REASON

BOOKS I & II



A CRITICAL THINKING-, REASON-, AND SCIENCE-BASED APPROACH TO ISSUES THAT MATTER

BO BENNETT, PHD

REASON: Books I & II

A Critical Thinking-, Reason-, and Science-based Approach to Issues That Matter

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This book is dedicated to everybody from whom I have learned—which is virtually everybody with whom I have ever interacted.

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Preface

Several years ago, I came across a website called "The Flat Earth Society." I, along with many others, thought I was seeing the humor of someone creating a parody (Google "Poe's Law"). To my shock, this was a real organization that appeared to have many (too many) members who authentically hold the beliefs that the earth is flat. When my initial shock wore off, I became fascinated with this group because where most people saw a bunch of crazies, I saw a group of people following the same flawed rules of reason that we see with religious fundamentalists, science deniers, and conspiracy theorists. Anti-vaccine activists reject the overwhelming majority of research of vaccine safety citing a global conspiracy to keep people sick and the medical establishment rich. Flat earther's also reject the overwhelming majority of research and cite a global conspiracy to keep those in charge rich (whomever that is). As a science communicator, I can spend my life throwing facts at these groups, but as we have seen in recent times, facts rarely matter when it comes to public opinion. Whether you believe the earth is flat, vaccines cause autism, global warming is a hoax, or the earth is 6000 years old, the reason you believe these things has to do with a flawed reasoning process and bad methodology. Correct the reasoning, and the beliefs will start to more accurately reflect the truth. Although I do sometimes share by personal beliefs in this book, you don't need to agree with them. It's all about learning how to think, not what to think.

I take a critical thinking-, reason-, and science-based approach to exploring issues that matter with the goal of both educating and entertaining. I have a PhD in social psychology, but I cover a broad range of topics including: Science Education (scientific method, what is / is not science, etc.), Success, Entrepreneurship, Motivation,

General Psychology, Social Psychology, Positive Psychology (well-being, flourishing, happiness, etc.), Cognitive Psychology (belief, cognitive biases, memory, our flawed brain, etc.), General Social Science, Critical Thinking, Logical Fallacies, Humanism / Secularism, and Philosophy. This book comprises parts one and two of an ongoing project to do my part in making the world a more reasonable place.

You can read more than you would ever care to know about me at http://www.BoBennett.com. But if you don't care to know more than you would care to know about me, then let me give you some of the highlights. I am a serial entrepreneur who has started and sold many companies over the last 25 years. I focus on building web properties and marketing. I sold my first company of significant value in 2001 at age 29, which allowed me the financial freedom to pursue interests that could have a significant social impact. I passionately studied the sciences, philosophy, and religion. I went back to school and earned my master's degree in general psychology, then my PhD in social psychology. My mission in life (and goal of this book) is to contribute to the well-being of individuals and society by combining education with entertainment.

The topics I address in this book range from the light-hearted with more entertainment value than anything else, to the serious topics that can have great impact on personal and societal well-being. I like the balance because life should also be fun and we shouldn't take everything too seriously.

Much of this book is the result of my work at TheDrBoShow.com. However, this book is written more for the layperson. I do my best to avoid jargon and explain the jargon that I do use, in clear language that most people can understand without too much thinking (save the thinking for the issues explored).

The Point of Reason and Rationality

I want to make the distinction between *rationality* and *reason* in the domain of argumentation (these terms have specialized meanings when referring to different topics). The two terms are often used interchangeably, and one could argue that the current usage of the terms have, for all practical purposes, made them synonymous. However, when exploring this area in detail, the distinction is an important one. *Reason* is defined as the "*capacity for consciously making sense of things, applying logic, establishing and verifying facts, and changing or justifying practices, institutions, and beliefs based on new or existing information.*"[1]. *Rationality* implies conformity of one's beliefs and action to one's applied reason. For example, if a terrorist was holding people hostage and demanded a piloted helicopter with enough fuel to cross the border, the deactivation of all tracking satellites in a 200 mile radius, and two-million dollars cash, these demands (not necessarily the master plan) could be described as rational, as the demands would facilitate the terrorist's goals of escaping. If the terrorist, however, demanded a video of a squirrel and a hedgehog playing the game "Rock'em Sock'em," a pair of Betty White's underwear sealed in a jar of formaldehyde, and a getaway unicorn, the demands would be irrational.

