

Chapter 23

Understanding Climate Change Denial

Abstract At its heart, climate denial is the rejection of the scientific consensus that humans are disrupting the climate. Denial of a consensus can be identified by five telltale characteristics: fake experts, cherry picking, logical fallacies, impossible expectations and conspiracy theories. These techniques are observed in the tactics and strategies of the climate denial movement, disseminated by ideological think-tanks, some conservative governments and vested interests through a range of media streams. The key to responding to climate misinformation is to provide alternative narratives that are more compelling than the myths they replace.

Keywords Climate denial • Denier • Consensus • Peer-review • Uncertainty • Fake experts • Cherry picking • Logical fallacies • Impossible expectations • Conspiracy theories “Climategate” • Intergovernmental Panel on Climate Change, IPCC • Conservative ideology • Media balance-as-bias • Conservative think tanks • Government • Corporate vested interests • Internet • Misinformation • Refutation • Backfire effect

Things to Know

The following is a list of things to know from this chapter. It is intended, as it is in each chapter, to serve as a guide to points of emphasis for the student to keep in mind while reading the chapter. Before finishing with this and every chapter, the “Things to Know” should be understood and can be used for review purposes. The list may not include all of the terms and concepts required by the instructor for this topic.

Things to Know	
Consensus of evidence	Consensus of scientific organizations
Denialism versus skepticism	Consensus of scientists
Conservative ideology	Media balance-as-bias
Conservative think tanks	Government and vested interests
Internet role in misinformation	Backfire effects
Alternative narratives	Fake experts
Cherry picking	Logical fallacies
Impossible expectations	

23.1 Introduction

There is actually no such thing as a climate change denier. No one denies that climate changes (in fact, most climate change deniers will argue that past climate change is evidence that current global warming is also natural). What ‘climate deniers’ reject is the scientific consensus that humans are disrupting the climate. A more appropriate term would be ‘consensus denier’ (but for convention’s sake, we will adopt ‘climate denier’).

The term ‘denier’ is also controversial, with connotations that climate denial is akin to Holocaust denial. It’s important to stress that the term denier should not be used as a pejorative term equating climate denial to Holocaust denial. Climate change and the Holocaust are not equivalent. However, it is appropriate and instructive to examine the rhetorical tactics and psychological processes at play involved in the denial of climate science. The climate denial movement has employed numerous strategies and rhetorical tactics to cast doubt or distract from the consensus. These efforts have been successful, as illustrated by the increase in public confusion about climate change at the same time that the scientific consensus has strengthened. This chapter will examine the various strategies, rhetorical arguments and driving forces of climate denial.

23.2 Basis for the Scientific Consensus on Climate Change

To understand climate denial, we need to understand first what is being denied. Climate denial is the rejection of the scientific consensus that human activity is disrupting our climate. Scientific consensus is typically thought of as the agreement among the scientific community and most popularly expressed as the near-unanimous agreement between actively researching climate scientists. Numerous surveys of the climate science community have been conducted since the early 1990s to determine the level of consensus that humans were causing global warming. Over time, the percentage of climate scientists who agreed that humans are causing global warming has increased steadily, demonstrating a strengthening consensus (Fig. 23.1).

Two of the most recent studies adopting different methodologies have arrived at strikingly consistent results. One study led by Peter Doran et al. in 2009 surveyed

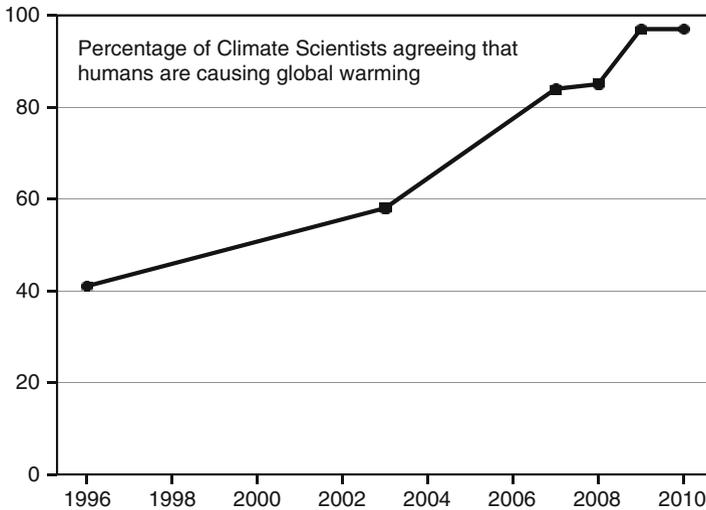


Fig. 23.1 Percentage of climate scientists agreeing that humans are causing global warming (Adapted from Bray (2010) with addition of Anderegg et al. (2010))

over 3,000 Earth scientists and found that for areas of expertise more relevant to climate change, the agreement about human-caused global warming was higher. For the most qualified experts, climate scientists actively publishing peer-reviewed research, there was 97% agreement.

