say, walruses didn't have to traverse deserts when they got off the Ark. For his entire report, see the BASE Institute website: <http://bit.ly/InjncX>.]

At no point does Cornuke submit his evidence to professional scrutiny or consider that his observations might be evidence of something else entirely. Nor does he include any comment by a credentialed geologist. The differences between Arroway and Cornuke's ap-

proach to evidence illustrate an important distinction between scientific and pseudoscientific inquiry: whereas science draws its conclusions based on data, pseudoscience often selects its data on the basis of a desired conclusion. It should be noted that Cornuke includes a disclaimer at the beginning and end of his article:

“The research and site survey being investigated by the BASE Institute has strong potential. Is it the remains of Noah's Ark? The BASE Institute does not make the claim that we have found Noah's Ark. We'll let you draw your own conclusions. In our opinion, it's a candidate. The research continues.”

This seems a somewhat disingenuous cop-out for someone who spends the entire write-up making the case that his find could be the site of the Ark, to the exclusion of other sites. At best, it would be mystery-mongering. Either way, his uncertainty sure didn't prevent him from making the media circuit when he made his announcement.

Another comparison fruitful comparison for students is to note the different ways in which scientists and pseudoscientists use scientific language. When Arroway summarizes the initial findings regarding the Message for her team (and, by proxy, for the reader), she illustrates that scientific terminology, when properly used, is denotative, precise, unambiguous, substantive, and eschews metaphor:

We have an extremely strong, not very monochromatic signal. Immediately outside the bandpass of this signal there are no other frequencies reporting anything besides noise. The signal is linearly polarized, as if it's being broadcast by a radio telescope. The signal is around nine gigahertz, near the minimum in the galactic noise background. It's the right kind of frequency for anyone who wants to be heard over a big distance. We've confirmed sidereal motion of the source, so it's moving as if it's up there. (78)

While the meaning may not be readily apparent to the layman (a problem that Sagan tries to address by having his protagonist deliberately speak “in the simplest language”) it is clear to the scientific audience. The pseudoscientific use of scientific language is largely ornamental and used to convey a sense of scientific authority to the layman without conveying meaningful information to the expert. For instance, take the sciencey, obfuscatory language of an abstract by Desmond P. Allen, in his “An Apology and Unification Theory for the Reconciliation of Physical Matter and Metaphysical Cognizance”:

[A] theory is set forth that reconciles inorganic, organic, and animated matter

with the metaphysical realities of both the creator and the created. By coupling the metaphysical implications of quantum physics with the biblical understanding of God's attributes, the thesis is set forth that our immediate physical reality—consisting of empty space, electromagnetic energy, and information—is basically a hologram depiction of God's intent. God spoke and it was so. Since creation, God's Spirit has continued to energize and interact with the universe in an entangled nature at the quantum level. Similarly, the individual metaphysical reality (the spirit) of each animated being interacts with its individual corporal body via this same entangled nature at the subatomic level.

This is science word salad. Even the fancy Latinate word “cognizance” that appears in the title is undefined (more precisely, it is defined in terms of other words without agreed upon referents, “soul or spirit”). All of the “quantum” is claimed to interact with God, whose nature is also undefined. Of course, the problem is that without the benefit of a science education, a layman might not be able to recognize the misuse of the scientific concepts of entanglement, energy, holograms, and information.

Another way to use *Contact* to illustrate the difference between scientists and pseudoscientists is to compare how their use of scientific equipment differs. In *Contact*, Arroway is an expert in the use of the tools of radio astronomy. Her Ph.D. dissertation, which is undertaken “with the concurrence of the faculty,” is “the development of an improvement in the sensitive receivers employed on radio telescopes” (40). She works on the ruby maser. The red color of rubies comes from a slight chromium impurity in the stone, and she explains that “when a strong magnetic field is impressed on the ruby, the chromium atoms increase their energy or, as physicists like to say, are raised to an excited state,” a property that she harnesses for “a good practical cause—amplifying a weak radio signal. [...] She found a way to make rubies with lanthanide impurities [that could] detect a much weaker signal than previous masers” (40). Scientists understand their equipment, what it is capable of doing, and the theories that allow it to work.

As an example of the pseudoscientific use of equipment, I would introduce students to ghost hunting, a field in which no piece of detection equipment cannot be misused, including cameras, audio recorders, digital thermometers, EMF detectors, thermal imaging cameras, and even Geiger counters. An excellent illustration of the failure of a ghost hunter to have even a passing understanding with the proper operation of their equipment came in the first season of the SyFy show *Ghost Hunters*, when the team was exploring the New

Bedford Armory (episode 7). At one point, the tech guy, Brian, boasts about teaching people how to use a Geiger counter, but when by another team member to give a demonstration, it's clear to everyone on the team that Brain is unfamiliar with the terminology and operation of the device, much less the physical phenomena it detects.

Other topics addressed at length in *Contact* that instructors might want to point out to students include the process of publication and the scrutiny of scientific findings by independent and anonymous peers, the replication of results, standards of evidence, the ability to abandon pet theories when they fail to accord with evidence, and logical fallacies. Crucial to all of the important topics explored in the novel is the relationship of the media to science and critical thought. While his biographers note that Sagan took a characteristically dim view of typical television fare in his speeches, his heroine enjoys one particular type of entertainment. While flipping through television channels, Arroway comes across one of her favorite shows, *Yesterday's News*, which reruns old news broadcasts. "The second half of the program," the narrator explains:

consisted of a point-by-point dissection of the misinformation in the first half, and the obdurate credulity of the news organizations before the claims of any administration, no matter how unsupported and self-serving. It was one of several television series produced by an organization called REALI-TV—including *Promises, Promises*, devoted to follow-up analyses of unfulfilled campaign pledges at the local, state and national levels, and *Bamboozles and Baloney*, a weekly program debunking what were said to be widespread prejudices, propaganda, and myths. (132-3)

Clearly, this is Sagan's nod to the importance of critical thinking and fact checking in civic life.

Early in *The Demon-Haunted World: Science as a Candle in the Dark*, Sagan mentions the importance of critical thinking and science education: "How can we affect national policy," he wonders, "—or even make intelligent decisions about our own lives—if we don't grasp the underlying issues?" (*Demon* 7). To Sagan, the critical skill set that underpins science is largely the same as that which undergirds responsible citizenship: fact-checking claims as a part of a rigorous skepticism. Unfortunately the extra work entailed by such skepticism "doesn't sell well" (*Demon* 5). Often skepticism can't compete with the sensationalism of extraordinary claims. This is one reason I piggyback lessons about critical thinking on the romantic notions expressed in these claims—they are memorable. Arroway, after she finds that Venus is incapable of supporting the life she thought and hoped

might be there, she reflects on the limits of romantic speculation about the nature of the universe:

[Her graduate school mentors] repeatedly stressed that speculation must be confronted with sober physical reality. It was a kind of sieve that separated the rare useful speculation from torrents of nonsense. The extraterrestrials and their technology had to conform strictly to the laws of nature. But what emerged from this sieve, and survived the most skeptical physical and astronomical analysis, might even be true. (*Contact* 39)

In Arroway's mind and in Sagan's, it seems, science is a way of having *better* romantic notions, *plausible* notions.

RJB

Possible assignments/projects/questions stemming from using *Contact*:

Ask students to identify extraordinary claims in the novel and give reasons why they think those claims are extraordinary.

A section of a high school science course might be devoted to exploring the scientific and engineering principles that appear in the novel.

Identify and explore communication problems associated with alien contact, including the lack of a common language, shared assumptions between civilizations, and obstacles caused by the vast distances involved. Have students discuss how Sagan seeks to overcome these obstacles in the novel and invite them to speculate about communication with extraterrestrials.

Take the evidence amassed by the BASE evidence to support the claim of the discovery of Noah's Ark and have students generate explanations that are better in line with scientific consensus.

Have students produce a script for a segment or episode of *Yesterday's News*, *Promises*, *Promises*, or *Bamboozles and Baloney*.

References:

Allen, Desmond P. "An Apology and Unification Theory for the Reconciliation of Physical Matter and Metaphysical Cognizance." *Answers Research Journal* 1.1 (2008): 27-42. <http://bit.ly/J2A7d4>.

Sagan, Carl. *Contact*. New York: Simon & Schuster, 1985.

---. *The Demon Haunted World: Science as a Candle in the Dark*. New York: Ballantine, 1997.

Spangenburg, Ray and Kit Moser. *Carl Sagan: A Biography*. Amherst: Prometheus Books: 2009.

2. Hoaxes in the Classroom

Written by Robert Blaskiewicz

In my career teaching writing to incoming college students, I am lucky to have spent three years at Georgia Tech, where innovation in the classroom is valued. But even in this environment, I'm still a bit of an evil imp. When one professor had students reconstruct the Thoreau's cabin from *Walden*, I tried to think of a way that students could recreate a historical event for a final project in a rock n' roll class I was considering. When I took the proposal to my boss, recreating the Beatles' final concert on the roof of Apple Records, substituting "Apple Records" with "Humanities Building," she balked. (Don't mock the idea...too much. Hardcore research skills, which are taught in the writing classroom, go into good historical recreations. I think the fact that there is not enough insurance in the world to convince the Dean that it should ever be done killed the project.)

I'm a fan of creative final projects. For instance, my students once organized a political campaign demanding equal rights for Reptilians. Their rally at a local mall got them ejected. Twice. It was great. This was a change for my conspiracy theory class, in which students usually create an entirely new conspiracy theory that somehow draws on existing ones. By the time my students have finished the class, they have encountered a conspiracy theory, broken it down into its component parts, researched/fact-checked each element, analyzed the conspiracy, and written an argumentative paper about the rhetorical and narrative elements of the conspiracy theory that make it memorable and "culturally transmissible," as it were. They then create their own conspiracy theory and write a paper illustrating how what they have learned in the class has influenced their own conspiracy theory.

And there it ends. We do not release our conspiracy theories onto the public because they are likely to be believed by someone. An important theme of the course is that conspiracy theories are not good things, that they are time sinks for people who would otherwise want to participate in American political life in a meaningful way, and that they perpetuate ignorance, misinformation, and hate (often targeting scapegoats). They are, to use Chip Berlet's phrase, toxic to democracy. We keep our tales from becoming hoaxes.

Professor T. Mills Kelly at George Mason University, however, came to another conclusion when a history class he taught recently culminated in students crafting two historical hoaxes and then propagating them on the Internet. The article about the hoax that received the most attention was Yoni Appelbaum's "How the Professor Who Fooled Wikiped-

dia Got Caught by Reddit (<http://m.theatlantic.com/technology/archive/2012/05/how-the-professor-who-fooled-wikipedia-got-caught-by-reddit/257134/>),” which appeared in *The Atlantic* in May 2012. It was the second time that Kelly had taught the class. The first time, in 2008, his students fabricated the story of “the last American pirate,” the imaginary Edward Owens, and put it up on Wikipedia. More recently, two hoaxes were released: one about a fictitious beer and one that centered on a redditor who thought that an ancestor might have been a serial killer. The first hoax didn’t really gain much traction, but the second one lit up the boards at reddit for just under half an hour before it was found out.

A course on historical hoaxes, or even just “hoaxes in history” sounds like a lot of fun, and I’d love to teach one someday. However, the subject matter, heck, the assigned reading, should raise a red flag to those considering releasing a hoax on the public. One of the books on the course list, Michael Farquhar’s *A Treasury of Deception*, for instance, opens with a discussion of Piltdown Man (http://en.wikipedia.org/wiki/Piltdown_Man), a hoax that not only muddled human evolutionary history for 40 years but also still provides fodder for those who would discredit science. Hoaxes, it seems, when they become embedded in a culture, actually make history harder to do.

I looked at Kelly’s syllabus (<http://edwired.org/wp-content/uploads/2012/01/sp12syl.pdf>) for the rationale behind the production of the hoaxes, and he provides two reasons:

The first answer is that by learning about historical fakery, lying, and hoaxes, we all become much better consumers of historical information. In short, we are much less likely to be tricked by what we find in our own personal research about the past. That alone ought to be enough of a reason to teach this course.

This is a good reason to teach about extraordinary claims in general, especially when the alternative is that students are going to encounter them out in the real world without the benefit of a teacher, but it does not follow that students will learn this lesson more thoroughly by perpetrating a hoax on the public. Kelly’s second reason I find far less compelling:

I believe that the study of history ought to be fun and that too often historians (I include myself in this category) take an overly stuffy approach to the past. Maybe it’s our conditioning in graduate school, or maybe we’re afraid that if we get too playful with our field we won’t be taken seriously as scholars. Whatever the reason, I think history has just gotten a bit too boring for

its own good. This course is my attempt to lighten up a little and see where it gets us.

Kelly picked an *awesome* topic for getting students fired up about doing history, and that should be enough. Kenneth Feder's fascinating *Frauds, Myths, and Mysteries: Science and Pseudoscience in Archaeology* covers the cultural preconditions that set the stage for an archaeological hoax, and why hoaxes that now seem hopelessly implausible ever had credibility is a question that is entirely suited to a history class. At the same time, I sympathize with the notion that you have to have fun with your topic in class--I bank on my enthusiasm for whatever topic I am teaching to carry the course along. But neither "lightening up" history nor becoming savvy about the pitfalls that lead to accepting hoaxes necessitates imposing a falsehood on the public. Indeed, it seems to be a distraction from doing historical research, ostensibly the purpose of a history class.

Educators at the college level are usually called upon to do more than just teach or do research; we are also expected to serve as ambassadors for higher education, our university, and our disciplines both in public life and to our students. I would argue that implicit to that public role is to not deliberately confuse people. I would take this tenet to be implied in the mission statement (<http://www.gmu.edu/resources/visitors/vision/mission.html>) of George Mason, which enjoins instructors to "Provide innovative and interdisciplinary undergraduate, graduate, and professional courses of study that enable students to exercise analytical and imaginative thinking and make well-founded ethical decisions." Kelly has certainly covered innovative, interdisciplinary, analytical, and imaginative aspects of a GMU course; I'm not sure the class satisfies the ethical component.

I think this is why so many academics and members of the public are kicking back so hard against the hoax class. Kelly anticipated this resistance in the syllabus:

In the interest of full disclosure, I have only taught this class once before and to my knowledge, no other history professor in the world is willing to teach something similar (or works in a department where they could get away with it). [...] The last time around, the final class project generated a great deal of discussion (much, but not all of it negative) in the academic blogosphere. As you'll see when we discuss the previous iteration of this course, I'm not particularly sympathetic to those who took a dim view of what my students did.

I'm aware that I may appear to be flirting with the appeal to popularity, but I'm trying to respect the collective judgment of experts in a profession when I say that if "nobody else in the world is willing to teach in this way," it should be taken a warning sign. A hoax may be

worth trying, but one must wonder whether it is worth repeating, especially when more people are misinformed at the end of the semester than at the beginning.

3. Is It Time To Call Creationists' Bluff And Push For "Teaching All Views"?

Written by Matt Lowry

Many readers of the SWIFT blog are no doubt, like me, a bit disappointed (though not entirely surprised) that a creationist-friendly law protecting so-called "academic freedom" of teachers is now on the books in Tennessee. The "Monkey Law," as it has been labeled in honor of the famous Scopes Monkey Trial from 1925, would seek to encourage teachers in the state's public schools to present the "scientific strengths and scientific weaknesses" of topics that arouse "debate and disputation" such as "biological evolution, the chemical origins of life, global warming, and human cloning." Indeed, as the National Center for Science Education notes (<http://ncse.com/news/2012/04/what-next-tennessee-007307>):

"Maybe it has a no-religion clause," the Tennessean characterized the law's critics as arguing, "but it gives a wink to teachers looking to promote their beliefs in the classroom — a move that would launch costly lawsuits that history shows school districts tend to lose." Hedy Weinberg, the executive director of the American Civil Liberties Union of Tennessee, told the newspaper that her group is in touch with concerned parents across the state, "waiting for one to report First Amendment violations teachers could make under the mistaken notion that they now have full protection."

A very similar law promoting this somewhat Orwellian notion of academic freedom was enacted in Louisiana in 2008. Of course, anyone who has followed the creationist movement for any amount of time sees quite clearly what is going on here: after their high-profile defeat in the *Dover v. Kitzmiller* trial in 2005, where they tried to push for explicitly including creationism (under the re-labeling of "intelligent design"), creationists are now falling back on an old, but tried and true, tactic – attacking and attempting to weaken the teaching of evolution. (Note that when I mention "creationists" I am referring to the usual, fundamentalist Christian variety so common in the United States, the young-earth variety. This is quite important for reasons you'll see later.)

My guess is that the thinking from the creationists is probably along these lines: we have these children in our churches where we can teach them the "truth", so all we need to do is discourage the schools from teaching evolution. By keeping these children ignorant of evolution (and science in general), the creationists win by default; hence the language in the "Monkey Law" emphasizing the teaching of the non-existent "scientific weaknesses" of

evolution. This is basically code telling the creationists to make up whatever fiction they wish about evolution and teach these straw man notions in public school science classes. And by doing so, the creationists then automatically steer the students in the direction of non-scientific alternative explanations. Speaking of non-scientific alternatives, let us note that the new Tennessee law also makes specific references to the science of global warming and human cloning, both increasingly hot-button issues for social and religious conservatives in the United States. But, interestingly, the language is more open-ended and doesn't stop explicitly at those topics; in fact, the language states that "scientific strengths and scientific weaknesses" of topics that arouse "debate and disputation." Note that the law doesn't specify among whom these topics can arouse debate and disputation. And I think it is on this point that the Tennessee lawmakers may end up getting hoisted by their own petard. I'm not referring to the inevitable lawsuits which will come along once some teacher starts to teach creationism explicitly (lawsuits which the state will, in all likelihood, lose). Rather, I am referring to the potential lawsuits that other wacky and non-scientific ideas are *not* being taught in Tennessee public school science classes.

Allow me to reference a humorous, yet very instructive, story about the failure of a creationist-friendly bill in Indiana a few months ago in order to make my point more clearly. This bill was originally intended as a way of promoting creationism explicitly, stating: "The governing body of a school corporation may require the teaching of various theories concerning the origin of life, including creation science, within the school corporation."

However, soon after it was introduced in the Indiana state senate, a very clever and forward-thinking lawmaker successfully amended the bill to read as follows:

The governing body of a school corporation may offer instruction on various theories of the origin of life. The curriculum for the course must include theories from multiple religions, which may include, but is not limited to, Christianity, Judaism, Islam, Hinduism, Buddhism, and Scientology. [emphasis added]

Once this language was accepted into the text of the bill, and once the formerly supportive lawmakers fully understood the implications, the bill was dropped like a hot potato and scuttled. That's because these lawmakers, in their zeal to garner votes from creationist-friendly constituencies in an election year, realized that the amended language would open up the classroom door to ideas of creationism different from the usual young-earth

variety favored by fundamentalist Christians. Rather than truly go down the road of teaching all views, which would inevitably arouse the wrath of the creationists, these lawmakers saw the handwriting on the wall and wisely dropped the bill. Of course, this fiasco puts on full display the hypocrisy of the creationist movement: hide behind the language of “fairness,” “academic freedom,” and (my favorite) “teaching all views” and then push one non-scientific alternative exclusively.

Beyond showing the creationists’ hypocrisy, the Indiana case also shows how laws like those in Louisiana and Tennessee can potentially be countered: call the creationists’ bluff by holding them to the “academic freedom” and “teach all views” ideas implied in their own laws.

For example, conceivably, one could file lawsuits against Louisiana and Tennessee schools for not teaching the “debate and disputation” that the Flying Spaghetti Monster is the creator of the universe. Why not a lawsuit when the schools refuse to teach the atheistic version of “intelligent design” as outlined by the Raelian cult, where the creator of humanity is an advanced alien race instead of God? Not to mention, might we see lawsuits based upon the exclusion of Islamic notions of creationism? Beyond evolution and creationism, could we even see lawsuits when the notion of the Four Element Model – invoking earth, air, fire, and water – is excluded from chemistry classes? What about when the Transcendental Meditationists’ view (basically, to them there’s no such thing as gravity) is turned down in physics classes? When astrology comes knocking on the door in astronomy and earth science classes, will it be turned away, risking another lawsuit? I think you get the idea.

Were this sort of silliness to come to pass, no doubt it would cause innumerable headaches for both the public school systems and legislatures in Louisiana and Tennessee, partly because of the sheer embarrassment of the circus it would create and the arousal of the creationists’ fury that their views, and theirs alone, are not the only alternative being pushed.

In fact, it just might cause so many headaches for the lawmakers that they could end up rescinding their so-called “academic freedom” laws altogether, going back to the old days where evolution and other scientifically accepted ideas were exclusively taught in public school science classes, while creationism and similar notions were taught in philosophy or comparative religion classes.

4. I Have a Warrant: Unspoken Assumptions and Critical Thinking

Written by Eve Siebert

Most required freshman composition courses focus on argument or persuasive writing, and most composition textbooks rely to some degree on the Toulmin model, developed by British philosopher **Stephen Toulmin** (http://en.wikipedia.org/wiki/Stephen_Toulmin). The Toulmin model consists of three necessary components and three components that may or may not appear in an argument. The three vital elements are the claim, the ground (evidence, data or support) and the warrant. The first two are fairly easy to explain and understand. The claim is the argument's thesis, what the author is trying to establish. The support takes up the bulk of most arguments: all the data, information and logical reasoning used to establish the validity of the claim. Warrants are a bit trickier. When I first began teaching, I found warrants rather confusing and therefore had difficulty in explaining them to students. By discussing the matter with other instructors, I found that my confusion was commonplace and that many of us felt that our textbooks' definitions of warrants were rather inadequate (they've improved in the last decade or so). Toulmin himself introduces the warrant by contrasting it with data: warrants are

rules, principles, inference-licenses or what you will, instead of additional items of information. Our task is no longer to strengthen the ground on which our argument is constructed, but is rather to show that, taking these data as a starting point, the step to the original claim or conclusion is an appropriate or legitimate one. At this point, therefore, what are needed are general, hypothetical statements, which can act as bridges, and authorize the sort of step to which our particular argument commits us. (p. 91)

A webpage mapping the Toulmin model (http://www-rohan.sdsu.edu/~digger/305/toulmin_model.htm) on San Diego State University's website defines the warrant as "the principle, provision or chain of reasoning that connects the grounds/reason to the claim."

From such definitions, I surmised that warrants were something that in some mysterious way tied the support to the claim, but I couldn't get much further than that. It didn't help that warrants, unlike claims and support, are often unstated, so they are invisible "somethings" that in some mysterious way tie the support to the claim.

I gradually became more comfortable with warrants. I began to see them as assumptions underlying authors' arguments that can either help them establish common ground with their audience or cause them to fail in finding common ground. Even if all the support

in an argument is valid and accurate, the argument can still fail utterly if the author makes assumptions that the audience does not accept.

For instance, a student once asked me to read a rough draft of a paper he had written about euthanasia/assisted suicide. The paper gave the general impression, never stated explicitly, that all moral people, particularly Christians, would agree that euthanasia is always immoral. That's a problem. Who is the audience for such a paper? Moral people don't need to be convinced because they already agree, and immoral people won't be convinced because they're immoral and won't be swayed by moral arguments. I tried to explain to him that there are good, thoughtful people who genuinely believe that, in certain circumstances, euthanasia is the kindest, most moral option. He might think that they are mistaken—that's fine—but it's important to realize that good people, even co-religionists, can have different points of view. The kind of unexplored and unquestioned assumptions he was making were likely to alienate his audience. The final draft he turned in addressed these issues. It was a thoughtful, reasonable argument. He hadn't changed his claim, and he used the same support, but the paper was a form of communication rather than propaganda or a sermon to the choir.

An article I like to assign to my classes to help them learn to identify warrants is "What's Happened to Disney Films?" (http://ksuemail.kennesaw.edu/~jpalmer/2110project/disney_films_article.htm) by John Evans, originally published in the *Dallas/Fort Worth Heritage*, a monthly Christian newspaper. His thesis is that Disney is no longer the family-friendly company it was in the 1950s and 60s. His support is a list of "undesirable content" in various Disney films, as well as in such films as *Pulp Fiction*, which were produced by companies owned by Disney.

I taught for many years at a Jesuit university: a large percentage of the students were Roman Catholic, and a significant minority were evangelical Protestants. Almost universally they found Evans' argument preposterous. Among the many problems with the article are the assumptions Evans makes. Take, for instance, his description of *The Lion King*:

New Age and occultic concepts appear to be introduced when it's said that the father lion is living on in the son. Also, a remark is made that dead kings are looking down on the young lion. These can be interpreted literally as the Hindu concept of the universality of the soul. Also, when the young lion talks

to his dead father, this violates the biblical admonition against communicating with the spirits of the dead.