One's ability to reason properly is the underlying cognitive ability that generally remains stable while one's rationality is greatly affected by temporary conditions such as heightened emotions, lack of sleep, or any cognitive impairment. One could usually be a very reasonable person but act irrationally when angered, for example. Being more rational can be a result of working on controlling your

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1 Kompridis, N. (2000). So we need something else for reason to mean. *International Journal of Philosophical Studies*, 8(3), 271–295.

emotions, avoiding activities and habits that lead to cognitive impairment such as drugs and alcohol or not getting enough sleep, or just recognizing when you are not in the ideal state of mind to make reasonable decisions or arguments. The benefits of rationality (acting in accordance with your reason) should be clear. But what may not be clear at this point, are the benefits of being reasonable.

There is an evolutionary argument for using reason. There is still some debate among cognitive scientists as to why exactly humans appear to have what we call superior intelligence compared to other species. We know the differences reside in the brain, we just can pinpoint what those differences are at this time. It is possible, even likely, that our level of intelligence emerges from several differences in our brain anatomy. Regardless of where those differences are, we know that our intelligence and thus, reasoning ability, has evolved to what it is today. Evolved abilities make us better suited for our current environment and by extension, reason makes us better suited for our environment. "Current environment" is a misnomer, however, since evolution works over thousands of years and does not respond to the rapidly changing social environment of today. It is possible that better human reasoning is still adaptive, but as the movie *Idiocracy* warns, it could also be maladaptive.

Idiocracy: The Future of Humanity

Virtually all behavioral scientists today agree that while there are both pros and cons to rationality and reason, in today's social environment, the personal and societal benefits of reason far exceed its problems. A leader in this field is Dan Ariely who wrote the books, *The Upside of Irrationality: The Unexpected Benefits of Defying Logic* and *Predictably Irrational, Revised and Expanded Edition: The Hidden Forces That Shape Our Decisions* which focus on

many of the benefits of irrationality and many of its problems, respectively. There are many benefits to reasoning as well as just as many problems associated with poor reasoning that can be found in personal, professional, and academic domains. While reasoning ability has been directly linked to many academic outcomes, scientifically, it is challenging to link reasoning ability directly to any specific life outcome such as wealth, happiness, or well-being. Ironically, however, it is through the reasoning process itself that we can infer that better reasoning is more likely to lead to better life outcomes.

An important distinction must be made between rationality on a personal level and a societal level. Virtually all of the benefits of irrationality such as the peace of mind that comes with believing in supernatural entities who are looking out for your best interests, eternal life in paradise, or the idea of Karma, are personal benefits that would have a potentially disastrous effect if implemented on a societal level. For example, societies that took the idea of Karma seriously would have no need for their own systems of justice since the gods, the universe, or whatever would see to it that perfect justice prevailed. World leaders who believe that the destruction of civilization is a necessary step for Jesus to return and bring about world peace, have little incentive to avoid such conflicts that are likely to lead to the destruction of civilization. This scenario is even more terrifying if others in power share the same belief. Personal irrationality that only affects an individual or a small number of people within an irrational person's circle of influence, may be beneficial to those people, but as more people are affected by the irrationality, the net result eventually becomes negative.

Reason is certainly something that can be learned, although research confirms that some people are more

predisposed to irrational thinking than others[2]. For those who suffer psychosis stemming from irrationality, *rational emotive behavior therapy (REBT)* is a psychotherapeutic solution for addressing irrationality. For the rest of us, improving our reasoning abilities is a result of multidisciplinary education and practice. Studying both formal and informal logic, fallacious reasoning, cognitive biases, probability, and other areas will provide the tools needed to reason more effectively. Engaging others in debate is perhaps the best way to practice reasoning skills, as long as the debate doesn't devolve into one personal attack after another, which is unfortunately all too common with online debates. Another effective way to improve reasoning ability is by questioning your feelings, values, and beliefs. Before I explain this one, a little myth-busting is required.