This result is echoed in a separate study that compiled a database of scientists from public declarations on climate change, both supporting and rejecting the consensus. The publishing record of each scientist was then scanned to determine their level of expertise on climate change. Among scientists who had published peer-reviewed papers, there was 97% agreement. The authors tested the robustness of this result by employing different thresholds for the number of climate papers published. For varying thresholds, agreement varied between 97 and 98%, strikingly consistent with the Doran survey (Anderegg et al. 2010).

The consensus on climate change also manifests in the published statements of prestigious scientific organizations throughout the world. Academies of Science from many countries endorse the consensus view, as do many prestigious scientific organizations such as NASA, the National Oceanic and Atmospheric Administration (NOAA) and the Royal Society of the UK. The Academies of Science from the following countries have all endorsed the consensus:

Australia	Ireland	Sénégal
Brazil	Italy	South Africa
Belgium	Japan	Sudan
Cameroon	Kenya	Sweden
Canada	Madagascar	Tanzania

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China	Malayasia	Turkey
France	Mexico	Uganda
Germany	New Zealand	United Kingdom
Ghana	Nigeria	USA
India	Poland	Zambia
Indonesia	Russia	Zimbabwe

However, a scientific consensus is not decided by majority vote. This is articulated concisely by John Reisman in the ironically titled *'Exposing the Climate hoax: It's all about the economy'* (Reisman 2011):

Science is not a democracy. It is a dictatorship. It is evidence that does the dictating.

While individual scientists may have their personal views on climate change, they must back up their opinions with empirical evidence and robust analysis that withstands the scrutiny of the peer-review process and then must survive the test of time. Thus the peer-reviewed literature is a robust indicator of the state of the scientific consensus. Naomi Oreskes conducted the seminal study of peer-reviewed climate research in 2004, surveying the abstracts of papers from 1993 to 2003 matching the search “global climate change” (Oreskes 2004). The startling result from this survey is that out of the 928 papers surveyed, none were found that rejected the consensus position that humans caused most of global warming over the last 50 years.

This is not to say no rejection papers exist. A broader survey of peer-reviewed papers was conducted (coordinated by John Cook) of 12,465 papers spanning 1991–2011, matching the searches “global climate change” and “global warming”. This broader survey compared the number of papers that endorse the consensus versus the number of papers that reject the consensus to find a widening gap between the two, with the number of papers endorsing the consensus increasing at an accelerating rate (Fig. 23.2).

Thus the scientific consensus on climate change manifests in a multitude of ways, just as there are many lines of evidence for human-caused global warming. It is important to appreciate this multi-faceted nature of consensus in order to understand how climate deniers reject the consensus.

Why is consensus important? When people understand that there is consensus among climate scientists, they are more likely to support climate policy. Conversely, if the public thinks that scientists disagree on global warming, they're less certain that global warming is happening and show less support for climate action (Ding et al. 2011). Consequently, a key strategy of the climate denial movement has been to cast doubt on the scientific consensus. A striking example of this strategy is articulated in a memo by political strategist Frank Luntz who provided the following advice to Republicans in 2002:

Voters believe that there is no consensus about global warming in the scientific community. Should the public come to believe that the scientific issues are settled, their views about global warming will change accordingly. Therefore, you need to continue to make the lack of scientific certainty a primary issue in the debate.

This strategy has been quite successful in persuading the public that there is much disagreement among the scientific community. Public opinion polls conducted

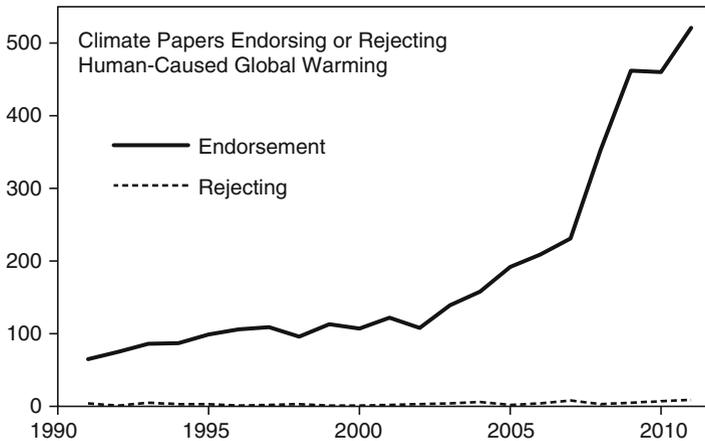


Fig. 23.2 Peer-reviewed papers from the Web of Science matching the searches ‘global warming’ or ‘global climate change’ from 1991 to 2011. *Solid line* represents the number of papers per year endorsing human-caused global warming while dashed line represents rejection papers

from 1997 to 2007 have shown that over this period, around 60% of the public thought there was a lot of disagreement between scientists about whether global warming was happening (Nisbet and Myers 2007). While the scientific consensus has been steadily strengthening, the public continues to erroneously think there is significant disagreement.