Among the warrants: New Age, occultic and Hindu concepts are bad, and Christian children should not be exposed to them. Aside from the fact that he seems to be stretching to identify such non-Christian concepts, he seems terrified that children might convert to Hinduism based on a film that features a singing warthog.

Similarly, in describing Pocahontas, he says that it “favorably depicts Indian animism—the belief that every natural object, such as rocks and trees, have spirits.” Again, he finds any non-Christian content in a family film to be unacceptable. His worldview, evident from these assumptions, is so narrow that his argument will only be acceptable to a very small percentage of Christians. Most readers are less put off by references to Native American religion in a film about Native Americans than they are by his attitude toward anything that doesn’t comport with his worldview.

A careful examination of warrants is vital to critical thinking, critical writing and critical reading. When we read or hear arguments, it is important not only to examine the evidence, but also to analyze the assumptions made. What is the author’s point of view? What is the agenda? What biases does the author have? I don’t necessarily mean “agenda” or “biases” in a negative way—we all have them—but it’s important to examine what is behind an argument. It is equally important to examine our own agenda, biases and assumptions when we make an argument. Will my audience share my assumptions or do I have to provide backing or evidence for my warrants? If my audience is likely to include people who have a significantly different point of view from mine, how can I find common ground with them? What are their assumptions and concerns? How can I address them? When writers fail to examine their own assumptions, their arguments are likely to fail.

References:

Evans, John. “What’s Happened to Disney Films?” Dallas/Fort Worth Heritage, Aug. 1995: 12 Rpt. in *Perspectives on Argument*, 4th ed. by Nancy V. Wood. Upper Saddle River, NJ: Prentice-Pearson, 2004. 148-49. Toulmin, Stephen E. *The Uses of Argument*. Updated ed. Cambridge UP, 2003.

5. Teaching Lies, Propaganda And Disinformation In The Classroom

Written by Tom Lolis

Me: Ok, class. David Icke. Go. What did you think of the reading?

Student A: I don't understand how 12-foot lizards can come from both the fifth dimension and from inside the Earth's core.

Student B: Maybe they're the same place?

Student A: Now *that's* ridiculous.

And so begins another day in one of my sections of ENGL-1101, otherwise known as "The Rhetoric of Conspiracy: Narratives of Power and Secrecy in the Digital Age." In this class, 24 young, brave souls (and myself) dive into a long-running paradiologue with which most of us possess at least a marginal amount of familiarity, namely, the discourse perpetuated via the transmission of conspiracy theories. You've probably heard snippets of tales about the man behind the curtain, or the man behind the man behind the curtain, or the alien behind the man behind the curtain, or the demon behind the alien behind the man...you get the idea. Whether it's speculation about the political machinations behind Bristol Palin's success (or ultimate failure) on *Dancing with the Stars*, that latest news report about a strange streak across the Los Angeles skyline, or Donald Trump's resurrection of the Birther movement, I'm betting that you're familiar with the underlying concept. There are forces out there that govern your life, and you don't even know about these forces. Or at least, you don't fully know. You know that you don't know. Only a select few know what's really happening in the world. The New World Order. The Illuminati. The An-nunaki. Skull & Bones. The gatherers at Bohemian Grove. And on, and on.

Instead of focusing on where and how such ideas generate, I'd like to address the use value of A) teaching these ideas, and b) encouraging students to mimic the strategies that inform conspiratorial rhetoric.

Let's start with question A: Why teach this stuff? Why not instead devote my work at Georgia Tech to processes of 'factual' accumulation? Certainly, there is a vast difference between a more standard line of questioning about, say, the history of science, and the opening of the classroom door to months-long discussions of pseudo-sective cults, "occult religions," militia groups, devil worshippers, holocaust deniers, and alien abductee support groups.

I'll cobble together a brief defense. For starters, many perpetrators of fringe discourses are very good at what they do. Consider, for example, David Icke or Alex Jones. Both maintain considerable web presences and demonstrate a clear affinity (at least in terms of presentation) with what we might think of as mainstream news media outlets. FoxNews, AM talk radio, NPR, and the Huffington Post all serve as stylistic models worthy of emulation.

Let's focus on one of the conspiracy community's more popular (and more controversial) figures: David Icke, who I mentioned in the above student dialogue. Icke first rose to prominence in England during the 1980s, where he enjoyed a successful career as a BBC TV sports presenter and, I'm sorry to say, a spokesman for the Green Party. In 1990, however, Icke reportedly became convinced that he was receiving visions from an otherworldly and potentially divine force. He sought counsel from a professional psychic and ruined his mainstream career by announcing on a popular British talk show that he was the Son of God (<http://www.youtube.com/watch?v=ufGVwaVpdRE>).

Icke immediately became a laughing stock and went underground for several years, only to re-emerge as an international conspiracy theory investigator. Since the late '90s, Icke has published nearly a dozen books, given lectures in packed auditoriums all over the world, and is a regular mainstay within the discourse of conspiracy culture. He is best known for a book called *The Biggest Secret* (1998), in which he outs the Bush family, the Rothschilds, the English Royals, the Clintons, Kris Kristofferson, and country music legend Boxcar Willie as part of a secret race of reptilian shapeshifters who seek to colonize this planet for their own insidious purposes. These malevolent creatures regularly engage in dark rituals that involve sexual abuse, satanic chanting, the eating of human flesh, and the drinking of human blood. (Icke calls these cannibalistic rituals, but they wouldn't really be cannibals if they're actually lizards, right?). In addition—these lizards—who are actually twelve feet tall—live off “life force” generated by the emission of human fear. So, the more discord they sow in the world, the more fearful we become, and the more powerful they grow. Got it? Ok. (It's actually much more baroque, but I'm going for the broad strokes here.)

In engaging with Icke's version of global terrorism, my 1101 students are encouraged to work through a three-step process. First, students will work through a range of Icke's texts in several forms of media. They read selections from his books, watch a DVD of one of his infamous PowerPoint presentations (which typically run from six to eight hours, though we only watch ninety minutes), sift through his website, and watch a Jon Ronson

documentary about Icke's conflicts with the Anti-Defamation League (who have argued that Icke's lizard-rhetoric is code for Anti-semitic propaganda). Then, students are asked to develop a critical analysis of the material. Disproving Icke's thesis is hardly the point, as that's too easy. Instead, we focus on what's potentially convincing about Icke's argument. At what point might an audience be swayed? And how? What makes certain examples work, even if they aren't necessarily sound? Once these processes have been identified, students are ready for the next step: create their own propaganda. (I should note that student-created propaganda is not unleashed for public consumption. We keep these materials in-house and use them solely as pedagogical models.)

In creating disinfo of their own, students become hyper-aware of the ways in which digital information can be manipulated to produce specific effects. Students are encouraged to create arresting posters, short films, podcasts, and websites. In class, we create a list of rules to break. (For example, "take quotes out of context to unfairly strengthen your case"; "create an argument that relies on feeling as opposed to evidence"; "rely on outdated sources of information.") At the same time, students are writing reflective responses about their rhetorical processes, in which they acknowledge the conventions they are breaking, and by extension, acknowledge their awareness of said conventions. By doing, students learn what not to do. Contrary to the axiom "learn the rules before you can break the rules," students signing up for English 1101 *learn the rules as they break them* while also identifying their rule-breaking regimen.

In addition to its rhetorical use value, students—I like to think—learn the virtue of tolerance as they fall down the rabbit hole of conspiracism. The Rhetoric of Conspiracy is not a course in which students are encouraged to proselytize the idiocy of the conspiracy theorist. Leaping to an inverted position is, I find, not without its own dangers. Instead, the course aims to ask questions about the generation of conspiracist ideology. Such ideas are, of course, systemic and point to growing distrust in government officials, a structural breakdown within mainstream theological institutions, the rise of the scientific metanarrative, and other dominant social forces. Just because we reject Icke does not mean we should implicitly trust Congress. It's important to avoid either/or constructions of belief and practice, and the recognition of such alternatives is a strong secondary objective of the course.

I'd like to mention an example of first-day work from one of my students. After our introductory session, students were asked to go home and write about a particular conspiracy in an effort to explain why it isn't true. (I wanted to get the "it's not true" line of inquiry

out of the way as quickly as possible.) As I sifted through the students' responses, I randomly selected one to read first. It was about the Tuskegee experiments, and the student in question explained how this shameful moment in American history (which the student had just discovered on an unnamed website) could not possibly be true. Websites about the experiments were another example of yet another ridiculous government coverup. For the student's cultural analysis, a general distrust of the systems that favor whites explained the dissemination of the outlandish myth of medical experimentation on illiterate African-American farmworkers.

It's easy to laugh at David Icke. But as part of a governmental system that *did* conduct the Tuskegee experiments, that interred Japanese Americans during WWII and funded programs to create psychic spies, it's important for us not to get too cocky. In recent history, we've seen firsthand the domestic dangers of conspiratorial thinking—the siege at Ruby Ridge, the disaster at Waco, the anti-technology campaign of Kaczynski, and the Oklahoma bombing, just to name a few. Such cataclysmic events point to moments of governmental instability in which conspiratorial thinking bubbles to the surface, and our culture demonstrates its inability to reconcile a dominant discourse with the emergence of a counterdiscourse. (The inability to understand ideological opposition is particularly relevant to any sincere examination of the US government's handling of the Waco siege.) If we can maintain our critical faculties without dismissing those who exist outside our own realms of the real—or at least, not dismissing “them” out of hand—perhaps the next generation will be smarter than we have been and avoid a few of the dangerous cultural collisions that we have not. In the hopes of furthering that goal, I'm even willing to keep David Icke on the syllabus next year.

6. The Monsters are Due on Maple Street

Written by Robert Blaskiewicz

WARNING: SPOILERS ABOUT A SHOW THAT AIRED 50 YEARS AGO

In a recent short-session summer class about the rhetoric of the Cold War, I showed the classic *Twilight Zone* episode, “The Monsters are Due on Maple Street” (1960). The story: A strange flash of light is seen over Maple Street, USA on a lazy summer day. The entire neighborhood soon discovers that the electricity is out and that their cars, telephones, and portable radios no longer work. As two men of the neighborhood, Steve and Charlie, are about to set off on foot to look for help, one of the neighborhood teenagers, Tommy, warns them not to leave because “they,” the ones who were in that thing that flew overhead, don’t want them to. Tommy says that’s how it always is in the science fiction that he’s ever read. And anyway, if the stories are true, the only ones who could leave the block would be “the ones they sent ahead,” the ones who just look like humans. The neighbors are inclined to laugh until Steve, who seems to have some authority on the block, tells Tommy to go ahead and finish his story, planting the idea that a family of alien imposters may be living among them. The families start suspecting one another of being aliens and interpret all sorts of otherwise meaningless observations about one another—one man’s car starts when the others’ don’t, another man is known to stay up at night talking on some sort of “radio” (a ham radio, it turns out)—as evidence of their neighbors’ extraterrestrial origins. (Of course, in the end it turns out that real aliens have been messing with the lights in order to illustrate what irrational ninnies humans become when they face uncertainty.)

Of course, the purpose of showing this episode is not to suggest that it is a realistic depiction of what something that is likely to happen over the course of an evening on Main Street, USA. Nonetheless, one can use “The Monsters Are Due on Maple Street” to give memorable (if unrealistic) examples of the types mental habits that can lead to irrational beliefs and behavior, as well as the concrete examples of logical fallacies students are likely to encounter in and out of class. For instance, I use the neighborhood’s acceptance of Tommy’s highly improbable hypothesis that aliens are living among them to illustrate the fact that people often prefer to embrace any explanation for unfamiliar phenomena over no explanation at all, and that first explanations, no matter how improbable, are often very difficult to dislodge even when they are wrong. One might also look to the example of the block “leader” Steve to illustrate the point that authority often has undue persuasive weight, even in matters of the absurd.

Once the idea that there might be aliens on Maple Street has taken root, we start to see conclusion-driven anomaly hunting leading to ever-shifting accusations. When Les Goodman's car starts by itself, the crowd starts hunting for evidence that would suggest Les is an alien. "He never did come out to look at that thing that flew overhead," notes one man, Don, which may or may not be true, but he then makes the dangerous leap into making a factual assertion about Les' motivation: "He wasn't even interested." "He always was an oddball," remarks Charlie, "him and his whole family. A real oddball." One woman demands to know why Les sometimes, late at night, goes out and stares at the sky, "as if he were waiting for something."

Later when Charlie's wife asserts that they have been good friends with the Goodmans ever since they moved in, Charlie replies: "That don't prove a thing. Any guy who would spend his time looking up in the sky early in the morning--there's something wrong with that kind of a person, something that ain't legitimate." One might use that statement as an example of the "bald assertion," one that conveniently serves to confirm his view that Les Goodman and his family are oddballs. Charlie is perhaps the worst critical thinker on the block; besides his persecution of the Goodmans, when Steve goes over to Les to make peace, Charlie shouts: "You best watch who you are seen with, Steve. Until we get this all straightened out you ain't exactly above suspicion yourself!" This would be an appropriate time to point out the fallacy of assigning guilt by association. Soon, the neighbors turn their attention to Steve and start picking out any little quirk of behavior as evidence that he might be the traitor they are now committed to finding. Soon the neighborhood tears itself apart and bursts into a riot as new suspects are identified on the basis of spurious evidence and are persecuted. Of course, here we are looking at confirmation bias run amok.

Other fallacies appear in the episode. For instance, you might point out that there is no good reason, really, to suspect that the unidentified light in the sky is the cause of the loss of power. This would be the post hoc fallacy. One could even look to the fact that the residents of Maple Street can't explain what the thing in the sky was, and therefore it becomes to them an alien spaceship--an appeal to ignorance. This episode can also lead to discussions of several other topics interesting to skeptics, including the effect of fear on our critical faculties, the evaluation of evidence and the burden of proof, outbreaks of mass hysteria and witch hunts, conspiracy theories, and alien visitation. And these are important lessons, for as Rod Serling says in his closing voiceover, "The pity of it is that these things cannot be confined to the Twilight Zone."

7. Science vs. Pseudoscience: Do You Know What You Think You Know?

Written by Karen Koy

Two years ago, looking to branch out from the life & earth sciences, I signed up to teach a class for our Honors program. As a part of their Honors requirements, students must take at least two Honors colloquia. These are small classes (maximum 15 students) that meet two hours a week. The topics are chosen by the instructor, and tend to be specific subjects not covered by classes within the course catalogue (for example, the Sixties alternative music scene or the life & philosophy of Charles Darwin). Having always wanted to teach a skepticism class, I thought this was the perfect chance to try it out.

Titled “Science versus Pseudoscience: Do you know what you think you know?”, the class covered subjects from cryptozoology to creationism to chiropractic. The subjects covered in class were chosen by the instructor and the students. There were several assignments that I will discuss in a moment. This fall I will be able to hold the class again. I will be able to take what I learned the first time around to improve the design of the class.

The class was divided into three sections: complementary and alternative medicine (CAM), paranormal/supernatural claims, and denialism. I put CAM up front because it seemed to have the most immediate and direct impact on the students’ lives. We started out by going over Carl Sagan’s Baloney Detection Kit, and applying it to the more outlandish CAM, like reflexology and iridology. Then we went over more mainstream practices like chiropractic and applied kinesiology. In the upcoming class I will also get the students to discuss gene therapy and other frontier medicine.

In the second section of class we covered the really fun stuff: cryptozoology, psychic readings, and UFOs. The assigned readings consisted of articles and websites from both believers and skeptics. If I had personal experiences with any of these topics, I related them to the class. During the discussion students went over questions they had from the readings, looked for logical fallacies and discussed why people really want to believe these things. Some students also talked about their own paranormal experiences, with the class analyzing what may have actually happened.

I created several small assignments during this section of the class, hoping to help the students experience the woo for themselves. One assignment came during the discussion of psychic powers. The class read anecdotes of psychic readings, and watched the *Bullshit!* segment on TV psychics with Mark Edward. The students received a printout of WikiHow’s “How to Give a Cold Reading (<http://www.wikihow.com/Cold-Read>).” We went over the

list as a group, giving examples of or performing each of the steps. Over the weekend, they were to give a reading (cold or hot) to one or more people, and write a report on their experience.

The sitters were mostly friends or family, since the students were uncomfortable approaching strangers. Most of the students got positive responses from their sitters, with one or two sitters being very impressed. Only one or two sitters had anything like a true skeptical response, pointing out the generalities in their statements, or that since they were friends, the student already knew the information they were “receiving” psychically. From this exercise, the students learned how easy it was to fool people, and how something which seems impressively personal and targeted is really very general. In this year’s class I hope to have a more in-depth discussion why people want to believe in psychics – what do they get out of it? What are the perceived and actual benefits and risks of using psychics? This will hopefully lead into a discussion about the morality and ethics of practicing psychics.

For the UFO segment, I gave the students links to images or videos of supposed UFOs. The images were a mix of known hoaxes, mistaken identifications or unknown. Among them were classic images such as the McMinnville Object, the Belgian triangles and the Gulf Breeze photos. The students rated whether each UFO was a mistaken identification, a hoax, or neither. They also had to discuss why they made each decision. During class I put up each photo/video, and the students went over their arguments with each other. They were often surprised by the solutions to the photos (for example, no one thought the Gulf Breeze photos were a model). We did not discuss the types of analyses that can be done with images, and what they can and cannot tell you. This next iteration I plan to go cover the pros and cons of image analysis techniques, probably prior to the UFO and cryptozoology weeks.

It was this assignment that lead to one of the final assignments. The students practically begged to have a project where they make their own UFO photos/videos to post online. Unfortunately we were only partway through the section and hadn’t gotten to ghosts or cryptozoology yet. Although I made those topics available, we hadn’t discussed them in any kind of detail so those groups had a harder time constructing their evidence. Students were allowed to work alone or in small groups. They had to create a video or series of photos, posted to a YouTube account. Then they had to analyze their viewership and comments and give a presentation to the class. This is where it got interesting.

The sole cryptozoology video (<http://www.youtube.com/watch?v=VHZ3Oac2RNo>) involved some tongue-in-cheek acting and a cheaply made Bigfoot costume. This video did not receive any credulous comments (unsurprisingly). Several students posted orb photos or superimposed an image of a person against a spooky background to simulate ghost images. Luckily there are several “known” haunted spots in town, and students took full advantage. Two projects involved a local historic cemetery (**Project 1** (<http://www.youtube.com/watch?v=17EZXWa99zQ>), **Project 2** (<http://www.youtube.com/watch?v=HqqbHC2MK2o>)), and another a highway shoulder rumored to be haunted (<http://www.youtube.com/watch?v=EhQu7ysUgiU>) by the specter of someone who died in a car accident. The haunted highway video prompted a message from a producer of the TV show *Fact or Faked? Paranormal Files*. In this show, a team tries to recreate paranormal videos or photos, using studio techniques and mostly concluding that their recreation isn’t good enough to “explain” the image or video. The message exchange follows:

Producer: Hi, Are you the person who videotaped the footage in the following clip? If so, I would like to contact you to inquire if it's possible to license this footage to the Syfy channel for the show *Fact or Faked: Paranormal Files*?

Professor: Hello. The footage in the clip is a part of a student assignment for a class I taught last year. I would have to check with my University about licensing rights. I'm not sure if it belongs to the University or the students whose project it was. Regardless I (and the students) would love to see it on the show.

Producer: Thanks for responding. Would you please clarify whether this is a real paranormal sighting or a faked event? Would make a huge difference.

Professor: The students created & posted this clip specifically to see how viewers reacted to paranormal evidence. In that sense it is "faked," although I doubt it is any less supernatural than other paranormal clips posted to YouTube. If you are still interested, please let me know.

Producer: Thanks. May be able to place in promo for show. How may I contact you?

I then gave the contact information for both myself and the University lawyer. We

never heard back. Likely the producers are not as interested in using “fake” videos, especially if the hoaxers are willing and able to explain how they actually did it. My students used easy techniques and commonly available or even free software to achieve their effects. It is something anyone can do in their spare time. The producers probably didn’t want that to be the message of their show. An alternative explanation may be that they simply didn’t want to deal with a lawyer.

One of the simplest videos involved the creation of a poltergeist attack (<http://www.youtube.com/watch?v=9v6-uYo0PMo>) using the old standby, fishing line. This video elicited two direct personal responses. One was from someone who was very concerned about the spiritual well-being of the students (typos in the original).

That’s an interesting video. I’ve watched it a few times because I was sure, the first 2 times, that I seen someones shady and someone breathe in through their nose like it was stuffy

I do hear the sniff part still... were you out with your room mate when this was recording? I’ve been watching it over and over trying to see if I could find any foul play (IE someone screwing around with him or him screwing around with you), the only part that has be questioning the video is the sniff.

Assuming, however, that is legitimate you shouldn’t have to much to worry about. Not yet anyway. Anything from a ghost to a demon could be doing this. While demons are something to worry about they aren’t as “dangerous” as people on T.V. and in the movies make them out to be.

Take some Olive Oil and with the bottle in hand pray. Pray your God to protect you from anything evil in the room. Then take a dab on your finger and touch each opening in the room (doors and windows usually) going Top Bottom Left Right.

Normally I try to steer away from super-religious stuff like that but assuming that it is demonic in nature our own research has found that it does indeed help.

If it’s a ghost, just tell it to leave. DEMAND that it leaves. If it doesn’t, contact me further.

Another commenter attempted to explain the events in the video (typos in original):

Ok. I just watched the video and here is what I observed.

First a box comes tumbling down but since it was out of view to begin with it could have been anything. Then there were two small objects popping out from back of the desk.

This too could have been flung by a mechanical device, the coffee can could have had a small vibrating motor in it that was set to vibrate hard enough to knock it down.

The poster probably came down because since it was on a smooth painted wall, either the tape was old, poor quality or humid conditions softened the glue.

The calendar moved as if a breeze hit it. I am assuming a stationary camera was set up so one guess it that there was a tremor.

However we do not know how the room was set up so the wall the desk was set against may not have been a complete wall and someone may have been throwing objects over the incomplete wall.

Another explanation is electrical malfunctions, faulty wiring sending jolts of electricity and creating static bursts to propel objects.

None of it seemed scary or unexplainable to me.

It is either hoaxed or explained through normal and mundane means.

Furthermore most of the movie was taken up with the showing of text so there was only a few seconds of video, this indicates to me that all these “happenings” which took place in just a few seconds was all a set up.

Several of the commenters’ explanations are themselves unlikely (faulty wiring propelling objects with “static bursts” and tremors moving a calendar like there was a breeze). Only one YouTube commenter correctly deduced the means of movement (and no, your comment will never be removed, dear sir). Most of the analyses assume that the students were being honest about how they made the video – setting up a camera to record when no one was in the room. From this assumption, people then explain the videos by more complicated means, such as mechanical devices or earthquakes. It is also interesting that instead of a single, simple explanation – someone pulling on fishing line – the commenter

came up with multiple, unrelated explanations (some of which, like static bursts, are fantastic in and of themselves). Why do you need multiple mechanical devices, old glue, faulty wiring and an earthquake, when a person with fishing line explains it all? It seems that some people have learned to be debunkers without being truly skeptical.

The students really enjoyed putting together the videos and following the comments and views. My students not only learned some new techniques for altering video or still images, they also experienced firsthand how easy it can be to pass off something as a genuine paranormal event. They were continually impressed by how seriously the videos were taken by viewers – and how they themselves had to look at internet videos and images with a grain of salt. The videos are still receiving comments from YouTube users. As one might expect, many of the comments lean towards the snarky and/or profane, although believers are also well-represented. This final project will make its appearance again for my new class.

The third and final segment of the class was denialism. The first topic we covered was Holocaust deniers – something none of the students knew existed. Next we talked about the denial of anthropogenic global warming, which the students had thought was true controversy among scientists. Students were able to draw parallels between the methods of the Holocaust deniers, the tobacco industry, and AGW denialists. The very last subject covered was creationism. This was the sticky wicket – I polled the class and most students considered themselves creationists. When we discussed their beliefs, several of the old creationist saws appeared: no one has ever seen evolution happen, the fossil record has gaps, etc. I was able to counter each statement. We then discussed what it meant to be a creationist. Most students did not realize that it is not a black and white issue, or that there is a group of creationists that believe the Earth is flat. The discussion seemed to open the students up to a more nuanced view of the religion/science interface.