A common but incorrect assumption is that we are creatures of reason when, in fact, we are creatures of both reason and emotion. We cannot get by on reason alone since any reason always eventually leads to a feeling. Should I get Grape Nuts or Lucky Charms? I can list all the reasons I want, but the reasons have to be based on something. For example, if my goal is to eat healthy, I can choose the Grape Nuts, but what is my reason for wanting to be healthy? I can list more and more reasons such as wanting to live longer, spending more quality time with loved ones, etc., but what are the reasons for those reasons? You should be able to see by now that reasons are ultimately based on non-reason such as values, feelings, or emotions. These deep-seated values, feelings, and emotions we have are rarely a result of reasoning, but can certainly be influenced by reasoning. We have values, feelings, and emotions before we begin to reason and long before we begin to reason effectively. This is

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2 Hood, B. M. (2010). The Science of Superstition: How the Developing Brain Creates Supernatural Beliefs. New York: HarperOne.

why questioning our feelings as reasoning adults is so important.

We all think we are reasonable and rational most of the time, and if you are reading this, you probably are. But reason isn't something people have or don't have; it is something we all have to a certain degree. Some of us are better at it than others. As we get better at it, we start to experience the benefits of better reasoning and are capable of doing away with more and more irrational beliefs that once brought us comfort, but we recognize as irrational because they contradict our reason. These benefits can be seen in our personal and professional lives, and the benefits can be extended to entire societies when its leaders and members value reason and rationality.

PART I: Science Works.

Overall, very few people have a strong understanding of what science is and what it is not. This ignorance often leads to the “rejection” of science or at least a *strawman* idea of science that can easily be dismissed. But science is too important to let this slide.

How Important Is Scientific Literacy?

The National Science Education Standards defines scientific literacy as "the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity." That sounds pretty important to me, but there are those who will disagree. The United States is indeed a melting pot, not just of cultures, but of ideas and values. Some people value belief and faith far more than reason and science, meaning that the subjective state of personal well-being is more important than accepting a scientific fact that risks decreasing that personal well-being. Of course, being scientifically illiterate can have a negative effect on one's well-being through making poor choices in life or being less in demand in the workforce. What people who hold that view don't consider is the big picture—how their beliefs (or lack of scientific literacy) affect their communities, society, and even humanity. For example, a lack of scientific literacy can result in preventable disease outbreaks in communities through not understanding vaccine safety. A lack of scientific literacy can result in a failure to embrace biotechnology that can keep local farmers in business and people fed. A lack of scientific literacy can result in listening to politicians who say that climate change is not a problem rather than listening to the scientists who actually study climate change, which the costs of such illiteracy can be catastrophic.

So what can we do about it?

I think there are perhaps hundreds of small ways that we can encourage scientific literacy such as making science more entertaining, making it a larger part of standard education, warning people of the dangers of scientific illiteracy, call out anti-intellectualism when we see it, and perhaps make Neil Degrasse Tyson President of the United

States :) At an individual level, I think that everyone can do something that is unique to his or her talents to promote scientific literacy. For me, it is my show, my online courses, my work as a professor at a local college, the books I write, and the podcasts I host. That's what I can do about it. What can you do about it?

Don’t Blame Science for Bad Doctors

Too often, the public sees science and doctors as the same “thing.” They are not. Not by a long shot. Science is a method for separating fact from fiction. Doctors and therapists are trained in this method—whether they use it or not, or how well they use it, is up to them. We shouldn’t reject science because of bad doctors for the same reasons we shouldn’t reject education because of bad teachers.

This seems obvious, but why do so many have this “rejection instinct”? It has to do with how we learn by association. “Science” is an abstract concept that is not easy to grasp and impossible to visualize. People know what doctors are and they can be easily visualized (think lab coat). When a doctor says something wrong (or just stupid), it is often seen as a strike against science. This a what is known as a *fallacy* or an error with reasoning that is often a result of lazy thinking.

Scientists can loosely be put into two categories: *practitioners* and *researchers*. I say “loosely” because there are many practitioners who are also researchers, or practitioners who run a strict research-based practice. The scientific method is an integral part of any researcher’s daily life, whereas practitioners, such as medical doctors or therapists who treat patients or clients for a living can begin to incorporate personal experience, anecdote, and “gut feeling” into their practice. While this is not always a bad thing, this is an abandonment of the scientific process. An example is doctors in the 1950s who endorsed smoking not based on research but on other factors mostly surrounding personal biases and other reasons.