23.3 Characteristics of Denial

How does one distinguish between climate denial and genuine scientific skepticism? Mark and Chris Hoofnagle identified five tell-tale characteristics of science denial (Hoofnagle and Hoofnagle 2007). They use the following definition for science denial:

Denialism is the employment of rhetorical tactics to give the appearance of argument or legitimate debate, when in actuality there is none. These false arguments are used when one has few or no facts to support one’s viewpoint against a scientific consensus or against overwhelming evidence to the contrary.

Simply put, denialism is the attempt to deny a scientific consensus based on rhetorical argument. A subsequent analysis by Diethelm and McKee (2009) examined a number of different movements that deny a scientific consensus, including climate denial, the denial of the link between smoking and cancer and evolution denial. They identified that the five characteristics of denial appear in each movement. They are:

1. Fake Experts
2. Cherry Picking
3. Logical Fallacies

4. Impossible Expectations
5. Conspiracy theories

These characteristics shall now be examined in more detail with a number of applications relating to climate misinformation.

23.3.1 *Fake Experts*

Most people aren't in a position to directly investigate complex scientific issues and rely on experts to inform their views. When people think there is a consensus among climate scientists about global warming, this strongly informs their views on global warming itself. One tactic to prevent the public from correctly perceiving the consensus is to invoke dissenting non-experts who appear to be highly qualified while not having published any actual climate research. This paints the picture of a scientific community still in strong disagreement, with both sides possessing roughly equal numbers. This tactic has a long history:

- An early example of this strategy comes from 1992, when S. Fred Singer released a "Statement by Atmospheric Scientists on Greenhouse Warming", featuring 47 signatories comprising mostly of weather forecasters and physicists.
- In 1995, Singer also published the "Leipzig Declaration" that claimed to refute that there was a scientific consensus about the importance of greenhouse warming. It featured 80 scientists and 25 TV weather forecasters. An investigation by Øjvind Hesselage found that 12 of the signatories denied signing the declaration while many worked in fields unrelated to climate (Jensen 1998).
- In 2007, Dennis Avery (a journalist and senior fellow at the Hudson Institute) published a paper "500 Scientists Whose Research Contradicts Man-Made Global Warming Scares" on the Heartland Institute website (Avery 2007). A number of scientists on the list expressed outrage and dismay at being included in such a list (Hoggan 2009). Avery is yet to apologize to objecting scientists for their inclusion.

In 2008, political lobbyist Marc Morano published a U.S. Senate Minority Report (working for Senator James Inhofe) titled "More Than 650 International Scientists Dissent over Man-Made Global Warming Claims" (Morano 2008). An investigation by the Office of Public Policy found that the "vast majority are neither climate scientists, nor have they published in fields that bear directly on climate science" (Kurtz et al. 2009).

The largest example of the fake expert (and best demonstration of the strategy) is The Petition Project by the Oregon Institute of Science and Medicine, featuring over 31,000 scientists claiming that there is no evidence that humans are disrupting climate (OISM 1999). Around 99.9% of the scientists are not climate scientists. The Petition Project will be examined in more detail in the next chapter.

A variation of the Fake Expert strategy is to take the handful of remaining dissenting climate scientists and magnify their voices to give the impression of more significant disagreement than there actually is.

A 1998 strategy memo by oil company representatives and conservative think tank members illustrates this strategy (Hoggan 2009). They suggested a “National Media Relations Program” to “identify, recruit and train” a team of five new ‘independent’ scientists to participate in media outreach on climate science. A key element of the strategy was the targeting of mainstream media with a steady stream of material to “undercut the ‘conventional wisdom’ on climate science”. The goal was to ensure that “media coverage reflects a balance on climate science”. The issue of media balance will be shortly examined in more detail.

The 2002 Luntz memo also explored the idea of amplifying the role of dissenting scientists. He recommended Republicans should “...be even more active in recruiting experts who are sympathetic to your view and much more active in making them part of your message... If you wish to challenge the prevailing wisdom about global warming, it is more effective to have professionals making the case than politicians.”

23.3.2 *Cherry Picking*

The consensus on climate change is based on the full body of evidence that has led to the conclusion that human activities are having a significant effect on Earth’s climate. Consequently, a common technique in climate change denial is to focus on select pieces of data, often out of context, whilst excluding any data that conflicts with the desired conclusion.