Upon reflection, I am going to reorganize the class so the topics the students most enjoyed are up front. This will allow the students to sharpen their teeth on sillier topics before diving into the more serious. When I introduce the make-your-own-evidence project, they will also have discussed all of the paranormal subjects and be better prepared to design their videos. My hopes for this new batch of students is that they walk away from the class able to recognize logical fallacies, poor use of analysis, and look at media and internet sources with a bit more skepticism than they had at the beginning.

8. “Is It Quackery?”: Searching Primary Literature and Popular Evidence for Signs of Pseudoscience

Written by Karen Koy

In an effort to shake up my teaching schedule, I volunteered to lead a colloquium for the Honors department this semester. This is a small class that meets twice a week for an hour. Titled “Science versus Pseudoscience: Do you know what you think you know?”, the class covers subjects from Bigfoot to health scams. One major goal of this course is to teach critical examination of evidence, both scientific and popular.

For the health & medicine portion of the class, I chose to address the two types of evidence separately. My students are upper-level science majors and have learned to read primary literature in other classes. We started with Greenberg *et al.*’s “Rainy days for the society of pediatric anesthesia” (2012). This is an excellent, tongue-in-cheek example of the correlation-causation heuristic. The paper positively correlates meteorological data with meeting dates of the Society, ending with the suggestion that umbrellas should be sold at meetings. The students, who were used to using primary literature in summary or lab reports, were initially baffled by the paper. Were they serious? Why would someone publish something like this? I asked the students some questions: Did this meeting cause it to rain? What would be the mechanism? Why would you come to that conclusion based on that evidence? The students saw the need for more than a correlation in the data, and we talked about the importance of prior probability analysis.

The next paper I offered them was Daryl Bem’s “Feeling the future: experimental evidence for anomalous retroactive influences on cognition and affect” (2011). This study contains multiple experiments supposedly showing psychic abilities in college students. Since Bem’s paper is very long and confusing, it was paired with the deconstruction by James Alcock (2011). I asked the students to critique the Bem paper on their own before reading the Alcock article. Many of the students picked up on the same problems outlined by Alcock. Overall the class’s unfamiliarity with statistics made it difficult for them to analyze the methods, but they did note that it was far more confusingly laid out than other scientific papers they had read. The class concluded this odd organization was used to obfuscate problems. The different areas the students majored in were helpful during the class discussion. A psychology student took issue with the validity of Bem’s stimulus-seeking measures. A math student pointed out that there were far better statistical tests to use to examine this type of data (ANOVA). We discussed designing proper controls, sample size effects, and experimental design. The students saw the fishing expedition that likely went

on with the data prior to publication. They were all shocked that the paper got published in the first place.

The next step was to give them a choice of several papers to critique on their own. Students chose a paper from this list, then presented it to the class and led a discussion. The class chose to review Wakefield's MMR-autism paper, the Cha *et al.* in vitro prayer paper, and the more recent Séralini *et al.* GMO paper. The students were allowed to get help with jargon and stats, but were told to avoid online reviews of or blogs about the papers – I wanted them to remain unbiased in their evaluations.

First up was Cha *et al.*'s "Does prayer influence the success of in vitro fertilization-embryo transfer?" (2001). In this study, groups of Christians in the USA, Canada and Australia were asked to pray for the fertility of couples in a Korean fertility clinic. Other groups of Christians were asked to pray for the first groups' prayers to be effective. The student presenter had looked up the researchers' credentials (after seeing that one was listed as a JD) and told the class about Wirth's fraud charges. I explained that the paper shouldn't be condemned based on that information – data is data, regardless of personal or criminal behavior. The class felt that the lawyer was there to deal with the ethics of enrolling people in a study and sharing their personal medical information with complete strangers without permission. The class recognized the strangeness of the experimental design. They were figured out that the data weren't actually different than the normal rates of successful pregnancy at that clinic. Considering the oddness of having people pray for people who are praying, the students felt that there had likely been prior studies that hadn't gotten good results. They deduced that this was the last in a line of experiments and the only one with some kind of positive result.

The second paper in the student-led discussion was Wakefield's "Ileal-lymphoid-nodular hypoplasia, non-specific colitis, and persuasive developmental disorder in children" (1998). This is the seminal paper supposedly demonstrating a link between vaccination, autism, and gastrointestinal disorders. It took me almost an hour to track down a copy of this paper that did not indicate its retracted status. The formatting of this copy was clearly different from a normal publication, and several of the students thought that was suspicious. I assured them that it had been published in a major peer-reviewed journal. The presenting student had his mother, a nurse practitioner, sit down and go over the paper with him to explain the jargon. This enabled him to break the methods and results down for the class. The class easily picked up on the problems with sample size, proper

controls, and non-uniformity of developmental delays within the study population. I explained the timing of autism symptom development and vaccines. The students saw the spurious links between the two. They also noted that the children had all already been diagnosed before the study even began, creating a selection bias.

The third paper was Séralini et al.'s "Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize" (2012). This study claims to show a link between GMO crops, Roundup herbicide, and cancer. The presenting student began the discussion by saying, "Data just kind of threw up all over this paper." The class again saw through an oddly designed set of experiments, small sample sizes, confusing methodology, bizarrely designed figures and unnecessarily complex statistics for what it was – obfuscation. They interpreted the huge amounts of data presented, particularly the tables of blood and urinalysis data, as a fishing expedition. The students became lost trying to parse out the methodology, so I went to the blackboard and drew out the experimental design as the students read through the methods. It was clear that proper controls were never used – all rats were exposed, in one way or another, to Roundup. The students were unfamiliar with the Sprague-Dawley rat strain, which is practically a tumor factory. I asked them, why would the researchers pick an inappropriate model organism? The class thought the researchers probably knew about this rat strain before beginning the experiment. The students thought the Sprague-Dawley line was specifically chosen because those rats develop a lot of tumors.

After we finished discussing the papers, I let students in on the papers' and authors' histories. The class was surprised by the shenanigans involved. It was especially surprising to them that it took so long for the Wakefield paper to get withdrawn.

The next part of the class examined medical claims. We started by discussing Wechsler et al.'s "Active albuterol or placebo, sham acupuncture, or no intervention in asthma" (2012). This paper beautifully illustrates how the placebo effect works. Asthma patients were given either albuterol, a placebo inhaler, sham acupuncture or no intervention (control). All three treatments had similar ratings of patient-determined effectiveness, which was significantly better than the control. The actual measures of effectiveness showed the placebo and sham acupuncture to be no different from the control, with the albuterol being remarkably more effective. In short, placebos make you feel better, but they don't actually change the course of your disease. This launched into a discussion of the ethics of offering patients placebo treatments and of health treatments that offer to "harness the power of the placebo."

With this information in hand, students were required to find two or three examples of health scams. They could be from the web, TV, print ads, or in-store displays. During class we pulled up the websites, TV spots and articles the students had found. One student even brought in some Five-Hour Energy drinks for us to critique. The whole class worked together to dissect the ads and labels, looking for the fine print and “quack Miranda warning.” If a study was mentioned, we found and evaluated it. The students were surprised at how poor the studies were – not published, poorly designed, or not showing what the labels claimed.

Primed with this discussion, the students were given two handouts to read. The handouts were information copied from websites, with the URLs printed so students could navigate the sites themselves. One was for Dr. Nicholas Gonzalez (www.dr-gonzalez.com), the other for Dr. Stanislaw Burzynski (www.burzynskiclinic.com). The class was asked to evaluate the websites and information contained within.

On the Gonzalez site, red flags abounded. The students zeroed in right away on the cost of the treatments, and the advertising for books and lectures. Other red flags included the mixture of diseases cured by the treatment (which opened up a chance to talk about “one true cause” and “one true cure” claims). The students were unimpressed by the results of the one clinical trial of the treatment, comparing the Gonzalez protocol to standard treatment. This study shows a significant increase in mortality and decrease in quality of life measures within the Gonzalez protocol group as compared to the standard treatment group (Chabot et al., 2010). The Burzynski site, by comparison, was full of what one student termed “green flags”. Burzynski does not claim to treat diseases other than cancer. There are multiple studies, including an approved Phase III clinical trial scheduled to start in 2012. Burzynski belonged to multiple appropriate professional groups. The students felt comfortable stating that this was not a quack site. I must have smiled, because one student said, “You’re going to drop a bomb on us, aren’t you?” And indeed I did. Burzynski hasn’t had a publication since about 2009, and the Phase III trial was approved several years ago and has no participants. The website doesn’t say, but he charged people tens of thousands of dollars to enroll in his ongoing Phase II clinical trials. His treatments include standard chemotherapy along with the antineoplaston treatment, a major flaw in study design. None of this information is included anywhere on the site, which the class found to be unethically deceiving.

The students were floored. Burzynski was once a qualified, non-quack doctor. Why would he go down this road? We talked about how people can be so sure of themselves that

they can't see where they are wrong. The class discussed the multiple ways people fool themselves to keep their worldview in place. We then talked about the ethics of treatments like this – if a person is going to die anyway, what does it hurt? The students thought it was unethical to offer treatments which don't work – time, money, and quality of life get poured down the drain by seeing these doctors.

This series of readings and class discussions taught students how to critique health claims from multiple sources. They were able to go through primary literature and look for flaws or issues, even without much background in a specific subject. The students know what trigger words or phrases to look for on supplement or other dubious product packaging and advertising. Finally, they learned that sometimes quackery is covered over with a veneer of legitimacy that must be scraped away.

References

- Alcock, J., 2011. Back from the future: parapsychology and the Bem affair.
http://www.csicop.org/specialarticles/show/back_from_the_future.
- Bem, D.J., 2011. Feeling the future: experimental evidence for anomalous retroactive influences on cognition and affect. *Journal of Personality and Social Psychology* 100(3): 407 – 425.
- Cha, K.Y, D.P. Wirth and R.A. Lobo, 2001. Does prayer influence the success of in vitro fertilization-embryo transfer? *The Journal of Reproductive Medicine* 46(9) 718 – 787.
- Chabot, J.A., W.-Y. Tsai, R.L. Fine, C. Chen, C.K. Kumah, K.A. Antman and V.R. Grann, 2010. Pancreatic proteolytic enzyme therapy compared with gemcitabine-based chemotherapy for the treatment of pancreatic cancer. *Journal of Clinical Oncology* 28(12): 2058 – 2063.
- Greenberg, R.S., M. Bembea, E. Heitmiller, 2012. Rainy days for the society of pediatric anesthesia. *Anesthesia and Analgesia* 114: 1102 – 1103.
- Séralini, G.-E., E. Clair, R. Mesnage, S. Gress, N. Defarge, M. Malatesta, D. Hennequin, J. Spiroux de Vendômois, 2012. Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize. *Food and Chemical Toxicity* 50(11): 4221 – 4231.
- Wakefield, A.J., S.H. Murch, A. Anthony, J. Linnell, D.M. Casson, M. Malik, M. Berelowitz, A.P. Dhillon, M.A. Thompson, P. Harvey, A. Valentine, S.E. Davies, and J.A. Walker-Smith, 1998. Ileal-lymphoid-nodular hypoplasia, non-specific colitis, and persuasive developmental disorder in children. *The Lancet* 351: 637 – 641 (retracted).

Wechsler, M.E., J.M. Kelley, I.O.E. Boyd, S. Dutile, G. Marigowda, I. Kirsch, E. Israel and T.J. Kaptchuk, 20120 Active albuterol or placebo, sham acupuncture, or no intervention in asthma. *The New England Journal of Medicine* 365(2): 119 – 126.

9. Reflections on a Semester of Using Pseudoscience to Teach Skeptical Skills

Written by Karen Koy

In the fall of 2012 I taught an Honors colloquium on Science & Pseudoscience. This class was discussed in my previous two posts to the JREF teaching series, “Science versus Pseudoscience: Do You Know What You Think You Know?” (<http://www.randi.org/site/index.php/swift-blog/1797-science-versus-pseudoscience-do-you-know-what-you-think-you-know.html>) and “Is It Quackery?: Searching Primary Literature And Popular Evidence For Signs Of Pseudoscience.” (<http://www.randi.org/site/index.php/swift-blog/1917-is-it-quackery-searching-primary-literature-and-popular-evidence-for-signs-of-pseudoscience.html>) In this last post I will take a look back at the most recent semester.

The Honors colloquium met twice a week, for an hour at a time. The topics covered were a mix of those suggested by the students and those I chose. For each topic, the students were given 2 – 4 handouts, which they were expected to read before the next meeting. In the previous iteration of this course, I required weekly summaries which were graded. Some of the students felt it was an unnecessary burden, so this semester the participation was based solely on in-class discussion. If I felt the topic required some background, I gave a short PowerPoint presentation (for example, explaining audio or visual pareidolia with examples). Otherwise I guided the students through a discussion. This often meant referring to a quote from one of the readings and asking what they thought. At first it was difficult to get the students to talk, but over time they became more comfortable and were able to come up with discussion points without prompting.

We started with a general discussion of science and pseudoscience. I gave a short lecture of basic types of logical fallacies, and the students discussed the signs of pseudoscience, using Dunning’s “How to Spot Pseudoscience” (2007). For the next meeting, students were given two handouts – one was information from homeopathy websites (<http://nccam.nih.gov/health/homeopathy>) and copy of Greenberg et al.’s “Rainy Days for the Society of Pediatric Anesthesia” (2012). During the next class, the students had to determine whether each topic was scientific or not. They were able to see the pseudoscientific nature of homeopathy, but the Greenberg paper confused them. It was peer-reviewed, in a high-quality journal, with proper statistics. This led to a productive discussion of what being statistically significant means, and the relationship (or lack thereof) between correlation and causation.

For the next few weeks we covered the really fun topics: UFOs, psychics, ghosts, and

cryptozoology. The students parsed out the scientific versus pseudoscientific aspects of each area – UFOlogy versus SETI and cryptozoology versus zoology, for example. Most of those topics were linked back to pareidolia. We looked at ghost, Bigfoot, Nessie and UFO images and videos. The students learned how the effect of lack of scale, de-focusing the camera and editing can drastically alter the perception of a sighting. Bigfoot cries and EVP recordings were used to demonstrate audio pareidolia. I played some recordings that showcased the verbal transformation effect, from the study by Remez et al. 1981. When the students didn't know what they were supposed to be hearing, their interpretations of a sound were all over the place. After the students were told what they were supposed to be hearing, they were able to hear everything quite clearly. The students made the connection back to blobsquatches – when given a photo with no prompting, they couldn't find the Bigfoot, but when it was pointed out beforehand, Bigfoot became easy to find.

This fun section set up the students' final project – creating their own paranormal evidence to post online. Three videos were created by the students: a UFO sighting, a Paranormal Evidence-style ghost investigation video, and a “blobsquatch” in the woods. The videos were all posted to a YouTube channel created for the class. For their final presentation, the students had to detail how the video was made, when they posted it, how it was advertised, and analyze the public response. The UFO video

(<http://www.youtube.com/watch?v=fP6CcHpvs8c&noredirect=1>) was filmed with a cell phone.

The UFO was created with a cut-out of a UFO shape held in front of a TV tuned to white noise. The bright flashing light was a cell phone flashlight application. The movement of the UFO was created by moving the camera while recording. The ghost investigation

(<http://www.youtube.com/watch?v=54xTMOTqzuo&noredirect=1>) was filmed using multiple cameras, some hand-held, some set in place. The student used editing to cut out portions of the video where the actors left or changed places. The blobsquatch

(<http://www.youtube.com/watch?v=59-MaD1eT6c>) video was filmed on campus, using an area of nature trails. The camera was positioned and moved so that it was unclear where the video was filmed on campus. This made it look as though the alien/cryptid was in the middle of the woods.

The blobsquatch video had the most views and comments, in part because of advertising. Our University mascot has his own twitter feed, and the creator tweeted the video link to the mascot. Anyone visiting the mascot's twitter would have seen the link. Overall the responses to the videos were not very strong – there were no believing comments, but plenty of disbelieving or snarky comments. If the videos had reached a wider audience,

there may have been a better representation of believing comments.

Overall, the students seem to have benefitted from the class. The students expressed appreciation for the class's discussion style. On evaluations, student comments included, "I liked that this was a discussion based class, I felt that I learned more that way," and "This class makes me really think about some of the stuff in the world." A downside to this design was that students were unclear about how their participation in the course would be graded. The syllabus needs to be updated to clarify the participation portion of their grade. I think the class went very well, and I will teach this class again in the future.

References:

- Dunning, Brian. "How to Spot Pseudoscience." Skeptoid Podcast. Skeptoid Media, Inc., 6 Apr 2007. Web. 27 Aug 2012.
- Greenberg, R.S., M. Bembea, E. Heitmiller, 2012. "Rainy Days for the Society of Pediatric Anesthesia." *Anesthesia and Analgesia* 114: 1102 – 1103.
- Remez R.E., Rubin P.E., Pisoni D.B., and Carrell T.D. 1981. "Speech Perception Without Traditional Speech Cues." *Science* 212(4497): 947 – 949.

10. The Culture of Psychology and Magic

Written by Anthony Barnhart

Psychology departments around the country face a series of new and difficult challenges as online universities gain traction in the educational landscape. Without the overhead of a brick-and-mortar institution, online universities can offer courses on the cheap that can be taken anywhere there is an internet connection, at any time, by students who often have full-time jobs during the day. With aging faculty members who are uncomfortable adapting to digital education and who are already spread too thin between standard teaching and research commitments, many traditional academic departments are having a difficult time being competitive in the online market. A second, tangentially-related concern is the status of psychology among the sciences. For most students who are not psychology majors, the only experience they have with the field is in an introductory psychology course, which often waters down the scientific components of the discipline in favor of “touchy-feely” content with broad appeal. This teaching bias tends to be magnified in the realm of online courses where science becomes more difficult to communicate, leading to a widespread misperception that psychology lacks scientific rigor.

With these concerns in mind, I was approached by the director of undergraduate studies in psychology at Arizona State University, where I am a doctoral candidate in Cognition, Action, & Perception, with a lofty request. Could I create an online course with broad appeal, minimal barriers, and solid grounding in science? Many courses with broad appeal (usually “special topics” courses) come with a host of pre-requisites (e.g., Research Methods, Statistics, etc.), which tends to limit enrollment to students who are psychology majors. Thus, many opportunities are missed for introducing non-psych majors to psychological science. Given my training as a magician (<http://www.Magic-Tony.com>) and cognitive scientist and the recent trend to bring the methods of magicians into the laboratory, it seemed natural for me to build a course on the psychology of magic. Over the last decade, many empirical papers have been published that have built upon theories derived by magicians or that have used the methods of magicians to improve the ecological validity of research that typically employs artificial laboratory tasks. Thus, there could be a strong scientific basis for the course, but magic also has widespread appeal that should entice students from many different fields to enroll.

As I have no experience teaching online courses (I haven’t even taken an online course!), it was decided that my first attempt would be in the form of a hybrid course. The

class would meet face-to-face once each week, and the remainder of the course requirements would take place online. The following semester, I would attempt to convert the course to an entirely online format. I settled upon a structure that was inspired by courses I had taken as an undergraduate while participating in the study-abroad program. The best (and arguably most interesting) way to learn is through immersion in the content area. For example, many people are amazed at the ease with which they learn a new language while living in a culture that speaks the language. In my years as a graduate student, I've had the opportunity to befriend many of the movers and shakers in the new "science of magic" movement, so why not try to immerse my students in this scientific culture to which I have been graciously allowed entry? I decided that I would attempt to have each face-to-face lecture period begin with a guest lecture from one of my friends or acquaintances from the worlds of science and magic. The students would learn the content directly from the scientists and magicians who generated it! Then, I would take over for the second half of each class period to try to relate content from the guest lecture back to readings and previous lectures as well as to more general topics from the psychological literature, thereby wrapping each lecture up with a nice little bow.

I am in a great location for teaching a course of this kind. Phoenix, Arizona has more magic researchers per capita than any other city in the world...There are three of us. Phoenix happens to be home to the Barrow Neurological Institute, where Stephen Macknik and Susana Martinez-Conde, authors of the book *Sleights of Mind* and regulars at TAM, are laboratory directors. In fact, I had the pleasure of making contributions to their book and acting as their magic instructor during its writing. Thus, I decided that *Sleights of Mind*, the first book on the neuroscience of magic written for the general public, will be the textbook for the course. It will provide a structure for the course and act as a springboard into discussion of deeper scientific issues in psychology and neuroscience. Plus, the students will have the opportunity to meet the authors when they visit the class to present a guest lecture! Chapters from *Sleights of Mind* will be supplemented with readings from relevant journal articles and essays by magicians.

As I write these words, a little under a week remains until the start of ASU's Fall semester, and enrollment in the course has nearly reached its 50-person cap. Registrants represent a wide swath of the ASU community. As you would expect, psychology majors dominate the list of enrollees, but it also includes students with majors in English Literature, Philosophy, Communications, Kinesiology, Business, and something called Urban & Metropolitan Studies. Broad appeal? Check! Currently, twelve researchers and magicians

have agreed to visit the course (either physically or digitally) to present guest lectures, and two others are tentatively scheduled. There may also be some unexpected celebrity visits!

My first physical lecture is scheduled for August 28th, and I have a few goals for this initial meeting. Firstly, at its heart, this course will be about science. This means that many of the readings and discussions will be difficult to follow without a basic understanding of scientific methods, and I cannot assume that my students have taken a course in research methods. So, my initial lecture will contain something of a crash course in experimental design and logic. However, my plan is to embed this crash course in a discussion of the history of scientific interest in magic. Around the turn of the 20th Century, partially as a response to the rise of spiritualism in America, a group of prominent psychologists took an interest in examining the methods of magicians as a way to understand the limitations and tendencies of human perceptual and cognitive systems. This interest led to the publication of a few theoretical treatises on the value of magic for psychology, including one by Alfred Binet (<http://magictony.blogspot.com/2009/03/history-alfred-binets-psychology-of.html>), the pioneer of intelligence testing. This early manuscript contains a host of hypotheses that lend themselves perfectly to simple empirical testing. For example, Binet references a hypothesis put forward by Max Dessoir, a French psychologist who had also written on the psychology of magic, saying:

[Dessoir] supposes an illusionist taking an orange, and after having shown it to those around him, throws it up into the air and then catches it in his hand as it descends. He repeats this performance once, twice, and the third time, after having placed the orange in his pocket without the knowledge of those looking on, he takes a pretense of again throwing it up in the air. Mr. Dessoir thinks, and we think with him, that many of those present misled by this action would believe they again saw the orange being tossed into the air as on the two other occasions and would be greatly astonished at not seeing it descend as they had reason to believe it would. (Binet, 1896, pp. 556)

I will encourage students to brainstorm means of testing Dessoir's hypothesis, being sure that any methods contain independent and dependent variables, accompanied by clear operational definitions. However, even if the hypothesis holds up, the quotation does not provide a concrete mechanism to explain the effect. I will further encourage students to generate their own hypotheses predicting the conditions under which people would and would not be susceptible to the illusion. Then, I'll drop the bombshell: Turn the clock for-

ward by about 100 years, and Gustav Kuhn (<http://gustavkuhn.com/VisualCognition/Home.html>) and Michael Land (<http://www.lifesci.sussex.ac.uk/research/land/mike.htm>) (2006) have directly tested this hypothesis and its basis in a very straight-forward way, showing that the illusion is driven by social cues to attentional deployment provided by the magician. I wonder whether their method will parallel any of the suggestions provided by students. It will be an important demonstration that there are multiple methods one can use to test any hypothesis.

The initial lecture will also contain a crash course on “magic lingo” so that students can keep up with theoretical readings from the magic literature and a brief discussion of proper etiquette for watching a magic show as a student of magic. Any magician will tell you that an audience of magicians can be one of the coldest audiences you ever play to, so I want to insure that my guest lecturers are welcomed by a warm audience and not a bunch of cold, analytical stares.

Although *Sleights of Mind* is focused primarily on cognitive neuroscience, the course has a broad scope. I am attempting to traverse nearly every subfield of psychology. The first weeks of the course will focus on the mechanisms and processes involved in attention and perception, including substantial discussion of inattention and change blindness, with a guest lecture by cognitive scientist and magician, Robert Teszka (<http://roberteszka.wordpress.com>). I will devote an entire lecture to addressing perceptual processes that happen without attention (many of which align with the “Gestalt Laws” addressed in any introductory psychology course), as these “pre-attentive” processes are regularly exploited by magicians by virtue of their automaticity. This discussion will introduce one of the themes of the course. We almost always experience our perceptions to be veridical. However they are usually based on incomplete sensory information. Perceptual psychologist Richard Gregory (1980) described perceptions as analogous to hypotheses, where conclusions are derived from imperfect data. Most of our perceptions are constructed partially through sensory information and partially through expectation and prior experience. Thus, we are making assumptions that are useful for successfully navigating the world, but which allow for us to be deceived when the assumptions turn out to be incorrect, as in the case of a magic show. The fallibility of our cognitive systems will come up again and again throughout the course, as I highlight mental shortcuts that are used to simplify processing of our complex environments.