The bottom line is that science, as a methodology, cannot be judged by the behavior of doctors because there is often a large disconnect between the two. Some doctors have a

strong understanding of the scientific method and are consistent with science-based medicine, practice, and research while others are not.

Trust science as a method, but approach any claims with a healthy dose of skepticism.

The Problem with Relying on Your Own "Common Sense" and Ignoring Scientific Consensus

Let me start by being perfectly clear that we should always employ reasoning when it comes to making decisions that matter. However, an important part of the reasoning process is knowing when to defer to those who know more than you on a particular issue, especially when "common sense" is anything but common, and often in conflict with reality. Further, what might be expressed as "personal freedoms" to reject the scientific consensus on certain issues can have a devastating impact on others. For these reasons and more, the problem of choosing "common sense" over scientific consensus is a serious one with far-reaching consequences.

"Common Sense" and "Intuitions" Often Contradict Reality

What is generally referred to as "common sense" is a subjective sense of our own knowledge. In psychology, there is a phenomenon known as the *Dunning-Kruger Effect*, which is the illusion that we are smarter than we actually are based on the fact we lack the cognitive capacity to realize our own ineptitude. In fact, this is only one of the hundreds of known *cognitive biases,* or a deviation from rationality or reason, that virtually assure that our perception of reality is greatly skewed and often incorrect.

From an evolutionary perspective, these biases are a result of helping us pass on our genes. Evolution does not care if we are smart, logical, reasonable, rational, or even right—as long as our intuitions and "common sense" are more conducive to passing on our genes than they are a hindrance to that goal. The accurate information we do have

as a result of the non-conscious and non-deliberate processes is obtained partly by genetics and partly by our environment. For example, it is "common sense" that we don't want to jump off a cliff because our ancestors had a healthy fear of doing so… that is why they lived long enough to pass on their genes. It is "common sense" for us to look both ways before crossing a road not because of our primate ancestors, but because of learning in our current environment. Be careful not to associate all evolutionary tendencies with good common sense. For example, eating as much as you can at every opportunity might have helped our ancestors survive, but this tendency is sending us to our graves early.

Here are just some examples where "common sense," "gut-feelings," "intuitions," and "our own understanding" are clearly at odds with reality:

- common sense tells us that the earth is flat (it's not)
- common sense tells us the earth is the center of the universe (it's not)
- common sense tells us the objects are solid (they are actually 99.9999999999999% empty space)
- common sense tells us that heavier objects drop faster than light ones (they don't)
- common sense tells us that if we flip a fair coin 5 times in a row and it comes up heads, then tails is "due" (it's not)
- common sense tells us that the winning lottery numbers "23, 5, 14, 34, 8, 38" are far more likely than "1, 2, 3, 4, 5, 6" (it's not)
- common sense tells us that an airplane is too heavy to fly (it's not)

- common sense tells us that time passes at the same rate everywhere (it doesn't)
- … and virtually everything related to quantum mechanics, the most well-supported scientific theory every developed, is against common sense

It would be nice if we can just "know" things magically. In fact, the appeal to common sense is often based on a combination of laziness and a defense of our own intellectual limitations. The pain of not knowing something is reduced by simply thinking we know—and not just know but know better than those who spend their lives doing the work to really find out.

Experts and Trust

There is a clear relationship between ignoring the claims of experts in favor of your own "common sense" and trust. If we were to undergo brain surgery, very few of us would question the surgeon's technique and choice of surgical instruments. Why? Our level of trust in the surgeon is high, and our level of confidence in our own understanding of the topic is very low. But what if the Internet was full of websites claiming that brain surgery was a conspiracy and just a surgeon's way of separating you from your money? No matter how full of crap these sites were, you may be persuaded by their strong emotional appeals, anecdotes, and cherry-picked data. You would be under the illusion that your level of "knowledge" on the topic is strong, and conversely, your level of trust in the surgeon would drop, to your own, and often society's detriment.

Here are some things to keep in mind to prevent this intellectually dangerous downward spiral.

- Don't think that reading a few articles on the Internet makes you more qualified than a scientist who spent

6+ years studying the topic and many more researching.

- Realize that conspiracies are a lot less common than you might think they are.
- Don't trust people; trust the science. Separate the message from the messenger. Look at the sources and give more weight to meta-analyses that combine sometimes hundreds of studies into one.
- Ask yourself if your views on the issue are politically motivated. The scientific conclusions are sometimes politically incorrect and provide evidence against the claims and positions of your political party. But science does not care about your politics, and neither should you when it comes to separating fact from fiction.

Your "Freedom to Reject Science" Ends When It Puts the Safety and Lives of Others in Jeopardy

Discussing freedom is a touchy issue, but it is important in understanding that your "right" to reject certain findings in science is limited, just as your "right" to freedom of speech is limited by not yelling "bomb" in an airport. Some examples include:

- Rejecting the science behind the safety of vaccines and putting your own children, and other people who cannot get vaccines at risk.
- Lobbying against GMOs "because it just seems wrong" rather than understanding the science behind GMOs, not realizing that GMOs can save millions of lives of people who are starving and cannot afford to shop at Whole Foods.

- Insisting that the universe is 6000 years old and trying to have that idea taught in public schools, which is undermining the younger generation's trust in science.

Use your own brain—but know its limitations. We are all subject to cognitive biases that give us a false sense of confidence in what we think we know and rationalize that the easy way out (expending no cognitive energy) gives us the intellectually superior high ground, when it clearly does not.

Doubting Science Because of Unknown Possible Long-Term Effects

First, let me say that it is reasonable to be wary of virtually any claim (including "I think, therefore I am"). However, "being wary" of something and "rejecting" it are two different things.

Understanding the Science

The claim that "there are no long-term negative effects" is not falsifiable (i.e., it cannot be proven false). Long-term negative effects (or risk factors) are a possibility with the introduction of every new medicine, technology, and ideology. Science does not work with certainties nor does it make any guarantees. What it can do, is use induction to make predictions of possible risk factors, and predict the probability associated with them. When a new medicine is released, extensive testing has already been done determining the risk factors linked to the medicine since testing began. The future potential risk factors are hypothesized based on theory. We don't know that aspirin won't make all heads explode on January 1, 2050. But to consider that as a risk factor, we need to have a reason (or a theoretical framework) for why that might be. In the absence of such a reason, we don't need to consider an exploding head in the year 2050 a risk factor of aspirin. How about more reasonable long-term side effects such as cancer or heart attack? The same criteria are applied—what reason do we have to think this would be a risk factor? Without a reason, we have no risk factor.

We Fear the Unknown

There are many psychological reasons why people tend to overestimate the probability of potential long-term negative effects. Many of these reasons are related to cognitive biases.

One evolutionary explanation has to do with the cost of being wrong versus the benefit of being right. We tend to have a *negativity bias* that results in a hypersensitivity of potentially harmful events. Our ancestors who were irrationally fearful more often than not out survived those who were irrationally confident more often than not. But in the age of science, we don't need to play it safe with irrational intuitions and gut feelings; we can make informed and confident decisions often with a high a degree of probability.

Risk and Rewards

As mentioned, science cannot provide any guarantees. Regardless, a science-based approach to predicting future possible negative effects is far superior to any other approach including one based on what one believes is one's own "common sense." Despite being a relatively low-risk product of science, we may find that the reward of a product is simply not great enough for the potential risk. Conversely, a personal benefit may be greater than a personal cost. On a personal level, I support this kind of thinking. For example, one may choose to consume organic food because they have the luxury of the expendable income to afford it. What I am strongly against, is someone ignoring the science and exaggerating the risk or reward, then demanding that it be made into a law that must be applied to everyone.

As I have explained, there are evolutionary reasons as to why we would tend to be wary of a recent scientific consensus because of unknown possible long-term effects. But we are not prisoners of our evolutionary tendencies—we can use our reasoning to overcome inaccurate intuitions (what we often call "common sense") and make better decisions. This is what science is all about.

A Guide for Trusting Sources of Science, for the Non-Scientist

It is no secret that much of the information found on the Internet today is strongly influenced by its monetary value, or to put another way, how many clicks an article can get. Unfortunately for science—and humanity—accuracy, journalistic integrity, and truth are of far less monetary value than shock, emotional appeal, and fear. As a result, if scientific information does manage to make its way into the mainstream media (assuming nothing is going on with the Kardashian's that day), it is often a greatly modified version of the information, twisted by biased media sources with far greater allegiances to politics or the bottom line than science. Assuming a media source does prioritize scientific integrity, the lack of scientific education and knowledge could lead to misreporting the facts. Despite these seemingly insurmountable problems, there are ways that you can get the most accurate information possible on scientific issues, even if you don't know much about science.