The discussion will segue into the second unit of the course, delving into clinical and

social psychology. I will begin with an examination of theories of autism and their relationship to magic. In *Sleights of Mind*, it was suggested that, since autistic populations are thought to be less sensitive to (or at least less attentive to) social cues, they should be less susceptible to social misdirection by magicians. However, an experiment carried out by Kuhn and colleagues (2010) suggested just the opposite, that autistic participants were more susceptible to social attention cues in magic. This outcome will be considered in light of controversies in the autism literature regarding social attention. With a critical eye, I will also discuss the “broken mirrors” theory of autism (http://en.wikipedia.org/wiki/Mirror_neuron#Autism) and mirror neuron (http://en.wikipedia.org/wiki/Mirror_neuron) theories of action understanding which have been invoked to explain why audiences are fooled by sleight of hand.

Continuing with examination of the social components of magic, we will touch on the topic of magical thinking at the individual and group levels as a way to control the fear elicited by uncertainty (and to reduce cognitive dissonance). This line of thought will touch upon the culture of the magic community, itself, and recent speculations on the relationship between magic and skepticism. Discussion will be supported by survey data collected on belief systems and skepticism in the magic community (see Nardi, 2010) and a guest lecture by Catholic priest and magician, Fr. Jim Blantz.

The third unit of the course could very generally be described as an examination of how our behaviors are driven by prior experience. One of the exciting lectures in this section will be given by magician Barry Schorr on children’s magic. I have arranged to have a group of children visit the class. Barry will perform a show for the kids so that students can experience the unique dynamic of a kids’ show (and the challenges of performing for kids). After the show, Barry will discuss the reasons why kids’ magic differs from adult magic, and I will lecture on experiments in developmental cognition that speak to some of Barry’s programming choices. This topic will be further addressed in a guest lecture by magic researcher, Irina Demacheva. This section of the class will also contain content devoted to mechanisms of memory (with a special presentation by Kenton Knepper (<http://blog.wonderwizards.com/>)) and aspects of decision-making and mathematical cognition (with a visit from magician and researcher, Jay Olson (<http://www.jayolson.org/>)).

The final segment of the class will be devoted to future directions in the science of magic, including a shift of focus to the mind of the magician. Do cognitive mechanisms in the magician change as he or she learns to deceive the senses? Neuroscientist, Flip Phillips (http://www.skidmore.edu/~flip/Site/flip_phillips.html), will visit the class to discuss interesting

work that he has carried out on the motor mechanics of deception. The course will conclude with a discussion of recent controversy surrounding a call for future research in the science of magic to be grounded in neuroscience. Katy Inglis (<http://www.dundee.ac.uk/psychology/people/phdstudents/kinglis/>), a magic researcher who has spent a lot of time considering the future of the movement, will drop in to facilitate this discussion.

In keeping with the immersive nature of the course, students will not be evaluated through exams. Instead, they will be graded based on a series of writing assignments designed to foster online discussion. They will also carry out a project over the course of the semester wherein they attempt to learn a magic trick. They will document their learning process while considering the psychology behind the magic trick that they have chosen to learn. The semester will culminate with group presentations where the students perform their tricks and discuss the psychological basis of each effect. I am excited to see how students adjust to this new course model and to a content area that is sure to be foreign to them all. I hope that they will come away from the course with a few things: (1) A newfound appreciation for the art of magic, (2) a realization that they can't always trust their senses, and (3) a few new tricks up their sleeves!

References:

- Binet, A. (1894). Psychology of prestidigitation. *Smithsonian Report for 1894* (pp. 555-571). Government Printing Office.
- Gregory, R. L. (1980). Perceptions as hypotheses. *Philosophical Transactions of the Royal Society of London B*, 290, 181-197.
- Kuhn, G., Kourkoulou, A., & Leekam, S. R. (2010). How magic changes our expectations about autism. *Psychological Science*, 21, 1487-1493.
- Kuhn, G. & Land, M. F. (2006). There's more to magic than meets the eye. *Current Biology*, 16, R950-R951.
- Nardi, P. M. (2010). Magic, skepticism, and belief: An empirical study on what magicians believe about the paranormal. *Skeptic Magazine*, 15, 58-64.

11. Adventures in Teaching Skepticism

Written by Marc David Barnhill

I continually impress upon my students that the most crucial element of critical thinking — and, not coincidentally, the most difficult — is the self-reflective interrogation of one's own assumptions. The act of discovering and evaluating cognitive biases is an ongoing one, and the critical thinker never reaches a place of skeptical enlightenment. (We inevitably believe that we have, which makes opportunities for metacognitive analysis all the more essential.)

Creating and seizing such opportunities is a major focus of my teaching, particularly in my "Critical Thinking, Reading and Writing" freshman English course -- or, as one of my students once dubbed it, "Skepticism 101." (This student later announced he would henceforth be known as "Confirmation Baez," which I will confess still gives me no end of pleasure.) The course gives students what is usually their first explicit exposure to such topics as logical fallacies, burden of proof, cognitive dissonance, cherry picking, pseudoscience, inattention and change blindness, source credibility, hypothesis and theory, hoaxes, urban legends, the Forer Effect, Occam's Razor, and other fundamentals of the skeptical approach to constructing knowledge.

In keeping with Robert H. Ennis's characterization of the critical thinker as "open-minded and mindful of alternatives," I try to guide my students through the informed sharing of their perspectives on topics and ideas, encouraging them to view the class population as a skeptical community of respectful but outspoken peers whose primary aim is to figure out together just how to do this seemingly impossible but obviously necessary thing.

I say "obviously," but the buy-in isn't always that immediate. Last semester, one student found the continual emphasis on evidence and logic a bit much.

"I mean, there are things we all believe in that there's no evidence for," she said.

"Like what?" I asked.

"Like ghosts," she continued confidently. "Everyone believes in ghosts but we don't have evidence for them."

Seconds later, she was disabused of the notion that everyone believes in ghosts, as various students weighed in on the subject. She seemed frankly astonished, as though it

had simply never occurred to her that there might be people who didn't share this particular belief. She asked a couple of clarifying questions to be absolutely sure she was understanding the situation correctly, then sneered and dismissed the "no-ghost" contingent as not counting because "that's ridiculous."

"And which fallacy is that?" I asked the class.

"No True Scotsman," several students replied, reassuring me that my life had, after all, been worth living.

The ensuing side discussion about paranormal experiences didn't change the young lady's mind to any degree that I could see, but it did demonstrate the sorts of biased assumptions that can distort our thinking, and it paved the way for a more nuanced exploration of evidence and interpretation. Here I was able to share my own "ghost sighting," which if nothing else illustrated the possibility of maintaining a skeptical perspective in the face of emotionally persuasive visual stimuli. A week later, our investigation into pareidolia provided the perfect entry point for a collection of classic "ghost photographs," which further challenged the notion that even those who do believe in ghosts necessarily do so without evidence. (The student in question was not impressed by the quality of this evidence, incidentally.)

Weeks later, the students examined a low-resolution black-and-white reproduction of a painting, and jotted down their thoughts about what they "saw" (in both literal and metaphorical senses) when they looked at it. The class was now primed not merely to discuss the image in terms of pattern-making and visual alternatives, but to listen to one another's differing interpretations and "try on" some of these to see how they fit. This sharing of perspectives, combined with evidence in the form of both increasingly clearer versions of the image and contextual information about the painting's mythological references, enabled the class community to construct and refine a plausible interpretation that stood up to scrutiny.

"Assuming you're not lying to us the whole time," added one student, threatening to run to the library to fact-check the information I had provided.

Huzzah.

12. Folk-Linguistics, Fringe Linguistics and Real Linguistics: Bringing Skeptically-minded Linguistics and Critical Language Studies into the High School Classroom

Written by Mark Newbrook

Linguistics, which began in its modern form around 220 years ago, is the ‘scientific’ study of language: the concerted empirically-based attempt to understand how languages and the general phenomenon of human language work. It includes the study of language change in history (the oldest aspect and still, for many non-linguists, the least unfamiliar) and, since the early twentieth century, the study of how languages are structured and convey meaning at any given stage in their history. Linguistics is connected with the philosophy of language, and its more specific branches such as sociolinguistics and psycholinguistics are connected with sociology, psychology, etc. It is also of major use in the learning of languages, by way of providing a general understanding of language and a framework within which languages (students’ own first languages and other languages which they are learning) can be fruitfully compared in many respects.

Even a very basic knowledge of linguistics is potentially of great use to everybody who is concerned with language – which effectively includes all people, considered as language learners or teachers, educationists, writers and broadcasters, the parents of children acquiring their first or other languages, citizens dealing with public language, readers and viewers, etc. And where (as in the state of Victoria in Australia) linguistics is studied in the last couple of years at high school, the benefits for tertiary studies, specifically, are very apparent.

Skeptical linguistics – a new branch of linguistics – is the critical study of fringe linguistics: non-mainstream (often ‘fringe’) claims or theories regarding language matters. These theories are of many kinds, and they are often presented as parts of wider fringe theories. For example, some writers claim that all civilisations are derived from one particular ancient civilisation (for instance, India), and that all languages are therefore derived from one particular ancient language (in this case, Sanskrit, the ancient language of northern India). Naïve theories of this kind are readily refuted by abundant linguistic evidence and argumentation. Unfortunately, however, they are accepted as true by many non-linguists, some of whom become committed to the associated world-views.

Those who accept or are tempted to accept such theories could gain from a basic understanding of linguistics; they would be less likely to be ‘taken in’ by claims of this kind.

An even more important benefit of thinking along skeptical-linguistic lines is an increasingly critical attitude to folk-linguistics: the ideas about language which are popular among people who know little or nothing about linguistics. This includes both one's own pre-existing folk-linguistic ideas and those of others. Folk-linguistic ideas and claims are not necessarily mistaken, or even confused. Some of them – for example, the better amateur findings about regional dialect/accent variation – are in fact accurate and indeed insightful. But they often require more careful or technical formulation in the light of linguists' findings and thinking. In some cases they clearly are mistaken or confused, or at best dubious; some of them are in fact arguably damaging. Folk-linguistic notions cannot be treated as automatically valid.

In fact, the non-mainstream theories which I mentioned earlier can be seen as extreme manifestations of folk-linguistics. Most of the writers in question are people who may not know any linguistics but who think about language more than most people do, develop their own highly specific, seriously non-mainstream ideas about language, and take these ideas so seriously that they wish to persuade others of them and therefore publish on them.

The people who could gain most from a critical understanding of folk-linguistic (and fringe linguistic) notions, and of the opposed ideas of linguists, include beginning students of linguistics but also, and more crucially here, many language-learners (and perhaps some of their teachers).

The most obvious way in which folk-linguistics and 'real' linguistics differ is that the former is often *prescriptivist* and the latter *descriptivist*. A *prescriptivist* view condemns non-standard usage, even that of native speakers of the language in question, as 'wrong' or 'bad', and urges that its users be trained to use standard forms instead. This applies especially to urban working-class accents such as 'broad' New York, and to stigmatised grammatical forms such as English *ain't* (as in *She ain't coming*), often described simply as 'bad English'. There is an associated idea that native speakers of non-standard varieties which display forms such as *ain't* are linguistically 'deprived' or 'challenged'; and there is a further associated idea that language use is in fact becoming 'worse' or 'looser' over time.

Many people also believe that 'correct' spelling is a matter of huge importance, and that children who cannot spell very well are therefore to be chastised. Some are even reluctant to admit that 'correct' spelling can sometimes vary among different communities us-

ing the same language. For example, British people in the USA who write *travelling* instead of American *traveling* are liable to be told that their spelling is ‘wrong’ – and *vice versa*.

Some people also talk as if all changes to the meanings of words are ‘bad’. Now there are special cases where changes to the meanings or uses of words are arguably confusing and/or have other problematic consequences; for instance, the now-common use of *testament* instead of *testimony* in expression such as *This is testament to her courage*, or, maybe still ‘worse’, the use of *disinterested* (traditionally meaning ‘unbiased’, ‘having no axe to grind’) to mean much the same as *uninterested*. A few changes may even be (in part) the result of ‘conspiracies’ on the part of groups of various kinds with their own agendas. But in most cases changes of meaning are simply part of normal linguistic change. For instance *nice* has meant both ‘imprecise’ and ‘precise’ in its time! And in any case it is difficult to resist linguistic changes effectively, even if they do appear to have problematic consequences. At most, one can try not to adopt the most problematic changes oneself and/or seek to discourage them in careful (written) usage.

In fact, some linguists actually focus in their work upon controversial cases in this area. For instance, some sociolinguists study (as social scientists) cases of disputed usage where the same forms (for example, *We have less students this year*) are considered standard by some and non-standard by others. And others study cases such as the meanings, uses and associations of words like *liberal* where such differences can be crucial in the discussion of political and cultural issues.

Students could be asked to consider the issues raised here, and also all these and other such cases (grammar and accent features, more ‘buzz’ words such as *anarchist*, *atheist*, etc.). Those who are studying or already know other languages could include consideration of items from those languages and comparisons with English.

Other common (cross-culture) folk-linguistic ideas include the (false) belief that the oldest known languages and, especially, the languages of illiterate traditional tribal peoples in places such as the Amazon, who lack advanced technology, are much more ‘primitive’ than, say, European or classical languages and ‘have no grammar’.

Instead of these descriptivist/folk-linguistic ideas, linguists would adopt the descriptivist view that the words, constructions, meanings, etc. found in languages are phenomena to be described and explained like other aspects of the world, not (except in truly special cases) condemned or discouraged. And they would challenge these prescriptivist

and other folk-linguistic ideas on the basis of evidence and argumentation. For example, they would ask to know the criteria by which forms which are used naturally, regularly and systematically by native speakers of a language, with clear meanings, could possibly be judged 'wrong' or 'bad'. (Students could be asked to consider this very point.) And, in an educational context, they would be concerned at the negative psychological effects of making students feel that their native language is somehow inferior because it features certain specific forms rather than others.

This is not to say that linguists would refrain from teaching foreign learners how things are said or written in their new languages. Nor would they recommend that students be allowed to use clearly non-standard forms – or 'incorrect' spellings – in formal or important contexts such as public exams or job interviews. Developed, literate societies do need standard varieties; and, while linguists would argue that too much emphasis is often placed on these things, it is unrealistic and indeed culpably disingenuous to encourage young and relatively powerless members of such a society to jeopardise their life-chances either through acts of sociolinguistic bravado or simply because they are inadequately informed. But this is not the same as denigrating students' native usage as inherently 'wrong' or 'bad'.

To conclude: in general, linguists would suggest that it would be helpful if students were encouraged to adopt critical and scientific/logical approaches to matters of language.

13. Teaching the History of Pseudoscience

Written by Brian Regal

Having spent the previous three years at Kean University assembling a core curriculum in the history of science, technology, and medicine, I thought a philosophy of science course would round out the program nicely. I did some assessment in the form of asking faculty, students, and colleagues from other institutions what they thought of this idea. The response was a collective pointing of fingers into mouths with the accompanying “aaahhkkk” of distaste and boredom. Rethinking my position, I proposed a course on the history of pseudoscience instead. The gagging stopped, replaced by smiles and nods of affirmation and many suggestions on case studies, text books and papers to read. I went right to work.

A course on the history of pseudoscience solves several pedagogical problems. A course involving ghosts, UFOs, spirit mediums, and monster hunters draws in students who otherwise would never go anywhere near a philosophy of science class. It teaches them how to tell the difference between what science is and what it is not, it teaches them to think skeptically and critically, and it does this within an historical context. It also allows me to spend time in the classroom on my specific research. I work on the fringe aspects of scientific thought focusing on the relationship between amateur practitioners and professional scientists, particularly surrounding questions of biological evolution and its impact upon culture, religion and politics. Drawn in by ghosts and monsters, students learn the tenants of the philosophy of science almost without realizing it. They learn how fascinating and useful philosophical, skeptical, and critical thought can be to the everyday experience.

My course proposal was sent to the university curriculum committee and once accepted and approved became HIST3854 *History of Pseudoscience in America* (<http://www.kean.edu/~bregal/HIST3854.htm>). It first ran in 2010 and student response has been overwhelmingly positive. It has drawn students not only internally from the history department, but from the Science, Technology, Engineering, and Mathematics (STEM) program. Students from as far afield as psychology, English, and religion and philosophy have enrolled.

There are many exceptional scholarly works on pseudoscience out there, but unfortunately they mostly deal with specific aspects with few dealing broadly with the history. As a result I chose to use as a basic text my own *Pseudoscience: A Critical Encyclopedia*

(Greenwood, 2009). To supplement this (as I do with all my classes) I use a series of scholarly articles. I mix classic works such as Paul Thagard on astrology, Thomas Gieryn on demarcation, and of course articles about the work of Thomas Kuhn with newer ones. The web site for the course has a series of links to on-line sources on pseudoscience history I think are appropriate as well as several wacky photographs from the history of odd thinking to dress it up (I also make extensive use of PowerPoint in class to show photos of various personalities, artwork and incidents from pseudoscience).

Focusing on the history of pseudoscientific thinking, the course is built around a series of case studies in chronological order. Students are encouraged to track sources of pseudoscientific claims and to think critically and skeptically when examining them. It begins with setting definitions of science and pseudoscience. Starting with astrology and alchemy and working through spiritualism, Forteanism, ghost hunting, eugenics, dubious geology, UFOs, and cryptozoology the course addresses these issues always with an emphasis on determining what makes them pseudoscientific or not. Discussions where students argue something is not pseudoscientific are encouraged. I add additional topics depending on current aspects of pseudoscience in the news. Another important issue I address in class is the process by which topics can jump from one realm to another. Students study how some ideas originally thought to be properly scientific later end up on the pseudoscience side of the tracks such as eugenics, while some once thought to be pseudoscientific, such as alchemy, have been reevaluated by scholars in a more positive light. (I also teach a course *The History of Alchemy and the Origins of Modern Science*.) Cryptozoology is viewed as something roundly thought to be pseudoscientific but which has the potential to become mainstream science. This approach, I think, gives the student a more subtle and nuanced view of a complex field of study in which black & white characterizations are the norm. Along with the secondary histories, emphasis is placed upon the use of primary source documents. The work load is a mid-term and final exam along with a major research paper. Students may choose any topic—with my approval—that falls under the rubric of the history of pseudoscience. They must tell the topic's history and examine its social impact.

Several courses offered at US colleges and universities include discussions of pseudoscience. A few, such as Portland State's Science and Pseudoscience and CUNY's Philosophy of Pseudoscience, are focused on the philosophical aspects. Mine focuses primarily upon the historical component. These others should be consulted as models by anyone considering building such a course. A history of pseudoscientific thought can greatly add

greatly the critical thinking component of any university assessment program and pedagogical mission particularly in the realm of the advancement of critical thinking skills.

14. The JREF Education Advice Column

Written by JREF Department of Blog-Based Education

The following hastily scrawled letter was found one morning slipped under the door at the JREF Blog Department of Education addressed to “Any Skeptical Professor.”

Dear Skeptical Professor,

I am a college student, and recently my biology instructor has said some strange things. The other day, he was talking about "all the toxins in our food and our environment." He also said, "With all the pesticides in our food, it's no wonder cancer is now the number one killer in America, even more than heart disease." He also talked about the professor who was reported to be looking for young woman to surrogate a Neanderthal baby. He apparently didn't know the professor had been misquoted.

I'm at a loss. I don't want to embarrass him in front of the class, but I also hate that he's passing on misinformation. I also have to consider that if I make trouble, there goes my GPA!

Any advice would be greatly appreciated!

Desperate in Detroit

Dear Desperate,

You are right in that confronting your professor in class would be a poor choice. Your professor should have office hours, you can go see him during that time instead. That way there is no pressure on him or you from having other students present during your discussion.

You should pick a topic with which that is easy to demonstrate a misunderstanding without making your professor feel defensive. It is important for you to start on a positive note. State that you found what he said very interesting, and decided to learn more about it (this is a complement). During your investigations, you found out something interesting you thought he would like to know.

My suggestion is to find original sources for the Neanderthal news item. Tell your professor you thought it was so interesting that you decided to read about it in more detail. Show him where the research differed from the media reports. This can become a discussion of poor science reporting and media bias towards sensationalism. Express your surprise at how badly the story was mangled.

Hopefully by starting out this way, your professor will be more receptive when you

bring other topics up. Remember – meet him outside of class, start with a positive statement, demonstrate that you are “on his side”, and show him the original sources or peer-reviewed research papers.

Good luck!

Karen Koy

Dear Desperate,

You have found yourself in a very tricky position, indeed! While the urge to publicly shame your professor may be quite strong, it's probably in your best interest to quell these urges (at least, in the moment). After-all, he's likely to shame himself in due time!

For better or for worse, most classroom situations are a one-way street. The professor disseminates knowledge, and the student acts as the receptacle. By voicing your disagreement with what's being professed, you run the risk of making the instructor feel that his credibility is being challenged. He is unlikely to take kindly to this turn of events, and his unease could easily be reflected in your subsequent grade for the course. However, you need not sit idly by while witnessing atrocities of misinformation. In fact, you may even be able to turn the interaction into a net-positive for both parties! Here's how:

While it's not advisable to publicly challenge your professor, teachers do appreciate students who seek extra information and who contribute positive content to classes. So, when your professor makes one of these claims, it's natural in the moment to ask whether he can guide you toward any research supporting his claim. (Spoiler alert: He probably won't be able to.) Be sure that you don't phrase your question in a combative way. If the question is posed from a place of genuine interest, the professor may be able to turn the situation into a "teachable moment" for both himself and the students, rethinking his choice of words.

When it comes to a simple misunderstanding of current events (as in your Neanderthal example) I see no problem with you interjecting that, "I heard that the professor was misquoted..." As a teacher, this is the type of correction that I would be very open to during class.

However, if your goal is to persuade your professor, you're unlikely to have any success through interaction in the classroom. The power structure and emotional context are

insurmountable barriers to persuasion. Your best bet at persuading someone like this is via email (assuming, again, that you approach it in a non-combative way). Guadagno and Cialdini (2007; *Computers in Human Behavior* (http://osil.psy.ua.edu/pubs/guadagno_chbalt.pdf)) showed that attitudinal changes in men are more likely in response to arguments made via email than face-to-face (when there are social barriers to persuasion, as there are in your case). Simply contacting the professor to report that he motivated you to pursue further research and that "there seems to be a controversy here" can be a cathartic exercise for you while also showing the professor that you're an engaged student. Of course, be sure to include a link to relevant research supporting your position. If the email also leads to a change in the professor's attitude, then that's an added bonus!

Sincerely,

Tony (Barnhart in Tempe)

Dear Desperate,

First off, I sympathize with your situation. Though it's many years ago now, I certainly had my fair share of professors inflicting bizarre beliefs upon their captive audience, and more recently have witnessed or heard students' accounts of colleagues' equally incorrect instruction. One would hope that open dialogue in class would yield a common acceptance of whatever the evidence actually points to, but if you sense that your instructor would not be amenable to such a discussion or would penalize you for dissenting, I wouldn't insist that you sacrifice self-preservation for principle.

Different institutions have different mechanisms and procedures for dealing officially with this sort of thing, so you should probably speak with a counselor, Academic Affairs officer, or ombudsperson, even if you don't intend to file a formal complaint -- just to get a clear sense of what options are available to a student in your situation. Hypothetically.

Of course, you can also talk with other members of the class about the instructor's fallacies and falsehoods, to kill the wrong before it takes root and, perhaps, to come up with ideas for dealing with the situation. But I'm sure your concern is for more than the immediate future.

Having said that, there are some steps you can take to prevent further miseducation from happening. You can start by assembling a collection of documents from reputable sources that provide clear evidence that counters your instructor's claims. Be sure to include website addresses or other publishing information, highlight the salient passages, and preface the entire packet with a typewritten note in which you express your concerns and respectfully request that the instructor educate himself a bit more. This can be done anonymously, and you can leave the packet in your instructor's mailbox or under his office door. Personally, I would also urge the instructor to acknowledge and correct his earlier inaccuracies for the class, and would observe that students' respect for their instructor would only increase were he to model the humility and self-examination required for effective critical thinking.