For those of you who do know a bit about science and how scientific information is published, you may think that peer-reviewed journals are the definitive source of scientific information. In a way they are, but in other ways, they are not. Jeffery Beall maintains a comprehensive list of academic journals that range from questionable quality to outright pseudo-scientific. Just because something is published in a journal, does not make the information scientific. Anyone can start a journal, and reviews by peers of quacks have no scientific value. For a perfect example, check out the *Journal of Creation* that "strives to publish papers that promote the development of rigorously logical biblically-consistent models in various areas." Not only do they not mention the goal of being scientifically valid, but they specifically state that "the journal covers a wide spectrum of studies, not just

science." Further, scientific papers can mislead non-scientists who don't have a firm grasp of the scientific process, methodologies used, and the limitations associated with the methodologies. For example, just because one study reports significant findings, it does not mean that those findings are indicative of a scientific discovery—it could be a flawed study or simply a statistical outlier (i.e., a study that shows significant results based on probability alone). For these reasons, the non-scientist is generally better off using scientifically-credible sources geared towards the general public.

While I am tempted to provide a list of sources, these would only be my opinion and certainly leave out many great sources of which I am not aware. Each specific scientific discipline has a myriad of highly credible sources, so I couldn't begin to do such a comprehensive list justice. I am better off giving you a few rules of thumb to assess the accuracy of your own sources. So here they are.

Is the source a scientist in the field he or she is providing information about? Be skeptical of generic bloggers/reporters/commentators with no academic credentials in the area of science on which they are reporting. Academics who stringently follow the scientific method certainly don't have a monopoly on scientific truth, but they are consistently more accurate and reliable than those who have no such training and rely on personal experience, anecdotes, and gut feelings.

Does the source have a good reputation within the scientific community? Google the source and see what others are saying about it in terms of scientific reliability. There will be those who object to virtually every source, but read the reasons why. Are the objectors credible? Does the source have praise from other credible sources?

Does the source have a clear political agenda? The worse place you can get your science information from is a politician, political commentator, or highly political media source. It is easy to cherry-pick the scientific literature and find data to support virtually any conclusion, and this is what media sources with a political agenda do.

Does the source cite valid sources or refer to research when making specific claims? Beware of sources that report on particular studies that fail to provide sources, or simply refer to something generic that they know their readers won't bother to investigate. Are they simply linking to another media source? This means they are not even getting their information directly from the source (the published article in the peer-reviewed journal). Another commonly deceptive strategy is to say something that sounds authoritative but does not qualify as a citation, such as "researchers from the University of Kalamazoo found that…" and not even bother linking that text to the research.

Does the information appear in any peer-reviewed, credible, journal? While the inclusion of such information in a peer-reviewed journal does not guarantee its veracity (as we have seen), the exclusion of such information is a strong indicator that the information is not scientific and highly unreliable. Visit Google Scholar and enter in some of the keywords to see if you can locate the research to which the article refers. If you can find it, then ask the following questions:

- **Is the source's headline consistent with the study's headline in the peer-reviewed journal?** If your source's headline reads, "Researcher Proves Bigfoot is Real" and the published paper's headline reads, "Researcher finds large unknown fecal mass," then that is a good indicator of a highly unreliable source.

- **Is the peer-reviewed article's abstract consistent with the findings of the story?** An abstract is a concise, one-paragraph summary of the article and its findings, and it is almost always freely available for all articles (without registering). If the bottom line of your source's story is that "science finally proved Bigfoot is real" and the abstract concludes that "it is suspected that the fecal mass comes from buffalo that have adapted to a new diet," then that is a good indicator of a highly unreliable source.

Due to the confirmation bias, you may be tempted not to question the conclusions of your favorite media source when the conclusions happen to conveniently align with your world view. Recognize the power of this bias and overcome it by valuing scientific integrity over consistency in your world view.

Why Trust Scientists?