If the problem continues unabated, you can consider Phase 2. Here you have a choice, which will depend partly on your comfort level and partly on the specifics of your institution. You can bring your concerns directly to the department chairperson, or dean, or whomever you've discovered is the appropriate recipient for such complaints, or you can write your instructor another note informing him that you are about to do this and giving him another chance. Either way, the eventual action would involve submitting a meticulously researched version of the earlier packet to the institutional representative, along with a letter clearly outlining what you consider the problems with and consequences of the instructor's teaching, with as much specific information as you can gather documenting the offending content of that teaching: exact quotes from the instructor, to the best of your ability to recall them; any relevant handouts or other material; and corroboration from other students, should any be willing to cooperate.

Obviously, anonymity is not an option at this stage if you wish to ensure that the institution will investigate your concerns -- and, again, the effect of tenure and similar considerations on an institution's ability or willingness to interfere with an instructor's teaching will vary. At the very least, though, you can (anonymously) inform the chairperson of what's going on so that he or she can decide whether and how to steer the instructor, and the department, in the right direction.

I wish you the very best of luck, and I hope you'll let us know how everything turns out.

Marc David Barnhill

Marc David Barnhill, Karen Koy, and Tony Barhnart are mild-mannered skeptical

teachers by day, caped crusading advice columnists by night. Together, they form a sort of Voltron of academic wisdom. The lion Voltron. Not the stupid car Voltron.

15. Teaching the Philosophy of (Pseudo) Science

Written by Sebastian Normandin

“What is science?”

I put this question to freshmen in a science college at a Tier-one research university hoping for some creative comebacks in the form of a paragraph or two. I got confusion. Science, apparently, is: everything, nature, technology, “the scientific method,” and, brilliantly, what scientists do. Faced with a barrage of odd, confused generalities, I was dismayed but not surprised. For what is science? It may be among the most elusive questions in the modern world, motivating scholars in history and philosophy of science to write and reflect endlessly. Though this simple question remains foundational to these fields, most thinkers abandon it at a certain point and move on to more concrete, pragmatic concerns. But the question remains.

One way to develop a satisfactory answer is to turn the question around – “What isn’t science?” This was to be my approach teaching an introduction to history and philosophy of science. I would use the concept of pseudoscience to help these budding scientists better understand what it is they think they are getting into. It’s logical. After all, how can one know light without darkness, life without death, love without hate, good without evil? And pseudoscience has such pejorative connotations it’s often seen as dark, even evil, or at least insidious. Value judgments aside, exploring this concept would be a way to draw my audience in and, without them noticing, teach some fundamental principles in history, philosophy and sociology of science.

Interesting, that idea of value judgments. We see values and the expression of values, (or beliefs, ideologies, or even, one might say, biases) as anathema to science. Science, conventionally understood, is “value-free” or “value-neutral.” It’s this kind of neutrality and objectivity that is seen as the hallmark of scientific thinking. But is this valid? In “Objectivity, Value Judgment, and Theory Choice,” the famed purveyor of the paradigm shift, Thomas Kuhn, argues there are no real universal rules guiding choices between scientific theories and the values that inform all thinking are subjective, transcending any ultimately rational framework. Further, there are all sorts of irrational psychological and social forces that influence which theories prevail in a given scientific community.¹

Kuhn’s idea of paradigm shifts has profoundly impacted the way scientific ideas are understood. He said that the development of science followed a pattern – a paradigm de-

velops, and most research is “normal” science that bulwarks the existing paradigm. Eventually, however, anomalies build up to the point of incoherence, forcing the adoption of a new paradigm – something that occurs, historically, almost overnight. He understood how important social context was in the scientific endeavor. In technical terms, Kuhn moved history and philosophy of science from an *internalist* to an *externalist* perspective. His work illustrates how contingent scientific ideas are, and further suggests that the idea of scientific realism – that science accurately describes a world “out there” independent of our subjective experience – is probably untenable. This doesn’t mean there is no “dark side of the moon” even if we aren’t able to see it. It merely means that this kind of ontological gymnastics is irrelevant to our understanding of science. Rather, we are left with a necessity to acknowledge social construction and a strong motivation to question the supposed objectivity and value-neutrality of science. Science, then, is subject to the same limitations as every other area of human endeavor.

What does this have to do with the teaching of pseudoscience? It reminds students that vigilance about the legitimacy of a scientific idea or theory is more important than ever and that all of us, as a society, need to be gatekeepers, wary of poorly constructed science. For any citizen of the contemporary techno-scientific world this critical understanding, and the ability to evaluate a given scientific practice from methodological *and* social perspectives, is an essential skill. It also suggests there are reasons beyond “truth” that prompt us to deny the validity of supposedly scientific claims.

But what are these reasons? This is where pseudoscience proves illustrative. Take astrology. In a classic article, “Why Astrology is a Pseudoscience,” Paul Thagard argues, contrary to many other philosophers, that there is no one clear criteria distinguishing science from pseudoscience (e.g. Popper’s idea of *falsifiability*, the notion that all scientific theories need to be open to being refuted). Instead, through a brief but brilliant history, Thagard shows that astrology is pseudoscientific because in its 2500-plus year history, *it has not once changed its basic framework or shown any progressive development at all*. For Thagard, astrology’s entrenched nature, the unwillingness of its practitioners to consider alternate theories or adapt their explanations based on new data, is what makes it pseudoscientific.³ At a stroke, this example gives students an instinctual sense of the importance of change and progressive development in science, making the point without understating how much foundational scientific theories remain fairly fixed.

Subjects like cryptozoology or ufology introduce students to the scientist as professional, reminding them that many social criteria – credentials, institutional affiliation and

training – go into evaluating a scientist’s legitimacy and claim to expertise. These fields also force students to think carefully and critically about the nature of proof.

The idea of proving seems an important aspect of scientific practice, but what does this mean? Science requires a level of *demonstration* (proof) and a quality of evidence that differs from unscientific or non-scientific practices. Here students learn the dangers of confirmation bias – selective and subjective use of data and evidence. Though part of all human endeavor, science seeks to minimize its impact as much as possible. The way cryptozoologists become obsessed with their subjects and pursue them with a reckless personal passion also warns us that personally investing too much in research outcomes can undermine credibility and lead to a charge of pseudoscience. Even legitimate practicing scientists can fall victim to this. Discussing the problem of confirmation bias and personal gain, I have the opportunity to ask tough questions about the procedures the modern pharmaceutical industry employs in its clinical trials. The nature of drug development also introduces the limits of contemporary science’s compliance with what sociologist Robert Merton argued should be scientific norms, like communalism (openness) and disinterestedness.⁴

The challenge of bias and the selective use of data are also issues in alternative medicine. Alternative medicine further highlights two other problems of pseudoscience – vagueness and a misinterpretation of, or even unwillingness to recognize, established laws of nature. Most alternative medicine is dependent on the idea of vitalism – the idea of a “life force” that shapes, guides, and heals the living. The problem with vital forces or energies is that they are vague and lack concrete proof. In addition, they run contrary to what mainstream science accepts as the known forces of nature. In this sense, alternative medicine is operating in what a Kuhnian might call a different paradigm. Indeed, many aspects of alternative medicine – its rationales, methods, and understandings – not only run contrary to the conventional scientific worldview, they are actively hostile to it. So much of what pseudoscience depends on – in things like homeopathy, hypnotism, and all sorts of areas where suggestion is important – is *placebo effect*, a poorly understood phenomenon reminding us of the power of belief. But belief does nothing to improve our knowledge – sugar pills or injections of saline may make people feel better, but science differs from pseudoscience in the need to explain *how*.

Problems of belief and what can be invoked as an explanation further illustrate the way science differs from other practices. “Creation science,” for example, prioritizes ancient religious texts (e.g. The Bible) as evidence to argue for an Earth created a few thou-

sand years ago over and above almost two hundred years of observational facts that provide evidence for a very different view – an almost unimaginably ancient Earth and the amazing process of natural selection responsible for producing its startling diversity of life. Not only do creationists valorize different facts, they actively ignore facts that contradict their theories. From the point of view of method, this is just not science. They also invoke supernatural forces, violating the dedication science has had to a “naturalistic epistemology” since the practice began in ancient Greece.

At a stroke, the critical investigation of a pseudoscientific domain, like parapsychology and the study of ESP (or *psi* as it’s now called) can highlight a number of unscientific elements – anecdotes, coincidence, and the lack of controls and clarity in experimental design. It also shows students that unexplained doesn’t mean inexplicable. Without formal historical or philosophical training, students tend to see science as a collection of “facts.” And, indeed, to some degree science is made up of facts. But as the French mathematician Jules Henri Poincaré said, “a collection of facts is not necessarily science.” And what is a fact? Thinking about this question shows us that not all facts are created equal, and that the kind of facts that science prioritizes are better understood as evidence – a word that implies awareness, and thus the idea of seeing or experiencing. This is the kind of *direct evidence* science demands, generated by experiments or garnered by careful observation (and here, even, scientists generally value experimental over observational facts – after all, our senses can so often be deceived).

As an example, consider the largely forgotten Velikovsky affair. Immanuel Velikovsky was a psychiatrist and eclectic independent scholar who wrote *Worlds in Collision* in 1950. Using evidence (facts) found in ancient historical and religious texts, he argued that the Earth and some of the other planets in the solar system had experienced numerous close encounters and collisions with each other (in what astronomers would see as a very recent timeframe) that contributed to their formation and transformation. Velikovsky essentially suggested that references in historical documents were archetypal recollections of these events. His claims generated a hysterical response from the scientific community, and rightly so. For Velikovsky had violated accepted scientific practices – speaking to a subject in which he had no formal training, ignoring existing theories and models, and prioritizing a certain kind of evidence (textual) over and above “better” evidence generated by careful observation and experiment.

Velikovsky’s catastrophism and ideas about planetary formation is a cautionary tale.⁵ It recalls the ways in which wild theorizing and speculation are pseudoscientific at

their core but, in certain cases, have also served the development of science. In the context of mainstream science, some of Velikovsky's insights about the importance of the catastrophic in astronomy have merit (i.e., the currently accepted theory about the formation of the moon resulting from an object impacting the Earth). Examples of the importance of heresy abound in the history of science. Figures like Copernicus and Galileo were operating outside the purview of "normal" inquiry into knowledge in their respective societies. More recently, Alfred Wegener's theory of continental drift, proposed in 1912 in a paradigm of gradualist geophysics, was labeled pseudoscientific and only finally accepted in the late 1950s as plate tectonics emerged as an explanatory framework.

One might ask if these renegade successes justify a kind of chaos without rules in knowledge inquiry, what philosopher Paul Feyerabend called "epistemological anarchism." ⁶ Well, no. For individuals this is often a laudable strategy but, collectively, it quickly leads to complete dissipation and incoherence. When it comes to creating meaning, some structure must apply and looking at pseudoscience reveals inquiry that pushes beyond the boundaries of the structure of science.

In the end, when teaching history and philosophy of science, one needs to be practical; and here science in its modern guise demonstrates its central virtue. If there is "success" in a given scientific endeavor (i.e., what philosopher Imre Lakatos called a *research programme*⁷), if it garners funding, employs researchers, produces peer-reviewed publications and technological byproducts, adds to knowledge of the natural world in a meaningful way, and, perhaps most importantly, is seen as legitimate and having merit in the wider social sphere, then it is "science." Looking at the ways many theories and ideas have failed to meet these criteria, and ended up labeled as pseudoscience, helps students fundamentally appreciate what we mean by the word.

Notes:

1. Thomas Kuhn, "Objectivity, Value Judgment, and Theory Choice," in *The Essential Tension* (Chicago: University of Chicago Press), pp. 320-339.
2. Thomas Kuhn, *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: University of Chicago Press, 1970 [1962]).
3. Paul R. Thagard, "Why Astrology is a Pseudoscience," in *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, Vol. 1978, Volume One: *Contributed Papers* (1978), pp. 223-234.

4. Robert K. Merton, "The Normative Structure of Science," in Merton, *The Sociology of Science: Theoretical and Empirical Investigations* (Chicago: University of Chicago Press, 1973).
5. Velikovsky has been the subject of intense study, most recently in Michael D. Gordin, *The Pseudoscience Wars: Immanuel Velikovsky and the Birth of the Modern Fringe* (Chicago: University of Chicago Press, 2012).
6. <http://www.generation-online.org/p/fpfeyerabend1.htm>
7. Imre Lakatos, *The Methodology of Scientific Research Programmes: Philosophical Papers, Vol. 1* (Cambridge: Cambridge University Press, 1978).

16. Of Angels and Blueberry Bagels: DNA, Bigfoot and the Classroom

Written by Dr. Brian Regal

Recently in my History of Pseudoscience class we discussed the hubbub over Bigfoot and DNA. Part of my approach to the course is to stress to students the importance of original source documents such as correspondence, texts, empirical data, diaries and other similar written materials. The scholarly historical enterprise centers on the analysis of original texts. What quickly became apparent to the students in this case is the quirky nature of the written record available. Despite the apparently scientific nature of the debate over DNA evidence and scholarly paper at the heart of it, there is yet, as of this writing, no scholarly paper, no official release of data. This incident is based on social media posts which themselves are for the most part innuendo, unsubstantiated accusations, petulance, bravado, claims and counter claims (including references to Angels and Blueberry bagels), and little else. In other words, they are the sort goldmine of human foibles historians love, and which tell us so much about human behavior and how knowledge is generated as well as the importance of skeptical thinking.

It began in November 2012 when news broke that Dr. Melba Ketchum, a veterinarian and head of the Texas based company called DNA Diagnostics, had isolated the DNA of a Sasquatch. Dr. Ketchum's work was known to Bigfoot enthusiasts for years and was looked forward to with some excited anticipation. North America's most famous anomalous primate, Sasquatch or Bigfoot, evolved out of a longstanding folk belief in a marginal indigenous tribe in the Pacific Northwest. There is a long tradition of both amateur naturalist and professional scientist interest in the creature with many attempts to find it. Over the years many footprints have been found, video and still images taken, but no real proof acquired. If Dr. Ketchum's work stands up to scrutiny it could help prove the creature's reality and herald a new era of legitimacy for cryptozoology.

Ketchum's company put up announcements on its web site saying it had sequenced a number of genomes and that a peer-reviewed paper would be appearing in the not too distant future. Even more startling than having sequenced Sasquatch DNA was the claim that the evidence supported the notion that rather than being related to the human line of evolutionary development, Bigfoot was in fact a product of unions between humans and an undisclosed earlier large bipedal primate that had taken place around fifteen thousand years ago. In other words, Bigfoot is human. Dr. Ketchum then went on to explain that this makes the population of Sasquatches not monsters, but "indigenous people."

Ketchum's results were leaked prematurely by Igor Burtsev, a well-known, long time Bigfoot researcher from Russia. Burtsev is of the opinion that Sasquatches have speech ability and have learned, in a few cases, to communicate in English. This, he says, makes them more human than ape. He is a champion of the infamous 'Carter Farm' case from Tennessee. There a family claimed that they had lived in close quarters with a population of Bigfoots for decades. They exchanged visits, food, and a laugh or two, and learned to speak with each other. There is a sub-genre of Bigfoot believers who claim to be amongst Bigfoots for extended periods under friendly circumstances—as opposed to the usual Sasquatch encounter which is accidental and usually ends with the witness running in the opposite direction. The Bigfoot friends, like the Carter family, never seem to have a camera around to take a few pictures that would easily clear up the entire controversy.

These considerations aside, leaking someone else's research before it is published, as Burtsev did, is considered very bad form and quite unprofessional in the world of scholarship. Accusations have flown as to why Burtsev perpetrated this scientific equivalent of shouting out the ending of a movie as it is just beginning. He says he did it because he "knew" the "scientific establishment" would quash such a major breakthrough—for a number of appropriately nefarious reasons—and he didn't want to see that happen again. Others claim that most of Ketchum's work had already been leaked.

Incidents like the Ketchum DNA discovery are useful to those of us who teach the history of fringe belief systems. They help show students the differences between science and pseudoscience, how both are done, and what their natures are. As an historian rather than a debunker I have the advantage of watching and analyzing both sides of these issues (I do not care if Bigfoot is real or not). I have yet to see any evidence proving unambiguously that these creatures are real. Having said that, however, I think there is at least a certain evolutionary plausibility to these creatures, and I think cryptozoologists have something to add to our knowledge of the way the world works, though they have yet to figure it out. Watching the various parties inside cryptozoology in North America battle it out and argue over who said what and the meaning of the leaked results is especially fascinating. With some notable exceptions, few in the realm of cryptozoology have any training in genetics, evolutionary biology, population studies, environmental science or even history and thus have little qualification to analyze the technical material, whether published or not.

One of the telling aspects of this case is how many in the world of Bigfootery have been skeptical of Ketchum's pronouncements if not outright hostile towards them. As if for

true believers the news of a human/Sasquatch hybrid, or the way the news was made public, was too much for even them. I think this reaction is a healthy sign of a growing skepticism within the ranks of monster studies.

Science is not done through press releases and rumor-mongering. It is also not done by the simple collecting of data. It is about building intellectual legitimacy both within the community of practitioners and amongst the general public. Science gets its authority first from doing its work to a high standard of intellectual rigor, unbiased analysis, and peer-review, and second by convincing the general public that its findings are respectable and accurate. Cryptozoology has worked for decades to acquire that sort of legitimacy but has yet to achieve it. Part of that failure has been from a lack of acceptable evidence for their claims, but also in the way their evidence has been put forward. As I have said many times in my writing, there are cryptozoologists who work with diligence at performing their work in as professional a way as possible. They deserve respect, but usually get ridicule and often because of what others in the field do rather than that of skeptics or debunkers. The Ketchum DNA Bigfoot story is yet another example of cryptozoology shooting itself in the foot pushing legitimacy even further off. This is not over its evidence, but over how it puts that evidence forward. My students came to the conclusion that we will learn more about this case from Twitter feeds and Facebook posts than from any peer-review article. While social media generates interest it does not establish legitimacy. All these shenanigans are bad news for cryptozoology, but great as teaching aids.

17. Teaching Writing in The Bermuda Triangle

Written by Eve Siebert

First-year composition classes are required at most American colleges and universities. At some schools, including the one at which I currently teach, “freshman comp” is the only class that is required for all students. Instructors of first-year writing classes are expected to accomplish a great deal: we are expected to prepare our students for writing at the college level in all disciplines; we are expected to introduce our students to college-level research (how to find and evaluate sources and how to incorporate those sources into their own writing); we are expected to teach our students how to craft a well-supported, well-reasoned and fair argument. Oh, and there are also the mechanics of writing: grammar, punctuation, diction, syntax, tone, analysis of audience and purpose.

Probably the most important part of our job revolves around argument and research: we strive to teach our students how to be critical thinkers and critical readers, and we try to teach them to be responsible writers. We spend much of our time discussing evidence: evaluating the strengths and weaknesses of potential sources and using evidence to support a strong, logical thesis. To that end, we introduce students to logical reasoning and logical fallacies.

In other words, a bunch of hippie English majors are teaching critical thinking.

One of the best short articles I have found that illustrates the importance of critical thinking, skeptical reading and responsible writing is Larry Kusche’s “The Bermuda Triangle,” published in *Science and the Paranormal: Probing the Existence of the Supernatural*, edited by George O. Abell and Barry Singer. Kusche is best known for writing the book *The Bermuda Triangle Mystery: Solved*, which shows that there really is no mystery surrounding the so-called Bermuda Triangle. While the book is comprehensive, the article deals in depth with two cases: the *Suduffco*, a freighter that disappeared in 1926, and a derelict supposedly encountered by the *Ellen Austin* in 1881. I pair the Kusche article with a more credulous Bermuda Triangle piece, George X. Sand’s “Sea Mystery at Our Back Door,” published in *Fate* magazine in 1952. The stories discussed in the Sand and Kusche articles do not overlap.

I begin by discussing the Sand article. Since the students have also read Kusche, they may have a more skeptical perspective on Sand than they would otherwise, but since Kusche doesn’t directly refute any of the stories discussed by Sand, the students have to do

their own critical thinking. First I ask the class to list positive aspects of the article. Generally, the students mention that Sand refers to specific details: names, dates, locations. They also mention that he is an interesting storyteller, although this is a problematic positive.

I then ask the students to discuss aspects of the Sand article that they find questionable. They notice, first of all, that Sand does not cite any sources, either in a bibliography or within the text, except for one vague reference to the U.S. Weather Bureau. He provides specific details but doesn't back them up with any evidence. Students also notice that some of the details are slightly dubious, causing readers to wonder, "How could he know this?" One particularly egregious example of a suspicious detail comes in Sand's description of the *Sandra*:

The crewmen had been at mess, and now those not on duty drifted aft to smoke and talk and reflect upon the dying day and what the morrow would bring. (12)

How does he know they'd just been at mess? How does he know that they then went aft to smoke and chat? Of course, it's possible that this information was reported somewhere, but, without a source, we have to question it. Sand includes many novelistic flourishes. These not only add to the interest of the story, they also contribute to the sense of mystery: everything is calm and peaceful, and references to St. Augustine lighthouse and the after-mess smoke suggests that Sand knows where the ship was shortly before it disappeared (fairly close to land) and at approximately what time it disappeared. But, again, how does he know? Can we trust the specific details he provides?

After discussing Sand, we turn to the Kusche article. Unlike Sand, Kusche cites sources—primary sources. He describes in detail his attempts to track down information on the disappearances and to validate or refute stories about the Bermuda Triangle. While practicing good research skills, he demonstrates the weaknesses of many other writers who have taken up the Bermuda Triangle as their theme. For one thing, he makes it clear that Bermuda Triangle writers often plagiarize each other and other sources, although he does not use the word "plagiarism." Plagiarism, both intentional and unintentional, is frequently a problem among college writers, so it is a good idea to confront it directly. Kusche shows that many Bermuda Triangle writers plagiarize in two ways: by failing to cite their sources and by using the language of their sources without placing the borrowed words in quotation marks. He notes, for instance, that Vincent Gaddis has been very influential on later writers:

It was obvious from the similarity of wording and incidents covered that many, if not most, of the later writers lifted their information from Gaddis. The incidents he discussed became the core of the mystery. (Kusche 298)

Kusche is able to trace writers' indebtedness to Gaddis not through their bibliographies, because they did not cite him, but from their appropriation of his language. Further, he notes that John Wallace Spencer's discussion of the *Suduffco* "consisted of reworded, condensed articles from the New York Times. (In one part of Spencer's account . . . a sentence of twenty-two words was exactly the same except for a change of verb tense)" (Kusche 299). Again and again Kusche reveals instances where writers have used sources irresponsibly and dishonestly.

The dishonesty is compounded by the fact that Spencer, having plagiarized the *New York Times*, leaves out the most crucial sentence: "The *Suduffco* was proceeding down the coast at a time when the coast was swept by storms" (qtd. in Kusche 299). By leaving out that bit of evidence, Spencer has turned a non-mystery into a mystery.

Kusche's discussion of the *Ellen Austin* and its encounter with a derelict ship is also instructive. Kusche researched primary sources very thoroughly and found that, although the *Ellen Austin* certainly existed, there was no evidence that it had ever encountered a mysteriously abandoned ship. He also established that the event couldn't have occurred the way it is described in various Bermuda Triangle works.

While Kusche's research is exemplary, he again demonstrates the problems that occur when researchers are sloppy or dishonest. He tracks the story through several sources, starting with an account written in 1914 by Rupert Gould. Gaddis used Gould as his source for a 1964 magazine article and a book he wrote a year later. Most other writers have used Gould and Gaddis as sources. Kusche is meticulous in describing the various accounts. He even provides word counts for each story. I ask my students what the significance of the word counts may be. If they look at me blankly, I say, "Well, Gould's account is 86 words; Gaddis's first version is 115 words; his second is 188 words; the next account is 429 words. What's happening?" The answer, of course, is that each account becomes longer because the authors are adding details, details that are not in their sources. The later writers embellish the story prodigiously; one even mentions that the *Ellen Austin*'s captain thought about the *Mary Celeste* (http://en.wikipedia.org/wiki/Mary_Celeste) as he boarded the derelict. These details have no basis in fact and are not accounted for in the acknowledged (and unacknowledged) sources, but they have become part of the mythos of the Bermuda Triangle. The writers repeat each other's mistakes and elaborations and add their own, and yet

their books appear in the non-fiction section.

After discussion Kusche, we return to Sand. I ask my students to do some Internet research on the stories in the Sand article. The assignment is twofold: I want them to discover the truth behind the stories, if possible, and to assess the quality of information available. As far as the second part of the assignment is concerned, the students find that the problems that Kusche notes are magnified on the Internet: plagiarism is so much easier when you just have to copy and paste. The stories also continue to grow on the Internet and are accompanied by outlandish explanations for the “mystery” disappearances.

Fortunately, among the plagiarized and fictionalized accounts, it is also possible to ferret out likely explanations: the weather was bad; there were mechanical problems; a pilot got lost. In the case of the *Sandra*, the first disappearance Sand discusses, students are likely to find another Kusche article, published in *Skeptical Inquirer* (http://www.csicop.org/si/show/critical_reading_careful_writing). In this article, Kusche asks many of the same questions my students had asked when we first discussed Sand. It’s rewarding for them to realize that Kusche shares their doubts. Kusche also has the answer: Sand says the weather was calm when the *Sandra* sailed in June. Indeed, it was calm in June, but the *Sandra* actually sailed in March and faced nearly hurricane-strength winds.

Very careful readers will notice something else about this Kusche article. He quotes Sand’s account of the *Sandra*:

The *Sandra* was a square-cut tramp steamer, decorated here and there with rust spots along her 350-foot length. Radio equipped and loaded with 300 tons of insecticide, she leisurely thumped her way south in the heavily traveled coastal shipping lanes of Florida in June 1950. (qtd. in Kusche, “Critical Reading”)

All of this information is indeed included in the Sand article and the general wording comes from Sand as well, but the quotation is not quite accurate, and sentences are rearranged. The same is true of the second paragraph Kusche quotes. I don’t have an explanation for this inconsistency. It is possible that Sand’s article was published in more than one form; it is also possible that Kusche made a mistake when he quoted. Inaccurate quotation is another problem that frequently occurs in student writing. The differences between Sand’s original and Kusche’s quotation of him are significant enough that it seems like sloppy work on Kusche’s part. This is disheartening, but it is also a teachable moment: no

source, however good, is perfect, and no source should be trusted implicitly. Critical readers should approach writings with an open mind, but they should also be skeptical and seek to verify and confirm any information they find.

References:

Kusche, Larry. "The Bermuda Triangle." *Science and the Paranormal: Probing the Existence of the Supernatural*. Ed. George O. Abell and Barry Singer. New York: Scribner's, 1983. 296-309.

---. "Critical Reading, Careful Writing, and the Bermuda Triangle." *Skeptical Inquirer* 1.2 (Spring/Summer 1977). Available at http://www.csicop.org/si/show/critical_reading_careful_writing/

Sand, George X. "Sea Mystery at Our Back Door." *Fate* Oct. 1952: 11-17.

18. Homeschooling Beowulf

Written by Eve Siebert

In a recent article for *Skeptical Inquirer*, I wrote about the ways some Young Earth Creationists distort, misinterpret and mistranslate *Beowulf* and use it to support their discredited worldview. Briefly, the argument is as follows: *Beowulf* is a true story; all the monsters in the poem are really dinosaurs or similar reptiles; since the story is true and features dinosaurs, dinosaurs and men must have co-existed relatively recently; therefore, the theory of evolution is wrong. At the end of the article, I noted that this idiosyncratic interpretation of *Beowulf* has found its way into works intended for homeschooled children. In this post, I want to elaborate on the ways Christian homeschooling families approach *Beowulf* and English literature more generally.

I should begin with a caveat: not all homeschooling families are alike. Many Christian homeschoolers approach *Beowulf* in much the same way high school English literature classes do: by analyzing the plot, characters, themes, language, symbolism, etc., without any particular ideological agenda. For instance, the Conservative Homeschoolers forum (<http://freedomtoschool.proboards.com/index.cgi?board=litr&action=display&thread=1878>) provides links to many useful resources and study guides (though many of the links are no longer active). On the other hand, many other homeschooling sites do stress a particular interpretation that supports their religious beliefs.

One Christian homeschooling approach to *Beowulf* is to emphasize Christian elements, as well as moral elements that can be seen to reinforce or reflect Christian ideals. In 2009, Homeschool Connections (<http://maureenwittmann.blogspot.com/2009/05/homeschooling-beowulf.html>), a Catholic homeschooling organization, offered an online summer class called “Beowulf the Christ,” taught by Henry Russell, headmaster of St. Augustine’s Home-school Enrichment Program. According to the course description,

[*Beowulf*] will be explored as an allegory that teaches the Anglo-Saxon world how to transform pagan heroic ethos into a pattern for Christian heroism and how to re-envision blind Fate as Godly Providence.

The suggested text is Charles W. Kennedy’s 1940 translation, and students are warned to avoid “a web version that cuts out the Christian elements.”

Jeff Baldwin of Worldview Academy also interprets the poem in a distinctly Christian light. Worldview Academy (<http://www.worldview.org/index.php/about-us/what-is->

worldview-academy) strives “to help Christians think and live in accord with a biblical worldview so that they can serve Christ and lead the culture” and provides homeschooling resources. Baldwin argues that *Beowulf*, unlike Aeneas or Achilles, is a Judeo-Christian hero. Baldwin begins his review by saying,

If you can imagine a Christian writing a poem about Aeneas, you have an idea of the epic *Beowulf*. The plot is based on pre-Christian Scandinavian legends, but the author of the poem . . . has attempted to “Christianize” his tale.

Baldwin disagrees with the assessment of E. Talbot Donaldson, “the translator of our recommended edition” (even though Burton Raffel’s is the one actually on sale), who suggests that Christianity has little to do with the poem’s “emotional power.” Baldwin argues that pagan classical heroes “were superheroes--that is, the gods have granted them so much ability (and so much magic armor) that it is entirely evident they will succeed. The mark of being favored by the gods, in pagan thought, is that you are the strongest and best-equipped.” In the Judeo-Christian world, however, “we must be weak to be strong—because God manifests His strength in our weakness. The concept of the underdog, I would argue, is ‘invented’ with David beating Goliath.” While he admits that *Beowulf* has unusual strength, he believes that “there still persists an element of humility with him that jars followers of Achilles. Achilles is certain of victory, while *Beowulf* knows the outcome depends upon God. When he defeats Grendel, it is acknowledged that the battle belongs to the Lord.” He concludes by saying that “*Beowulf* provides an excellent launching point for an extended discussion of brokenness and God’s will.”

While these and similar approaches to *Beowulf* may overemphasize the Christian elements, they do not stray far from some standard interpretations (see Irving for a summary of critical responses to the Christian and pagan elements in the poem). Other interpretations promulgated by homeschool advocates are less supportable. Doug Phillips of Vision Forum Ministries (<http://web.archive.org/web/20120720054323/http://www.visionforum.com/news/blogs/doug/2003/05/>) says,

The beauty of *Beowulf* is not only its literary brilliance, but its rich Creationist theme, which dominates the epic from its discussion of Cain and Abel and references to the Nephilim of Genesis 7, to one of the antagonists of the story, the dragon, a clear, historic reference to dinosaurs living contemporaneous with man. For these and other reasons, it has long been my view that *Beowulf* is one of the ten most important works of Christian literature in history.

Many readers may have missed the rich Creationist theme, the references to the Neophilim and the “clear” reference to dinosaurs and humans living together. That, of course, is because they do not exist. To be fair, the poet almost certainly was a creationist, and Hrothgar’s scop (oral poet) sings about the creation of the earth by the Almighty (ll. 90-98). The scop also mentions the creation of “each of the kinds” (cynna gehwylcum) that move about alive (l. 98). You might think that creationists would seize on this passage—the reference to “kinds” resembles creationists’ own language when they try to explain away the huge number of animals on the ark—but they tend not to. As the Classical Christian Homeschooling (<http://www.classical-homeschooling.org/v2/index.php?page=536>) website explains:

Beowulf was a real historical person, as ancient records confirm; and the poem is a pre-Christian era epic of the Saxons. The references to Old Testament persons and events are not the work of later Christian revisionists, but handed down generation after generation from the post-flood founders of the Saxon tribes.

Both Classical Christian Homeschooling and Vision Forum Ministries have gotten their information from Bill Cooper’s book, *After the Flood: The Early Post-Flood History of Europe Traced back to Noah*. Doug Phillips calls Cooper’s book “a landmark work of scholarship;” Classical Christian Homeschooling calls it “a thoroughly researched account of the historicity of Beowulf.” In fact, it is not scholarly in any meaningful way, and it is full of fallacious reasoning and factual inaccuracies.

However flawed Cooper’s book is, it is highly influential and respected by creationist homeschoolers. This view of *Beowulf* is given voice in *Jonathan Park and the Hunt for Beowulf*, one of a series of “audio adventures,” available on CD sets or as MP3 downloads. They recount the exploits of an intrepid band of adventurers known as the Creation Response Team. In *The Hunt for Beowulf*, the CRT seeks to recover the stolen Beowulf manuscript because it contains proof that dinosaurs (the dragon and Grendel) were still alive in the early Middle Ages.

The Jonathan Park Adventures are enormously popular with creationist homeschoolers and are sold or endorsed by many homeschooling sites. Sadly, they represent the antithesis of education: they are full of logical fallacies, pseudoscience, pseudo-history and pseudo-just-about-every-other-academic-discipline.

Perhaps the most disheartening view of *Beowulf* can be found on the Trivium Pursuit (<http://www.triviumpursuit.com/blog/2012/07/22/classical-homeschooling-peer-pressure/>) website, run by homeschoolers Harvey and Laurie Bluedorn. A reader wrote to the authors seeking “Biblical direction” about what works to introduce to his or her homeschooled children. The reader mentions *The Odyssey*, *The Iliad*, Dante, Chaucer and *Beowulf*. In response, the Bluedorns say, “The question I would ask is this — do I want to read Homer, Dante, Chaucer, and *Beowulf* at all and require my children to read them?” They list three principles to follow in deciding what children should read. The first principle is to do what is pleasing to God. The second is, “There is only so much time in the day.” The third is, “Just because something is old doesn’t mean it is good.”

What are God’s tastes in literature? Well, He certainly doesn’t like Chaucer:

Canterbury Tales is full of gross, profane babble. I don’t believe it is fit for the eyes of a child, even in its abridged form. I’m sure there probably are sections that would be of some value, but I’ve got better use for my time than pulling on the chore boots and wading through the muck for a few pieces of corn.

One of the great works of English literature, full of overtly Christian tales. But, nope. A few of the tales are somewhat...earthy, so it shouldn’t be read. *Beowulf* fares slightly better, I guess:

Many years ago I had the children read *Beowulf*, in its unabridged form, and then had them write a paper on it. Hans’ paper was entitled *Beer-wulf: A Story of How God Used a Monster to Rid the Land of the Beer Halls*.

Well, at least they read it. The idea that Grendel is a divinely sent tool of vengeance and purgation is an unusual one, however, and suggests that Hans and his parents may have missed some of the poem’s subtleties.

The Bluedorns are quite clear about the purpose of literature:

There is no neutrality. If a piece of literature cannot be used to build Christian culture in my children, then it will be used to build something culturally anti-Christian in my children. Wasting time is anti-Christian.

If *Beowulf* or any other work of literature (or history or science) doesn’t explicitly support a particular interpretation of Christianity, it is not worth reading. This may be homeschooling, but it is not education.

References:

- Cooper, Bill. *After the Flood: The Early Post-Flood History of Europe Traced back to Noah*. Chichester: New Wine Press, 1993.
- Fulk, R. D., Robert E. Bjork, and John D. Niles, eds. *Klaeber's Beowulf and The Fight at Finnsburg*. 4th ed. University of Toronto Press, 2008.
- Irving, Edward B., Jr. "Christian and Pagan Elements." *A Beowulf Handbook*. Ed. Robert E. Bjork and John D. Niles. Lincoln: University of Nebraska Press, 1997. 175-92.
- Siebert, Eve. "Monsters and Dragons and Dinosaurs, Oh My: Creationist Interpretations of Beowulf." *Skeptical Inquirer* Jan./Feb. 2013: 43-48.

19. The Mind of Creationists and Our Communication Gap

Written by Matt Lowry

I have spent many electrons typing on my keyboard and posting online about those who would use the government to impose their religious beliefs upon the rest of us by undercutting science education in our public schools. In fact, the most published category on my blog is in reference to creationism (<http://skeptdic.com/creation.html>), that bugaboo which never seems to go away, like a bad game of Whack-a-Mole that you can't ever finish.

Like many who call themselves skeptics, I have some friends who are into pseudo-science, the paranormal, and religion. Specifically, I have friends who proudly call themselves creationists, in the sense that they adhere to the most common variant called Young Earth Creationism (<http://www.skeptdic.com/yec.html>) (where their reading of the Bible says the Earth/universe is roughly 6000-10,000 years old). What I want to do here is to recount a conversation I had with one of these friends and how it opened my eyes into how the creationist mind seems to work.

A couple of years ago, I posted an article (<http://skepticalteacher.wordpress.com/2010/09/25/an-actual-geocentrism-conference-are-you-frakkin-kidding>) on my blog about an upcoming geocentrism conference, which was titled "Galileo Was Wrong (<http://www.galileowaswrong.com/galileowaswrong>)" – in the sense that the participants in this conference were actually arguing the Sun isn't the center of our solar system and that astronomy and physics for the last 400 years or so is completely wrong. In my post, after presenting a plethora of scientific reasons as to why geocentrism is outright wrong, I took some time to focus upon one of the primary arguments presented by the geocentrists: their reading of the Bible.

On my blog entry, I stated:

... Last, but not least, it seems that the motivation for modern geocentrists to hold these loony views, despite all of the evidence & science against them, is based in their particular reading of the Bible. In other words, their particular set of religious beliefs trump all of scientific reality. Or, to put it another way, they are engaging in some really interesting mental gymnastics to come to the conclusion of "the Bible is literally true" and retrofit all evidence (through liberal use of cherry-picking, goalpost moving, and in some cases outright lying) to jibe with their religious views.

Yes, just like Young Earth Creationists (YECs), they call themselves “Biblical literalists” and use their reading of various Bible passages to justify their pseudoscience (by the way, it seems that all of these modern geocentrists are YECs, but not all YECs are geocentrists). I must say that it is nice to see that while most YECs may reject modern evolutionary science on the basis of their “literal” interpretation of the Bible, a large number of YECs aren’t quite so far gone as to go down the rabbit hole of geocentrism. Which, interestingly enough, begs a question: how can two different groups of people (geocentric vs. heliocentric YECs) claim two disparate “literal” readings & interpretations of Biblical scripture? How can the two groups claim to be reading & interpreting The Truth from the Bible, yet also disagree on this topic?

In every interaction I have had with geocentrists, whether it be perusing their “Galileo Was Wrong” website or looking through their literature (my favorite one is a book mailed to me at the school where I teach titled “The Geocentricity Primer: The Geocentric Bible #7”), I have found their arguments placing a heavy emphasis upon their reading of the Bible.

Enter my discussion with my YEC friend. After posting my blog article onto my Facebook page, my friend was among the first to comment that these geocentrists were nuts. I agreed, but then I began to engage him in a deeper discussion as to why he thought they were nuts. His initial response was pretty simple, saying that it was pretty much because of the scientific reasons I outlined in my blog post (i.e. geocentrism cannot explain inner planet phases, parallax, retrograde motion, and is inconsistent with basic physics). Upon seeing his response, I asked him another question: “Did you notice that these geocentrists based most of their arguments upon their reading of the Bible?”

He responded quickly: “Well, they’re wrong.” To which I responded: “Yes, but why do you think they’re wrong? You stated just now that it was because of the scientific arguments that I presented. Therefore, you must agree that science can trump someone’s reading of the Bible.”

He saw where I was headed with this line of thought, and he quickly changed his tune. “Well, their reading of the Bible is incorrect. That’s why they’re wrong,” came his reply. Never mind the fact that he never bothered to point out to me any kind of Biblical evidence, such as Scriptural passages, which outlined exactly what was wrong with the geocentrist arguments. When I pointed out to him that he was changing his argument he be-

came increasingly uncomfortable, especially when I followed up with the logical conclusion: if you think that scientific facts can trump a geocentrist reading of the Bible, then why can't scientific facts trump a YEC reading of the Bible?

At that point, I could see that my friend had cognitive dissonance in full swing within his mind, as he kept insisting that "all you need is the Bible to see the truth" and whatnot. I insisted on pointing out to him that the geocentrists, whom he labeled as nuts, would make exactly the same argument contrary to his personal reading of the Bible. Once again, he squirmed, merely insisting that he was right and they were wrong. Eventually, I let the matter drop, but not until after I had planted that skeptical seed of doubt. Hopefully, one day, it will start to grow.

This entire interaction taught me something which I hadn't quite internalized until that point, and I think this is something which skeptics and supporters of science often struggle with. We often lament about how many people seem to be almost willfully ignorant of science and its wider implications, as if we simply expect everyone to give science as much credence and importance as we do. Now, don't get me wrong – YECs and geocentrists alike enjoy the fruits of science's labors, such as TVs, computers, the Internet, planes, cars, and so on. But what they seem to fight, and where the aforementioned cognitive dissonance seems to come in, is when the questions go beyond the mere "toys" of science to larger issues of one's belief system and/or worldview. Once science starts to encroach upon that territory with its pesky facts and logic, many are willing to either ignore science or even fight against it openly!

So it seems to me that we have a pretty serious communication gap with people like YECs, in that we naively expect them to think like us, when nothing could be further from the truth. In many ways, those of us who embrace the scientific mode of thinking are the exception, and even then you don't have to look far to find a skeptic who all-too-easily slips back into the more common mode of unscientific thinking. Because of this gap, in many ways when attempting to engage in discussion with them, we are literally speaking different languages: we are coming to the issue from a naturalistic, science-based framework, and they are coming to it from what they consider a Biblically-oriented worldview. And, in many ways, never the twain shall meet, as the saying goes.

So, what to do? How can we bridge this gap? I think my interaction with my YEC friend on the question of geocentrism might provide a lesson in how to address this question. Rather than argue with him about how YEC was scientifically unsound, which I had

futilely attempted to do before, I went right to the core of his arguments: I used his own language of “truth in the Bible” against him by providing him with an example of a worldview (geocentrism) which he considered incorrect, even though that worldview made exactly the same kinds of appeals to Biblical literalism which he himself had so often made!

Now, will such argument be effective? I don’t know, only time will tell. But I think it will accomplish two things: 1) it will give my friend some pause to think, in a manner in which he is able to think, and 2) it can keep the conversation going because now we are, in some way, at least sharing the same language.

20. The Science Of Space Monsters!

Written by Nicole Gugliucci

When I was a graduate student at the University of Virginia, I had the great opportunity to teach an astronomy class during the summer of 2010. My first choice was a 300-level class for undergraduates called “Life Beyond Earth.” The original syllabus was created by Robert Rood, a longtime UVa professor who recently passed away. With guidance from him, Ed Murphy, and Joleen Carlberg, all previous instructors of the class, I was able to cobble together my own version of this popular course using the textbook *Life in the Universe* by Jeff Bennett and Seth Shostak. Believer or skeptic, scientist or sci-fi fan, we all love to ponder the possibility of the existence of “someone out there,” but can we study it in a reasonable, scientific way?

The hook may be SPACE MONSTERS, but the content of the class is science. The syllabus brought in aspects of astronomy, biology, spaceflight, and skepticism for a fast-paced, one-month summer class. A convenient way to structure the discussion is to use the famous Drake Equation (http://en.wikipedia.org/wiki/Drake_equation). This says that the number of intelligent civilizations that we may contact in the galaxy can be calculated if you know a number of factors, such as the star formation rate in the galaxy, the number of habitable planets, and the lifetime of an intelligent civilization. Obviously, most of these factors are pure speculation at this point, and the Drake Equation is much maligned for some for not being “accurate.” Well, most people don’t realize that this equation was not meant to be a rigorous mathematical treatment of the subject, but was written down by Frank Drake in 1961 as a way of organizing the very first conference on the possibility of finding radio signals from extraterrestrial civilizations. So it works quite well as a syllabus guideline, too.

The astronomy content is fairly straightforward. Our Milky Way Galaxy makes about one solar mass worth of stars per year. As stars form, planets form in disks around them. Although extrasolar planets were long theorized to exist, they weren’t actually discovered until the 1990s. If I go ahead and check my Exoplanet app (<http://itunes.apple.com/us/app/exoplanet/id327702034?mt=8>), the current total of confirmed exoplanets as of this writing is... 1843. Now, how many of these are habitable? Well, it depends on your definition of habitable, and that is where things start to get really fuzzy. Even if you go for “Earth-like” planets, we still have yet to truly find Earth’s twin, though the Kepler mission (<http://kepler.nasa.gov/>) is well on its way to giving us a better estimate of the number of

Earth-like planets in the Galaxy.

Given a planet on which life can arise, you can start to talk about the origins and evolution of life itself. We have one glorious experiment to draw upon, that of our own home planet. Though we really don't know what alien life would be like, I'm pretty convinced that they aren't going to be humanoids with bumpy foreheads. The biologists point out time and time again that life could have taken so many different pathways, body plans, and even chemistries. The best we can do is study the science of life on this planet and explore its many varieties and extremes. This is the part of the class where I add a disclaimer that I am NOT a biologist by training, but I do the best I can. In fact, this class may be better co-taught by a biologist and an astronomer to cover all your bases.

The rest of the Drake Equation involves a bit of sociology as well. The last factor, according to Drake, is probably the most important for determining if we'll be able to contact intelligent life with our radio telescopes. That is, how long does a civilization survive? Are we destined to blow ourselves to bits before becoming a spacefaring species? Will we destroy the ecosystem and ourselves with it? Carl Sagan notably said; "It is our fate to live during one of the most perilous and, at the same time, one of the most hopeful chapters in human history." How have other civilizations, if they existed, dealt with this crisis?

Another aspect of the class that is of interest to skeptics is the lesson on UFOs. Most people coming into this class have probably seen a TV special or two on "ancient aliens" or "unidentified flying objects" or alien abductions, and so they have heard of the concepts. But are they really well-versed in this history of the alien saga since the 1940s? Probably not. Skeptics, however, can provide that bit of knowledge. My assigned reading for this part included the *Junior Skeptic* (http://www.skeptic.com/junior_skeptic/) issues that cover UFOs and abductions. Delving into the history of the events such as the Roswell crash, which didn't really become a widespread belief until a rather credulous book was published in the 1980s, is quite enlightening. You probably won't convince a believer in the span of one or two college lectures, but it helps to dispel some of the misinformation and give them skeptical resources on these topics.

Another one of my favorite alien topics is the Fermi Paradox. It comes from a lunchtime conversation involving physicist Enrico Fermi about these new-fangled UFO reports and whether we should reasonably expect to be visited by aliens from other parts of the galaxy. After all, it has been over 13 billion years since the universe was around, and a generation of stars that predate our sun should have been able to form planets, and thus

life. The galaxy is of a finite extent, therefore it is reasonable to assume that someone should have whizzed by in a spacecraft by now. But as I mentioned, the quality of evidence for extraterrestrials visiting Earth is paltry at best. So where is everyone?

There are many possible answers that fall into three main categories: they don't want us to know about their existence, they never made it across the galaxy, or we are the first spacefaring civilization. None of those are particularly comforting thoughts, and we have no evidence of any particular scenario. However, it is an interesting thought experiment that is surely responsible for thousands of hours of intellectual conversation. After 50 years of searching the skies with radio telescopes, after 4.5 billion years of life on this planet with no sign of otherworldly visitors, it is a disquieting notion that the galaxy SEEMS so quiet.

I'm not giving up hope just yet that we're all alone in the cosmos. My students were all pretty hopeful as well by the end of the class. The galaxy is probably teeming with life, at least at the microbial level. Science tells us that life, even our single sample of Earthly life, is hardy and opportunistic. So that alone is a fascinating prospect. But will we ever make contact with cogitating beings? We can only imagine the possibilities. And make sci-fi movies about them.

The speculation about the existence of extraterrestrials is wide and vast. However, the discussion CAN be grounded in science and rationality. It fascinates me as an interdisciplinary topic and as one that draws in interested students with a provocative topic that has such rich educational potential.

21. The Conspiracy Wiki Experiment

Written by Robert Blaskiewicz

During my first year at Georgia Tech (2009-2010), I taught three sections of a conspiracy theory-themed research and writing class. I use conspiracy theories in my composition classes because every single claim made by a conspiracy theorist needs to be fact checked. Any bit of information they offer as evidence can be faked, taken out of context, or misinterpreted, and bad information often cozies up next to good information. Conspiracy theories are factual and logical minefields and are generally difficult to evaluate. I teach students to identify the relevant claims, how to evaluate them, and how to find better, more reliable information. Conspiracy theories are a sort of critical thinking and research bootcamp.