Scientists are people, and like all people, they are susceptible to biases, have self-interests, and are corruptible. In fact, corporations, lobbyists, political parties and action committees, defendants and plaintiffs will hire their own team of science "experts" who agree with their claims (or will, for the right price). Given the number of studies that have been done on any given issue (especially the major ones), finding data to support virtually any conclusion is not that challenging. This is a good reason to be skeptical of the claims of scientists—especially those who have clear conflicts of interest or report findings that conflict with an overwhelming consensus. The good news is that science as a method, process, and academic endeavor makes this kind of behavior exceptionally rare, making scientists as a group extremely trustworthy—at least when it comes to their published research. And here are just a few reasons why.

Full disclosure of biases and potential conflicts of interest are taken very seriously in science. Research and journal publication require full disclosure of potential conflicts of interests. Harsh disciplinary action can be taken against academics who fail to disclose any potential conflicts of interests. While this does not guarantee that no particular scientist will break the rules, it does function as an effective deterrent.

Biases might affect the hypotheses and the area of research, but are far less likely to affect the results. A strong example of this is the largest study ever conducted on the effects of intercessory prayer, conducted by the Templeton Foundation. The current President of the Templeton Foundation, John M. Templeton, Jr., is an evangelical Christian. The funded study basically set out to provide evidence that praying for others to get better was demonstrably effective—an area of research and hypothesis

clearly influenced by the group's biases and personal beliefs. However, the results of the study not only failed to support their hypothesis, but also showed that when people know they are being prayed for, they were worse off physically[3]. Although the scientific process transcends personal biases and beliefs, it is not impossible for personal biases and beliefs to cause scientists to deliberately and dishonestly manipulate the results. If science comprised just one scientist, this would be a major problem—but it doesn't, so it isn't.

Science is self-correcting. The methodology sections of papers require very clear details of how the research was conducted so that other scientists can replicate the research. If any errors, biases, or "shenanigans" that affected the results made their way into the research (but not the disclosed methodology), replication would produce different results. Repeated attempts at confirming the results of the study by different researchers would provide further evidence against the claims and conclusions of the initial study. Scientific consensus is based on an understanding of the collection of research on a given topic—not just a few cherry-picked studies. Researchers take part in the peer-review process who know how to read a scientific paper and spot errors in the methodology and even the occasional fraudulent study. A humorous (but also disturbing) example is a scientist who found 130 "gibberish" papers that were computer generated and successfully published in scientific

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3 Benson, H., Dusek, J. A., Sherwood, J. B., Lam, P., Bethea, C. F., Carpenter, W., … Hibberd, P. L. (2006). Study of the Therapeutic Effects of Intercessory Prayer (STEP) in cardiac bypass patients: A multicenter randomized trial of uncertainty and certainty of receiving intercessory prayer. *American Heart Journal*, 151(4), 934–942. doi:10.1016/j.ahj.2005.05.028

journals[4]. These papers were all subsequently pulled from the journals.

If you don't trust scientists with scientific information, who do you trust with it?

In many cases, the cause of distrust in science is a result of the opinions of other people. These other people are often, friends, political commentators, the media, religious leaders, and former Playboy bunnies. Scientists are rarely as familiar as your friends, passionate as political commentators, visible as the media, certain as religious leaders, and sexy as former Playboy bunnies, but these traits of the messenger are independent of the truth of the message. The question you need to ask, is why would any of these groups with all the same biases and corruptible tendencies but none of the knowledge, checks and balances, and strict guidelines of the scientific method be more trustworthy on scientific issues? The answer is, they're not. If you need advice on what to serve for a dinner party, ask your friend. If you want to know what those floaty things are in your eye, ask a scientist.

No matter how many rebels scream that the earth is flat, and no matter how many papers they manage to publish with "evidence" that might support that conclusion (none, for the record), the fact of the oblique spheroid earth will not be suppressed by any person or group's political or religious interests, no matter how big their pocketbook. This is why we should trust science as the best way we have to separate fact from fiction, trust any overwhelming scientific consensus, but still reserve a healthy dose of skepticism for the claims of any one paper, article, or scientist.

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4 De Gloucester, P. C. (2013). Referees Often Miss Obvious Errors in Computer and Electronic Publications. Accountability in Research, 20(3), 143–166. doi: 10.1080/08989621.2013.788379

End of the free sample

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