Tech's First-Year Writing Program is pretty innovative and stresses communication in a variety of media, including online media. As a new postdoc, I felt inspired to experiment with assignments that made use of new media. So, in lieu of a traditional final paper, I designed a final project where students in my three sections would collaborate with one another on a massive wiki about conspiracy theories.

For the Georgia Tech Conspiracy Wiki, I used MediaWiki (<http://www.mediawiki.org/wiki/MediaWiki>), the open source software behind Wikipedia. My college's IT staff installed and configured the software. I designed a logo and outlined the project. As the backbone of the project, I used the conspiracy classification system that Michael Barkun's lays out in his *A Culture of Conspiracy*. The three principle types of conspiracy theory he outlines are *event conspiracies*, supposed conspiracies with limited goals (like the assassination of a president or bringing down an airplane), *systemic conspiracies*, which are more extensive and have more ambitious goals (like the Jesuits taking over the world or secret Islamists trying to impose Sharia on America), and *superconspiracies*, which involve nested hierarchies of conspirators and draw on any number of eclectic "alternative knowledge" traditions (like David Icke's interdimensional, shape-shifting, mind-controlling, reptilian alien overlords). Each section of the class would be responsible for building up a portion of the website under one of those headings.

Students selected individual topics that they wanted to work on, and I gave them a template for a wiki entry that would help them sort and and evaluate their sources. Students were free to pick and choose which elements to retain in their final write-ups:

History/Event (what conspiracy theorists would call "the mainstream account")

The Conspiracy Theories

Conspiracy Theory Proponents

Analysis (breakdown of the conspiracy theory and relevant debunkery)

Cited References (the footnotes)

External Links

Additional References (relevant sources that did not make it into the wiki)

Related Topics (links to elsewhere in the wiki)

It turns out that a wiki was an especially appropriate medium for writing about the convoluted webs of interconnected plots and agents found in conspiracy theories--the “links” that conspiracy theorists make became literal links to other pages in the wiki. Students were graded weekly on the quality and frequency of their weekly contributions. The only downside to this approach was that it was an utter monster to grade. I still wake up in a cold sweat just thinking about it, but it was a worthwhile experiment, I think.

The final product was not perfect--I wouldn't expect them to be since these were motivated but novice researchers and writers. Also, because ability varies between new college writers, the projects have some fairly rough bits, including formatting inconsistencies, unfinished entries, orphaned links, and the occasional willingness to give conspiracy theorists more credit than they have perhaps earned. More frequently, however, I found that students put were able to collaborate on interesting and useful summaries and explorations of complex topics raised by conspiracy theorists. I was very pleased on the whole with the quality of the website and the range of topics that 75 students discussed together.

22. The Christopher Columbus Contradiction

Written by Marc David Barnhill

I've usually found that the class sessions that most effectively push the conversation about skeptical inquiry forward are a happy combination of careful planning, quick connections, and a dash of luck.

Take one Thursday in early October. "Why don't we have class next Monday?" someone asked, innocuously enough.

Several students muttered, "It's Columbus Day," and everyone settled down for the work of the day.

In response to the comments of a student who had already developed a reputation for appealing to claims of elaborate cover-ups by secret organizations, I had brought in "Dead and Alive: Beliefs in Contradictory Conspiracy Theories," a January 2012 *Social Psychological and Personality Science* article by Michael J. Wood, Karen M. Douglas, and Robbie M. Sutton of the University of Kent. It's a serious slice of statistical research, chock full of data and formulas and complex observations, but my community college developmental writers were able to pick out and grasp the salient ideas: that "conspiracy theories can form a monological belief system: a self-sustaining worldview comprised of a network of mutually supportive beliefs," and that "even endorsement of mutually incompatible conspiracy theories are positively correlated." How is it possible that some people manage to believe both that Princess Diana (of whom most of my students have never heard) faked her own death and that she was murdered? Or that Osama bin Laden (of whom they are well aware) not only recently faked his own death but had also been dead for years? Because *"the monological nature of conspiracism...is driven not by conspiracy theories directly supporting one another, but by the coherence of each theory with higher-order beliefs that support the idea of conspiracy in general."*

Though the overarching findings here were clear, they elicited typical objections from some students. "That doesn't make sense," they insisted. "It doesn't take critical thinking to realize that two things you believe contradict each other."

"Well," I said, fishing around for some way to connect the phenomenon to something more immediately observable. Aha, I thought. Got it.

"Why don't we have school next Monday?" I asked.

"Columbus Day," the chorus replied.

"Okay, and what are we celebrating?"

"Murdering Indians?" someone offered, provoking a mix of laughter and grim agreement.

"No argument," I said, "but for the sake of the conversation, leave genocide out of it for a minute. What is the holiday meant to be celebrating? What did Columbus do?"

The expected answers came simultaneously. "Discovered America," shouted some. "Proved the world was round," shouted others.

I wrote both of these accomplishments on the board, then asked the class to start unpacking the implications of each. The ensuing discussion yielded a number of insights, among them that proving the spherical nature of the earth required circumnavigation of the globe.

"But wait," someone said. "He didn't make it around the world like he thought he would, because America was in the way."

"But that's why he discovered it," another student responded. "By accident."

"But he didn't know that, right?" someone else added. "Isn't that why Native Americans are called Indians? Because Columbus thought he reached India?"

"Which means he didn't discover it."

(As more voices joined the discussion, I made a mental note to return later to the aforementioned mass exploitation and violence of the 1490s encounter, evidence of earlier European voyages to the Americas, the ethnocentrism implied by claims of "discovering" an inhabited place, the actual historical precedent of knowledge of the earth's shape, and other relevant problems. The students were about to make a more immediate discovery of their own.)

"Okay, so he didn't discover America, but he did reach it. Isn't that what's being celebrated?"

"And he still proved the world was round."

"No he didn't! If he didn't make it around the world, then people only thought he had proved the world was round. It might still have been flat if he didn't actually sail all the

way around it."

"Yeah! The only way his trip could have proven the world was round is if he made it all the way back to Europe!"

"But...if he went to America and back..."

And there it was. It became inescapably obvious to the entire class that, totally aside from the question of the accuracy of the claims, a belief that Columbus had discovered America and a belief that he had proven the roundness of the earth were, necessarily, mutually contradictory claims -- both of which nearly everyone in the room had somehow managed to carry with them for decades without recognizing the inherent logical problem.

"Damn!" observed a usually silent student. "That's, like, obvious!"

"So, what, we're all just stupid? None of us thought to question it?"

"Not just us, everybody. All the people who taught us that, and celebrate the holiday, and buy the claims. What the hell?"

An uncomfortable silence followed, broken by our typically conspiracist student. "It's a conspiracy!" he yelled, smiling. Everyone laughed, but out of the moment of humor came an idea. Recalling the analysis by Wood et al., someone suggested that something about the Columbus story might represent a set of "higher-order beliefs" with which the two contradictory claims were "coherent" -- not a belief in conspiracies, but in an ideology that the Columbus narrative supports.

Excitedly, several of the students started generating a list of such ideological beliefs: the idea of discovery, the colonialist impulse, the justification of exploitation and nation-building, the exaltation of the intrepid individual who bucks the status quo, and so on.

Then someone put the brakes on. "But this is just a hypothesis, right? We would need to do research to demonstrate that there really is a whole system of support for those ideas."

"That won't be hard," added another student. "Just look around, you can find that everywhere."

"Wait," another student objected, "wouldn't we actually have to try to find DISconfirming evidence? To avoid confirmation bias? Otherwise we're just going to find what agrees with the hypothesis."

And so on. The conversation was sprawling and messy, but undeniably useful, and the class wrestled with complicated but essential questions about how cognitive and cultural biases can drive interpretation and frame the questions we don't ask as well as our answers to the ones we do.

For my part, I wonder how the session would have gone had it happened in November instead.

23. Priming, Probability, and Plagiarism

Written by Marc David Barnhill

The British poet Christian Ward became a controversial figure recently when his poem "The Deer at Exmoor," which won the Exmoor Society's Hope Bourne poetry prize, was revealed by the *Western Morning News* to have been plagiarized (<http://www.thisiscornwall.co.uk/spot-difference-poems/story-17767296-detail/story.html>) from Helen Mort's "Deer," which had itself won the Cafe Writers Open Poetry Competition in 2009.

Just how similar are the two poems? Well, you can read Mort's version [here](http://cafewriters.awardspace.com/winner_2009.htm) (http://cafewriters.awardspace.com/winner_2009.htm), and I've looked at Ward's. We're talking about an 18-line poem in which every line is perfectly identical with its counterpart in the original with the following exceptions:

- "mother" has been changed to "father" in lines 1 and 11, and consequently "she" to "he" throughout;
- "that" has been removed in line 6;
- "Ullapool" has been changed to "the River Exe" and "the kingfisher / that darned the river south of Rannoch Moor" has been changed to "the peregrine / falcon landing at Bossington Beach" in lines 7-8;
- "pines" has been changed to "trees" in line 14.

The rest is exactly the same, down to the punctuation.

I think you'll agree that, by any reasonable definition, it's the same poem.

Ward then apparently deleted his *Write Out Loud* profile (cached here (http://webcache.googleusercontent.com/search?q=cache:xR_9iXQRxVMJ:www.writeoutloud.net/public/profiles/christianward+&cd=1&hl=en&ct=clnk&gl=uk&client=firefox-a)), removed his online poetry archive and wrote (presumably) a public letter (<http://www.thisiscornwall.co.uk/Poet-Christian-Ward-says-m-sorry-prize-winning/story-17838451-detail/story.html?sp=normal&1357982258070>) which appeared in the *Western Morning News*. After bizarrely referring to the revelations of what had occurred as "allegations of plagiarism," he apologized, stating, "This incident is all my fault and I fully accept the consequences of my actions. I apologise to the Exmoor Society, Helen Mort, the poetry community and to the readers of the WMN."

So far, so good. He continued: "Furthermore, I have begun to examine my published

poems to make sure there are no similar mistakes. I want to be as honest as I can with the poetry community and I know it will take some time to regain their trust. Already I have discovered a 2009 poem called 'The Neighbour' is very similar to Tim Dooley's 'After Neruda' and admit that a mistake has been made. I am still digging and want a fresh start."

Ward also complained about the hostility and violent language with which some have responded to the incident, a rhetorical tactic he repeated in a comment he made (first!) on the *Guardian's* January 14 online coverage of the story (<http://www.guardian.co.uk/books/2013/jan/14/poetry-competition-winner-plagiarist>), which Ward called a "shoddy piece of recycled journalism."

Now, Ward's reaction to his hyperbolic critics is perfectly valid, and *ad hominem* (<http://www.fallacyfiles.org/adhomine.html>) attacks and threats are unfortunate and inappropriate. They are also, however, simply red herrings (<http://www.fallacyfiles.org/redherrf.html>) when we're discussing the act of plagiarism itself, and the "recycled journalism" barb in the context of addressing his own plagiarism is a stunning, if perhaps unconscious, example of the *tu quoque* (<http://www.fallacyfiles.org/tuquoque.html>) fallacy, or at least of irony.

So how did a published, aspiring poet with hundreds of poems of (again, presumably) his own come to commit such a blatant act of intellectual thievery? In his apology, Ward recalls, "I was working on a poem about my childhood experiences in Exmoor and was careless. I used Helen Mort's poem as a model for my own but rushed and ended up submitting a draft wasn't entirely my own work....I had no intention of deliberately plagiarising her work. That is the truth."

This statement is breathtaking. "Careless"? "Wasn't entirely my own work"? In the spirit of charity during what must be an intensely unpleasant time for Ward, I can chalk those characterizations up to tragic understatement. But to claim that he "had no intention of deliberately plagiarising" is a bit difficult to swallow.

I catch college students plagiarizing on a regular, though infrequent, basis. (I can usually nip any such tendencies in the bud through a combination of discussing the import and consequences of plagiarism, creating opportunities for appropriately citing and documenting sources, demonstrating such pattern-detecting tools as Turn It In (<http://turnitin.com/>), and designing writing and research assignments that require unlikely connections and analyses and draw cumulatively on students' ongoing thinking about complex issues.) Even there, most students have the sense to attempt to disguise or alter the

sources from which they've stolen -- not realizing that the strings of obviously substituted synonyms that usually result are themselves clear markers of what's really going on.

To be fair, student plagiarism really is often unintentional (<http://www.apa.org/monitor/feb02/glitch.aspx>), either because students haven't adequately understood and internalized the practice of attribution (particularly when they hail from countries and cultures where the rules about this sort of thing are genuinely different) or because they've honestly mistaken unconsciously borrowed material for their own original content. It happens. Studies have shown (<http://www.thedailybeast.com/newsweek/2009/07/06/you-didn-t-plagiarize-your-unconscious-did.html>) that cryptomnesia and implicit memory can lead not only to the false belief that one has independently generated an idea borrowed from elsewhere but to false memories of the circumstances in which one came up with the idea in the first place. Moreover, the act of reading a piece of writing may act as a kind of textual priming, leading us to come up with words and phrases with seeming spontaneity that were actually triggered by what we have read. In an excerpt from his new book (<http://www.ny-books.com/articles/archives/2013/feb/21/speak-memory/?page=2>), Oliver Sacks discusses Helen Keller's famous plagiaristic run-in with source confusion and describes the difficulty involved in "distinguishing a genuine memory or inspiration, felt as such, from those that have been borrowed or suggested, between what the psychoanalyst Donald Spence calls 'historical truth' and 'narrative truth.'"

But Ward's plagiarism isn't a case of unconsciously remembering and reproducing striking phrases in the context of one's own creation. It is literally the same piece of work, 90% identical to the source. And indeed I do see rare instances of students submitting paragraphs or even entire essays taken verbatim from an uncredited (usually online) source. More often than not in these cases, even when an apology is offered, the students will protest that the plagiarism was unintentional, that they had used the source as a launch pad for their own writing, and that in the rush of research they had unfortunately let someone else's work creep in. The defense seems laughable in its implausibility; it also perfectly mirrors Ward's.

You may be familiar with the urban legend of the student accused of plagiarism who insists to her professor that the work in question is really hers, at which the professor holds up an identical published article -- his own. As my little contribution to this legend, I'm here stating that a mentor of mine in graduate school claimed that this had actually happened with one of his own students. Regardless, one typically assumes at the climax of

such a story that the busted student has no choice but to confess in the face of clear evidence. But often students will continue to insist that the plagiarism was unintentional. "I'm writing about the same topic," a student who ripped off two consecutive paragraphs verbatim once told me. "Obviously a lot of the sentences are going to come out the same." I'm less interested in the question of the student's sincerity than I am in the belief that such a possibility could be taken as plausible.

Still in the spirit of generosity, I recall a student in my poetry class who challenged my assertion that a poet had deliberately chosen the sonnet form for a particular work in order to draw upon the historical and thematic associations of that form. I encourage challenges to interpretive claims, but was surprised by this one. How did I know that the form had been "chosen"? How did I know that the poet had intended to write a sonnet? Wasn't it possible -- even likely -- that he just went ahead and wrote a poem, and by sheer coincidence it came out to 14 lines of iambic pentameter divided into a problem-posing octet and solution-suggesting sextet rhyming ABBAABBACDECDE?

And she was serious. She genuinely believed it was within the realm of plausible expectation that someone might accidentally write a Petrarchan sonnet. And several other students expressed similar views. The statements that filled the ensuing discussion seemed to me to be related to our difficulty in comprehending probability and large numbers -- closer to mathematicians' difficulty in grasping the Monty Hall problem (http://en.wikipedia.org/wiki/Monty_Hall_problem) than to a lack of literary awareness. (The students modified their perspective after struggling with the assigned task of writing their own Petrarchan sonnets.) Seen in the light of our inherent innumeracy, Ward's appeal to accident isn't quite as comically desperate as it may appear. He may even believe it.

In a cultural climate where writers from Jonah Lehrer to Bob Dylan have been outed for plagiarism, it's tempting to file this story away as just one more sad sign of the times. But it's got me thinking about how our cognitive biases play into the nuances of attributing authorship of language and ideas, and I'll undoubtedly be teaching about these issues differently as a result. You can quote me on that.

24. The Hypothetical Audience

Written by Miranda Celeste Hale

Many of us who teach college composition courses spend a significant portion of each term instructing students how to craft rhetorically effective argumentative research papers. We cover all of the most important aspects of this process, including how to choose a topic, develop a thesis, generate content, and find quality sources to support the paper's assertions. We also tell students to be aware of who their audience is and to choose the techniques that will be most persuasive to that audience.

That final step has always felt a bit odd to me. In the classroom, a student's paper will almost certainly be read by only their instructor and perhaps a few of their fellow students. "Audience," then, is a vague concept in this context, and its vagueness requires students to imagine an audience that goes beyond what the classroom can provide. And, although imagination is certainly an important skill, telling students to "imagine an audience" isn't enough.

Recently, while revising my syllabus and teaching plans for next semester, I decided that I need to come up with a better way to illustrate to students the importance of keeping their audience in mind when crafting an argumentative research paper. I knew that, in order for such a technique to be effective, I needed to be realistic and to keep in mind the inherent limitations of the classroom. While attempting to come up with a useful technique, I kept coming back to the word "hypothetical," and soon realized that, although imagination isn't enough, guided and focused imagining that is done for a specific purpose might be, and that a "hypothetical audience," precisely tailored to the student's argument, could provide that necessary focus.

Additionally, the ability to imagine a realistic hypothetical audience is a pragmatic skill and tool in and of itself, one that can be adapted to many contexts. It also provides a way to promote critical thinking and skepticism in the classroom. When instructing students to "imagine an audience," most textbooks that I've used offer rather generic and imprecise directions along the lines of "imagine an intelligent and well-informed audience" or "imagine an audience that is similar to your classmates." Such directions are inadequate primarily because they omit any discussion of the imaginary audience's potential reaction to the paper's assertions and claims. This omission is significant. Before we teach students how to craft effective arguments of their own (critical writing), we explain why it is important to be skeptical towards the arguments of others, asking questions such as, "is the

author trustworthy? Why? How do you know?”, “Does the author provide sufficient support for each of their assertions, or do they instead rely on assumptions or make unsupported generalizations?”, and “Does their evidence come from high-quality and unbiased sources?” (critical reading). We teach our students how to engage in critical reading, how and why it is important to scrutinize every argument carefully and thoroughly, and how to respond to an author’s arguments with charitable-yet-strong skepticism. When directing students to “imagine an audience,” however, we often forget that this imaginary audience must also practice that same skepticism, and that, without this skepticism, such an audience is a useless invention.

In contrast, because it is done for a very specific purpose, imagining a useful “hypothetical audience” is a worthwhile and useful process, one that requires students to make extensive use of their critical thinking skills. In order to effectively implement this practice in the classroom, instructors would need to explain to students both the rationale behind it and the point of it. More importantly, instructors would also need to thoroughly explain and illustrate each of the necessary steps. This instruction would most likely include directing students to:

1. Imagine a hypothetical audience that will respond to their paper’s arguments with the same skepticism that students have been taught to apply to the arguments of other writers.
2. Imagine this hypothetical audience’s potential responses to each of the paper’s assertions. This hypothetical audience will critique the quality of and the trustworthiness of the facts and evidence used to support those assertions and will seize upon any assumptions or unsupported generalizations, pointing out why and how they weaken the paper’s argument.
3. Decide how to thoroughly and adequately address each of the hypothetical audience’s criticisms and how to fix the “holes” in the paper’s argument. This will determine the changes and improvements that need to be made during the revision process.

Students may also require one-on-one guidance as they proceed through these steps, especially if they have never before considered how a skeptical audience might respond to and critique their argumentative writing. It is simple enough to “put ourselves in another person’s shoes,” but applying such a technique in a directed and purposeful way requires focus and practice. If instructors explain and illustrate this technique in a clear,

relevant, and detailed manner, and help students to understand why it is important and helpful, then this focus and practice will pay off.

Such focus and practice is necessary not only in the classroom context, but also in “the real world”. The ability to imagine a hypothetical audience is a skill and tool that can be utilized in many ways, and is one that, ideally, students will also use in relevant non-academic contexts. Outside of the classroom, students deal with real audiences (such as bosses, co-workers, peers, and anyone they want to inform and/or persuade), but the ability to imagine a hypothetical audience, and to use that hypothetical audience as a “sounding board” of sorts, can help students to identify the weaknesses in their written work before presenting it to an audience. Similarly, any of us can (and, I’d argue, should) use this technique as a way to carefully analyze and critique our own arguments before we attempt to persuade an audience of any sort.

The “hypothetical audience,” when used in a careful, precise, and focused way, is a useful tool for the argumentative writer. It also provides us with an opportunity to practice both critical thinking and applied skepticism. I look forward to trying it out in the classroom setting next semester, and I think that it will be far more effective than my prior practice of simply instructing students to “imagine an audience.” Imagination is an important skill, but, in order for it to be useful in this context, it must be done with a clear and specific purpose in mind, and the “hypothetical audience” provides exactly that.

25. Your Nervous System Can Fool You

Written by Sheldon W. Helms

One of the most entertaining and impressive critical thinking lessons we can teach our students involves convincing them that their nervous systems can fool them. We often hear believers in the paranormal exclaim in their defense, “I saw it with my own two eyes!” or, “I know what I heard!” Anyone who understands the fallibility of the human nervous system knows that such statements are hardly convincing evidence. Luckily, there are some fun and interesting ways to teach people about why this is the case.

Although our brains and their adjoining nerves do their best to provide us with a clear and accurate depiction of the world, the human perceptual system is far from perfect. Not only is it limited in what information it can gather (e.g., most types of electromagnetic energy are beyond our perceptual range), but it also sometimes makes mistakes with the data it can collect. A good example of this is a phenomenon known as pareidolia, a perceptual error in which random, meaningless images or sounds are given apparent significance.

Your nervous system is bombarded with information from the environment every moment of every day. As this happens, sensory nerves dutifully collect information about your surroundings and send signals to your central nervous system (the brain) where those data are organized and given meaning. Most of the time the brain gets it right, and provides you with a relatively accurate depiction of what is going on around you. At other times, however, the data are incomplete, or the brain struggles to decide upon two competing answers as to what is being detected. Worse, certain evolutionary tendencies can cause your brain to favor some types of answers over others, and get in the way of the truth. It is at these times that we are most likely to experience pareidolia.

Examples of pareidolia from everyday life abound. Although a good number of visual cases have made headlines (e.g., sightings of the Virgin Mary in a bathtub stain, or images of Jesus on a piece of burnt toast), I have found that some of the most entertaining are the auditory pareidolic effects created by listening to song lyrics backward. Often referred to as “backmasking,” the practice has a long history but gained its greatest popularity in the mid-1960s, when a rumor began circulating that musician Paul McCartney had died and that a message about his death could be found by playing the Beatles song “Revolution 9” (among others) backward. This report spread like wildfire and had young people all over the world pushing their record albums backward on their turntables, trying to hear the messages. The rumor claimed that, at a certain point in the song, one could clearly hear a

voice saying, “Turn me on, dead man” and “Paul is a dead man, miss him, miss him, miss him.” An even more widely recognizable example is found in the Led Zeppelin song “Stairway to Heaven,” in which a series of oddly worded messages is claimed to manifest during a backward playing of the chorus, most of which are said to be satanic in nature, confirming many parents’ suspicion that the music their children were listening to, and toward which they felt no particular affection, was evil. Since then, many other bands and their songs have been targeted, some of which have been spotlighted in bills proposed by several states to ban albums and/or to require warning labels on albums about the messages they might contain.

The most interesting aspect of this phenomenon is that most of these auditory illusions need a significant amount of assistance before they are grasped by the listener. Jeff Milner’s Backmasking Collection (<http://www.jeffmilner.com/backmasking>) houses some excellent examples and allows the user to not only listen to song clips forward or backward, but also to read both forward and “backward” lyrics which can be separately displayed to test the listener’s ability to guess the messages supposedly contained in each. In my experience with students, hearing the lyrics correctly when the clips are played forward yields a success rate of about 85% (even at a college with a significant percentage of non-native English speakers). Hearing the “backward” message correctly, however, is a feat no one has successfully demonstrated in my tests; only a few of the more prominent “words” could be guessed correctly with any degree of reliability.

Another wonderful example of our brains’ ability to favor linguistic order out of disorder can be found on a web page created by Matt Davis at the Medical Research Council Cognition and Brain Sciences Unit (<http://www.mrc-cbu.cam.ac.uk/people/matt.davis/sine-wave-speech>). Dr. Davis uses a form of artificially degraded speech called “sine-wave speech” to determine what features must be present in order for auditory speech to be recognized and understood.

After playing a few of these examples to students, I often ask them if they can think of any sensory misperceptions they have ever made. This is important to me because I know that most of my students cannot imagine themselves actually believing that messages are hidden in popular music, and I want them to relate personally to the phenomenon of pareidolia so that they will be motivated to understand it and have a more reasoned (i.e., compassionate) understanding of how others might be fooled by it. One commonly experienced example is hearing the phone ring while taking a shower or listening to loud music.

In this case, your brain erroneously interprets similarities in tones created by the background noise to those created when phones ring. (With the introduction of cell phones and their endless ring tones options, this example may lose its relatability.)

Providing examples of a phenomenon is a good conversation starter, but a higher scientific goal is to explain why things happen. Challenging students to develop their own theories to explain pareidolia can yield interesting results, but much depends upon their knowledge in areas such as neuroscience, sensation and perception, evolution, and related fields. If time does not permit a lecture on these subjects, asking students to concentrate on two key points can assist them:

1. Neuroscience and Psychology: Apophenia, the experience of seeing meaningful patterns or connections in random or meaningless data (Brugger, 2001) can explain pareidolia as part of an overarching human tendency. It can be found to decrease, such as in cases of *receptive aphasia*, a neurological condition in which someone loses the ability to understand language in its written or spoken form, showing that our ability to understand language has a neurological basis. Research on language acquisition can be discussed with students to begin understanding how the brain makes linguistic meaning out of specific noises that we call language (see the work of Paul Broca, Karl Wernicke, Noam Chomsky, Erick Lenneberg, and Laura Ann Petitto).
2. Evolution: What evolutionary advantages might these errors represent? Type I errors (the identification of false data as significant) are preferable to Type II errors (the identification of significant data as meaningless) (Shermer, 2000). Would you prefer a nervous system that is tuned to make errors of a Type I nature, or of a Type II nature? I ask students to consider the advantages and disadvantages of each, and to apply their conclusions to how early humans (and their predecessors) may have evolved pareidolia as a side effect of a survival strategy that might create some annoying mistakes, but has served us well over the years.

Although these activities concentrate on auditory perception and pareidolia, they can easily be modified to address visual perception and pareidolia. Whichever you choose, these can serve as portals into discussion about a wider range of mistakes of perception such as:

Japanese researcher Chonosuke Okamura's report, "Original Report of the Okamura Fossil Laboratory," in which he described his interpretation of tiny inclusions in polished limestone from millions of years ago as the preserved fossil remains of tiny humans

and other animals, as proof that life on our planet has only changed in size, and not in morphology, over the millennia.

Images of religious figures and artifacts (the Nun Bun, the Virgin Mary Grilled Cheese Sandwich, etc.), and how people's preconceptions about religion correlate with their ability to find and to believe in the significance of these images.

Psychologist Konstantīns Raudive's "discovery" of the electronic voice phenomenon (EVP) in the early 1970s, and his belief that these were the voices of disembodied spirits.

The mental status test known as the The Rorschach Inkblot Test, and other such "projective tests" rely upon patients' reports of pareidolic phenomena to evaluate their thoughts and feelings.

References:

- Brugger, P. (2001). From haunted brain to haunted science: A cognitive neuroscience view of paranormal and pseudoscientific thought. In J. Houran & R. Lange (Eds.): *Hauntings and Poltergeists: Multidisciplinary Perspectives*. Jefferson (NC): McFarland. (pp. 195-213).
- Fontenelle, L. (2008). Pareidolias in obsessive-compulsive disorder: Neglected symptoms that may respond to serotonin reuptake inhibitors. *Neurocase*, 14(5), 414-418.
- Shermer, M. (2000). *How We Believe*. New York, NY: W.H. Freeman.

26. Your Common Sense Can Fail You

Written by Sheldon Helms

One of the most common impediments to learning is our seemingly innate tendency to overemphasize the usefulness of common sense. Although it may be quite useful with the mundane decisions of daily life, more complicated issues often contradict what seems intuitively likely. Thus, an important critical thinking exercise is convincing students that common sense can fail you.

In my experience, the three most instructive themes in this regard are: (http://mce_host/site/%E2€ •mailto:rjblaskiewicz@gmail.com")1. (http://mce_host/site/%E2€ •mailto:rjblaskiewicz@gmail.com")Demonstrating the difference between correlation and causation; 2. Emphasizing the difference in value between anecdotal evidence and. replicated, peer-reviewed research; and 3. The importance of control groups and placebos.

Correlation versus Causation

Some of the most glaring examples of the fallibility of common sense lies in the seductive nature of correlations. In many cases, it seems obvious that a phenomenon is being caused by the factor that occurs with it most frequently. In other words, if A and B always (or quite frequently) occur together, then one must be causing the other. Although a lot depends on the variables involved (e.g., none of my students believes that a rooster's crow makes the sun come up), this error can be close to irresistible. But simply stating that correlation and causation are not always related is not enough for most people to grasp our meaning. Instead, three avenues of reasoning must be fleshed out, and relatable examples should be used.

1. Correlation Does Not imply Causation:

Arguably one of the most widely cited examples of the "correlation means causation" error is the erroneous belief that vaccinations cause autism. The history and dangerous results of this belief (begun by medical fraud, and popularized by numerous celebrities) have been covered ad nauseam on various blogs and publications, but a frequent argument used by its proponents is that rates of autism have steadily increased with the introduction of (and increase in) childhood vaccinations. At least part of this correlation is quite real, but it certainly does not support the claim of a causal link between autism and vaccines. Instead, some childhood vaccinations are simply timed around the point in a

child's life when she or he is likely to begin showing signs of autism. Therefore, many parents of children with autism find the claim of a causal link quite compelling, since the timing of both vaccines and autistic behaviors and diagnosis in their children seem suspiciously close.

A more humorous example of this error can be found on the web site of the Church of the Flying Spaghetti Monster, in the form of an open letter to the Kansas School Board (<http://www.venganza.org/about/open-letter/>). In it, the writer satirically expresses a shared concern over students being exposed to only one theory (i.e., evolutionary theory), and offers her/his own competing theory to explain the phenomenon of Global Warming. The fact that this theory happens to be derived from a correlation with pirates makes it a ridiculous, yet poignant, example of the classic correlation/causation error.

2. Direction of Causality Problem (reverse causation):

Unfortunately, many texts and web sites offer only ridiculous examples of the Direction of Causality Problem (e.g., more firefighters are called upon to fight larger fires, therefore, people could assume that firefighters' association with large fires means that firefighters cause fires), also known as reverse causation. However, many real-world examples exist in the research that can be used to instruct students. A 1997 study in the *International Journal of Epidemiology* investigating the correlation between breastfeeding and growth stunting in infants provides such a case. At the time of the study, a debate was growing in the nutritional sciences about the benefits of breastfeeding. A number of correlational studies had reported that toddlers breastfed beyond 12 months were significantly underweight and smaller than their age-matched counterparts who were not. In a study of 134 toddlers in Peru, Marquis, Habicht, Lanata, Black, and Rasmussen (1997) collected data not only on their feeding habits, but also on factors related to overall health and thriving. Their conclusion was that children with more health issues, and whose development was poor, were being breastfed more and for longer periods of their lives than those who were generally healthy and growing well. Therefore, earlier studies showing a negative relationship between breastfeeding and growth had reported the causal factor as an effect, and the effect as the causal factor; *reverse causation*.

3. The Third Variable Problem:

A good example of the importance of understanding this phenomenon began when numerous epidemiological studies reported that women receiving hormone replacement therapy (HRT) experienced a significantly lower incidence of coronary heart disease

(CHD). This correlation was found in all but a few studies after the initial report, resulting in an increase in “preventive” HRT being prescribed for post-menopausal women. Re-analysis of the data from these studies, this time controlled for socio-economic status, showed that women in higher socio-economic groups were more likely to be taking HRT; these women also had better diets and were more likely to exercise regularly, resulting in the decrease in CHD incidence. Later, in fact, scientists conducting randomized controlled studies demonstrated that HRT caused a small but statistically significant increase in risk of CHD (Lawlor, Davey Smith, & Ebrahim, 2004).

Anecdotal Evidence vs. Replicated, Peer-Reviewed Research

How often have we read statements such as, “Suzie J. from Richmond, VA used our product for just six months and reported a 50 lb. weight loss!”, or “How well does our reading program work? Just ask Timmy G. of Bakersfield, CA! His grades went from C’s to A’s and B’s in less than one year!” Such anecdotal evidence is used primarily to sell products and services to a public too busy or distracted to seek out scientific evidence of their value. Given the ubiquitous nature of these claims, they’re a great way to teach students to think critically with examples they can relate to.

For example, nearly all of my students are familiar with the phrase, “Hooked-on-Phonics worked for me!” Anyone alive in the 1980s or 1990s was inundated by television and radio commercials in which cute little kids sang the praises of the reading program inspired by a father who wanted to help his struggling child improve his reading skills. Their subsequent marketing of a product that seemed to make up for years of incompetence in the public schools resulted in millions of dollars in sales, and a stern backlash by those in the educational community (and later the Federal Trade Commission) who demanded evidence (http://articles.latimes.com/1994-12-15/news/mn-9369_1_hooked-on-phonics-program) of its effectiveness.

One of my favorite exercises for my students is to ask them to consider the effectiveness of such anecdotes and testimonials, and how they differ from peer-reviewed research. To emphasize this point, I ask them to consider how they might carry out a study in which they tested the effectiveness of a program like Hooked-on-Phonics, and require them to devise an experiment from start to finish, considering possible correlates (e.g., parental involvement) that might affect the outcome of studies that did not include randomized trials. After they complete this activity, my students often begin asking their own questions. Two

of the most frequent are: 1) “Why isn’t there a law requiring businesses to prove the effectiveness of their products before being allowed to make claims and sell them?” and, 2) “Why doesn’t the general public demand that manufacturers show proof that their products work before they buy them?”

The Importance of Control Groups and Placebos

Aside from the possibility of dishonesty, one of the reasons that anecdotes and testimonials are of little scientific value is that there is no basis for comparison of the person reporting success to the general public. In other words, if exposure to a variable is associated with a change in another variable, how do we know that the change wasn’t the result of chance? Would the change have occurred anyway, without exposure to the other variable? To answer these questions, we must consider the importance of control groups.

Particularly important in the social sciences, control groups allow researchers to eliminate and/or isolate specific variables in their studies. They allow researchers access to the behavior and/or condition of a group of people who are left in their “natural state,” never exposed to the causal agent or condition. In many experiments, a host of *possible* causes for phenomena must be narrowed down to one *probable* cause, which isn’t easy when you consider that many variables can be affected by such things as the testing environment, researcher bias, and even biological differences between subjects.

Although those of us who work in the sciences take for granted the importance of control groups, a surprising percentage of my students must be reminded to demand them when evaluating claims. For many, controls seem counter-intuitive. “If something works, it just works,” they seem to argue. But critical-thinking requires us to redefine “works,” and to more closely evaluate claims of effectiveness in terms of comparing treated to non-treated individuals.

A highly effective tool when using control groups is the placebo. From the Latin, “I please,” a placebo is a fake form of the suspected causal agent or condition. In medicine, the classic placebo is an inert substance in the form of a pill. In psychology, the placebo condition might be a fake form of therapy. In any case, its use reflects the knowledge that expectation on the part of the subjects can change their behaviors in ways that mask the effect of the suspected cause. Subjects told that they might be receiving medication, but also that they might instead receive a placebo, are not likely to be so affected, and any change can then be attributed to the medicine.

The effect of the placebo has also opened up inquiry into the fascinating world of the Placebo Effect (<http://harvardmagazine.com/2013/01/the-placebo-phenomenon>) -- which Dr. Harriet Hall (<http://www.skeptdoc.info/>) suggests we begin referring to as the Placebo Phenomenon, reflecting its non-effect, and psychological roots. A recent series (<http://www.psychologytoday.com/collections/201201/the-placebo-effect>) of articles in *Psychology Today* devoted to examining the science behind placebos address a number of findings, including some of the exaggerated claims of their effectiveness, as well as the controversial issue of doctors prescribing placebos to patients with real (albeit psychologically induced) complaints.

In closing, I would like to emphasize to anyone (professional or non-professional) attempting to warn people against the over-use of common sense to keep in mind that scientific thinking is often quite unnatural and counter-intuitive. Therefore a good measure of patience and repetition is usually required before people become comfortable giving up their use of instinct, hunches, and personal experience in favor of the more artificial practice of critical thinking.

References:

- Lawlor, D. A., Davey Smith, G., & Ebrahim, S. (2004). "Commentary: The hormone replacement-coronary heart disease conundrum: Is this the death of observational epidemiology?" *International Journal of Epidemiology*, 33(3), 464–467.
- Marquis, G. S., Habicht, J. P., Lanata, C. F., Black, R. E., & Rasmussen, K. M. (1997). Association of breastfeeding and stunting in Peruvian toddlers: an example of reverse causality. *International Journal of Epidemiology*, 26(2), 349-356.
- Nathans, A. (1994, December 15). Hooked on Phonics settles with FTS on advertising claims. *The Los Angeles Times*. Retrieved from http://articles.latimes.com/1994-12-15/news/mn-9369_1_hooked-on-phonics-program.
- Novella, S. (2007, November/December). The Anti-Vaccination Movement. *Skeptical Inquirer*, Volume 31.6. Retrieved from http://www.csicop.org/si/show/anti-vaccination_movement/.
- The Placebo Effect. (2012, January). *Psychology Today*. Retrieved from <http://www.psychologytoday.com/collections/201201/the-placebo-effect>.

27. Teaching Science with Pseudoscience

Written by David Dixon

All university-level physics instructors, at some point in their careers, will receive an unsolicited letter or email from a member of the public detailing a novel, unorthodox, and potentially revolutionary theory. Most of these theories are ignored or swiftly discarded. At my previous teaching position (Cal Poly in San Luis Obispo, California), the physics department has been maintaining an archive, affectionately known as “The Box,” of all the crackpot theories that have been mailed in since the early 1990’s. A few years ago I borrowed The Box over the summer and read through its contents, and found that some of these theories can be repurposed for classroom discussion or for homework problems. When students can identify errors and misconceptions, they gain familiarity with the critical analysis of claims about the natural world.

An example of such a theory involves the “Principle of Equivalence” from general relativity, which states that a frame of reference experiencing a gravitational force is identical to an accelerating frame of reference. Astronauts on board a spaceship which is accelerating in a straight line through outer space at 9.8 m/s^2 feel the same sensations of “weight” as they would just standing on the surface of the Earth. The crackpot theory is that our sensation of gravity on the Earth’s surface is actually caused by the Earth *expanding* at 9.8 m/s^2 , producing the “fictitious force” that we interpret as gravity. I propose this theory to my introductory physics students, and they always laugh, but I then ask that they *specifically* identify its weaknesses. They can even propose experiments to test the theory, such as comparing the timetables for international flights; if the Earth were indeed expanding, the flight times should be increasing with time. One can also analyze this theory using the laws of kinematics, usually taught in the first few weeks of an introductory physics course—if the Earth were expanding, that means in the past it was smaller than it is now, and the smallest it could possibly be is a single point, so if it started from a single point at rest and expanded outward at 9.8 m/s^2 , how long would it take to achieve its current radius of 6400 km? (Answer at the end of this article.)

This teaching method can be extended to bad science generally, including topics which are familiar to scientific skeptics. In particular, a critical analysis of homeopathy is well-suited to an introductory physics or chemistry class when the atomic model of matter is first mentioned, since the origin of homeopathy predates this model. Surprisingly, I have found that very few of my students had ever heard of homeopathy, and those that had thought that it was identical to herbal medicine. By having students actually calculate the

number of molecules of the substance in each step of the dilution process, they gain not only a familiarity with dealing with powers of ten, but also the discreteness of matter when they calculate the ultimate number of molecules being much less than one. After one such class discussion, a student asked, “So if there aren’t any molecules left, then how does it work?” “They believe the water remembers,” I replied, and the class responded with laughter.

Not all pseudoscientific theories provide teachable moments like these—many of the theories lack internal logic or testable claims—but the ones that do can serve as a sort of vaccination against bad ideas. The term is deliberately chosen; vaccination is the introduction of a weakened form of a disease so that the body’s immune system can “learn” how to protect itself against a stronger version later. Crackpot theories and pseudoscience have weak scientific arguments at their foundation, and so the process of picking apart these arguments can strengthen students’ analytical abilities and hopefully make them more resistant to their own misconceptions. As science educators, one of our charges is to promote scientific literacy among the general population. Dissection of crackpot science is a legitimate and often very entertaining way to achieve this goal.

Another possibility for showing the difference between science and pseudoscience is to have students note the differences in writing style. Whereas scientific papers are generally formal, dispassionate, detailed and carefully stated, crackpot papers are informal, self-aggrandizing, vague, and flippant. This speaks to their lack of training and rigor and can be used as a point of discussion, especially among students who are embarking on their own research projects.

So if you’re a science teacher and you receive an email from a crank, don’t just throw it away! (Don’t reply to the crank either, by the way—they are usually unshakably devoted to their theories, so it will be frustrating and fruitless for both of you.) Try instead to locate the flaws in their arguments and make pedagogical lemonade out of pseudoscientific lemons.

(The answer to the expanding Earth problem is about 19 minutes.)

28. Your Beliefs are Malleable

Written by Sheldon W. Helms

“I’m an insulin-dependent diabetic. Twice a day I take synthetically manufactured insulin that still contains some animal products — and I have no qualms about it... I’m not going to take the chance of killing myself by not taking insulin. I don’t see myself as a hypocrite. I need my life to fight for the rights of animals.” --PETA Senior Vice President MaryBeth Sweetland on her use of insulin, which was tested on animals

Many years ago, while teaching my first college level course in Human Sexuality, I was having a bit of difficulty dealing with two students who seemed to always be at each other’s throats. Each time a controversial topic (e.g., abortion, homosexuality, pornography) was covered, their open disagreements seemed to escalate into full blown arguments. After a few weeks of this I’d had enough, and I executed a plan designed to teach them (and the rest of the class) to expand their horizons and to find common ground. I asked all of the students to write a short paragraph expressing their positions on a list of ten sex-related topics, and to turn it in after they had signed it. They were then instructed to write a research paper in which they attempted to support the *opposite* of their own opinion on one of the topics in the list. This is an old trick, and I expected a bit of resistance and protest, but I had faith that most would follow through and learn from the experience.

A strange thing happened after the papers were submitted, however. Inexplicably, a few of the students thanked me for the assignment, and said that they had changed their minds about the topic they chose for their papers. I asked if they had learned something new about the topic, or whether they had been “on the fence” in the first place. Many said that they really hadn’t learned much and that they already knew their opponents’ positions, but they just felt differently after writing the paper. Although this reaction was shown by a relatively small percentage of students, and there are many possible explanations for their reports of attitude, I couldn’t help wondering if I might have inadvertently “brainwashed” my students! A better explanation, however, can be found in the literature on cognitive dissonance.

Coined in the late 1950s by psychologist Leon Festinger in his very popular book, *When Prophecy Fails* (<http://www.amazon.com/When-Prophecy-Fails-Leon-Festinger/dp/1617202800>), cognitive dissonance refers to the psychologically uncomfortable state of holding two conflicting cognitions (thoughts, opinions, beliefs, memories, etc.).

Dispelling many of the myths about so-called brainwashing (which assumes that others can directly change our cognitions), Festinger found that people engage in cognitive shifts designed to reduce the unpleasantness they experience when their cognitions contradict each other. These reactions can range from mild annoyance to mental torment, and Festinger suggested three possible routes to reduction of the dissonance that creates them: 1) change the behavior that creates the dissonance; 2) add new cognitions to reduce the dissonance; or 3) change the social environment that reinforces the dissonance. Although I could never be certain, I suspected that #2 may have occurred in my students who'd inexplicably changed their minds after turning in their papers. After all, they could not go back in time and alter the fact that they had written the paper and expressed certain things as true; what they could change, however, were their beliefs. Once those two elements were consonant, their cognitive dissonance had been eliminated and they felt better.

The history of Cognitive Dissonance Theory is as interesting as the theory itself. The tale begins in the late 1950s, when Festinger and his colleagues infiltrated a UFO cult led by Dorothy Martin, a Chicago housewife and former devotee of Scientology founder L. Ron Hubbard. Based upon messages she claimed to receive through spirit writing, (<http://www.randi.org/site/index.php/swift-blog/623-testing-spirit-writing.html>) Martin and her followers believed that the world was about to end, and that the group's adherents would be the only survivors. As Festinger predicted, although the end-of-world prophecy failed, the most faithful among them became even more committed to their leader and her teachings because accepting the truth (that they had been wrong to give up their lives to follow her in the first place) was simply too psychologically distressing.

Although most of your students will, thankfully, never join a cult, they can all relate to holding some belief as a sacred cow about which they fail to think critically. Some might justify their cigarette smoking by stating that it prevents them from gaining an unhealthy amount of weight. Others may refuse to recycle, claiming that corporations and large factories pollute far more than they ever could as individuals. Still others might justify their religious beliefs in the face of evidence that their religious texts show no sign of divine inspiration, arguing that the books were written by fallible men who could have inserted their own ideas and/or mistranslated certain sections. Everyday examples such as these help me begin a discussion with my students that assists them in directly relating to others they might perceive as gullible or foolish.

After encouraging them to relate personally to the topic, I then ask my students to consider how cognitive dissonance might help explain why our offers to educate or to

demonstrate errors in others' reasoning are sometimes ineffective. I try to guide them toward seeing how petty and insignificant factual information might seem to "believers" when compared to:

the chance that they might lose important connections to friends, family, and worldview (religion),

the idea that they must accept the death of a loved one, or of the idea that the future can be foreseen (psychics),

or even to the relatively mild notion that they have wasted money or time on a useless product (Powerbalance Bracelets (<http://news.discovery.com/human/power-balance-maker-admits-bands-are-worthless.html>)).

At this point, with a coherent framework established, students are usually prepared to approach the published literature on cognitive dissonance. Luckily, a wealth of studies and books is now available for them. As my colleague **Carol Tavis** (http://www.forgoodreason.org/carol_tavis_mistakes_were_made) and her co-author Elliot Aronson point out in their wonderful book *Mistakes Were Made (But Not By Me)* (<http://www.amazon.com/Mistakes-Were-Made-But-Not/dp/0156033909>), Festinger's theory has been incredibly fruitful, inspiring over 3,000 published experiments and revolutionizing our understanding of human psychology. Tavis and Aronson have followed in Festinger's footsteps, pointing out how cognitive dissonance affects many facets of our daily lives, influencing politics, war, marriage, prejudice, science, and countless other areas. In addition to Tavis and Aronson's book, some of the published scientific literature can serve as good starting points for discussions with students about the power of cognitive dissonance. Among these are:

Research on the role cognitive dissonance plays in criminal investigations, and how law enforcement and prosecutors can be biased in favor of evidence that confirms their beliefs, rather than that which is true.(e.g.: Ask, K., Reinhard, M., Marksteiner, T., & Granhag, P. A. (2011). Elasticity in evaluations of criminal evidence: Exploring the role of cognitive dissonance. *Legal and Criminological Psychology*, 16, 289-306.

Brain scan (fMRI) studies suggesting that decision-related attitude change are associated with increased activity in specific parts of the brain, and occur rapidly, before someone has an opportunity to deliberate between options. (e.g., Jarcho, J. M., Berkman, E. T., & Liebman, M. D. (2011). The neural basis of rationalization: Cognitive dissonance reduction during decision-making. *Social Cognitive & Affective Neuroscience*, 6 (4), 460-467.)

Explaining what differentiates those who join terrorist organizations from others who may hold similar social and political views, but never turn to acts of violence. (e.g., Kohn Maikovich, A. (2005). A new understanding of terrorism using cognitive dissonance principles. *Journal for the Theory of Social Behaviour*, 35 (4), 373–397.)

Investigation of the effects of dissonance reported by lesbians who identify as Christians, and the strategies they employ to deal with those feelings of dissonance. (e.g., Mahaffy, K. A. (1996). Cognitive dissonance and its resolution: A study of lesbian Christians. *Journal for the Scientific Study of Religion*, 35 (4), 392-402.)

References:

- Festinger, L., Riecken, H. W., & Schachter, S. (1956). *When Prophecy Fails: A Social and Psychological Study of a Modern Group that Predicted the Destruction of the World*. University of Minnesota Press: Minneapolis, MN.
- Tavris, C., & Aronson, E. (2007). *Mistakes Were Made (But Not By Me)*. Harcourt Press: Orlando, FL.

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