Of course, it is usually not practical to present the full body of evidence on most occasions so how does one distinguish between misleading cherry picking and appropriate selection of data? Cherry picking occurs when the conclusion derived from a small selection of data differs from the conclusion arising from the full body of evidence. Common examples of this technique involve:

- **Short periods of time.** Focusing on short periods in a time series to argue a long-term trend. This is readily achievable with highly variable data such as the surface temperature record, by selecting a short period of time that starts at one extreme and ends at the opposite extreme, amidst a long-term trend. This may take the form of calculating trends over a short period where a statistically significant trend is not possible. The most egregious application of this form of cherry pick is to compare single data points in a noisy dataset.
- **Isolated examples.** Selecting isolated examples while ignoring others that lead to the opposite result. For example, although glaciers are retreating globally at an accelerating rate, there remain a small number of isolated glaciers that are growing. Using a few growing glaciers as an argument against global warming is ignoring the full body of evidence.
- **Specific locations.** Focusing on a specific location or region to the exclusion of broader regional data. A common example is selecting a temperature

reconstruction of a single location to argue that the Medieval Warm Period was warmer than current temperatures. However, when one includes data from across the world to build a global temperature reconstruction, one finds cooler temperatures at one location balance warmer temperatures from elsewhere. The result is that global average temperature over the past few decades are warmer than any period over the last 1,000 years, including the Medieval Warm Period.

- **Isolated papers.** Selecting isolated research papers that provide a “denial” viewpoint while ignoring climate papers that come to the opposite conclusion or that refute the denial paper. A commonly mentioned paper by Richard Lindzen purports to find low climate sensitivity using satellite data (Lindzen and Choi 2009). However, rarely mentioned are the numerous papers that find high climate sensitivity, even using the same satellite data as Lindzen, or the papers that point out the flaws in Lindzen’s methodology. Conversely, critics of Michael Mann’s 1998 hockey stick paper typically ignore the fact that over a decade’s worth of research has since independently confirmed Mann’s conclusions.
- **Quote mining.** Taking quotes out-of-context from research or correspondence to paint a misleading picture in contrast to what the full context provides. Climategate emails (see Conspiracy Theories) were frequently quote-mined to paint the impression of scientists engaging in nefarious behavior when the full context (and understanding of the science being discussed) revealed scientists merely discussing their trade in technical terms.

23.3.3 *Logical Fallacies*

Logical fallacies are logically false arguments leading to an invalid conclusion. Logical fallacies are based on erroneous logic, misdirection or false characterizations. It is useful to be aware of common logical fallacies used by climate deniers in order to effectively identify poorly constructed arguments:

- ***Ad hominem attacks.*** These dismiss a person’s arguments by attacking the person. Climate scientists routinely face personal attacks, particularly scientists who publish prominent research highlighting the human influence on climate change. Michael Mann labels this the Serengeti Strategy, referring to predators at the Serengeti National Park that target animals at the edge of the herd (Mann 2012). In a similar fashion, individual scientists are subjected to personal attacks with the intent to discredit climate science in general.
- **Straw man arguments.** This involves misrepresenting your opponent so that their position is easier to argue against. For example, aspects of climate science are mischaracterized presenting false positions that are easily refuted. The claim that ‘climate scientists say carbon dioxide is the only driver of climate’ is an oversimplification of the science; whereas in reality climate scientists consider many different forcings that drive climate (it just happens that carbon dioxide is currently the dominant climate forcing). Another misrepresentation is the myth

‘there was a consensus about global cooling in the 1970s’ which was shown to be false by a survey of peer-reviewed papers in the 1970s which found the vast majority of published research predicted warming.

- **Red Herring.** These pose a distraction with a statement that is easy to support but has nothing to do with the final argued conclusion. For example, the argument that carbon dioxide isn’t a problem because it’s a colorless, odorless gas. However, carbon dioxide is a problem not because it’s smelly or visually unattractive but because it traps heat. In fact, it’s because CO₂ is colorless (e.g., invisible) that it is a greenhouse gas. It’s invisible to sunlight but traps infrared radiation as it is on its way to escaping out to space. Similarly, another climate myth is that carbon dioxide is plant food and hence good for plants. In isolation, carbon dioxide is good for plant growth. But plants also need water and a certain temperature range to thrive. Global warming disrupts the climate’s water cycle, causing more intense droughts and floods and also increases heat waves that cause heat stress among plants.
- **False Analogy.** This is an argument made by analogy where the analogy is not a valid comparison. A good example is the Galileo fallacy, where climate deniers liken themselves to Galileo who defied the consensus that the Sun revolves around the Earth. The irony is that Galileo was suppressed not by scientists but by religious and political forces. Galileo’s conclusions were based on observation and logic, which later came to be known as the scientific method. In contrast, climate denial is driven by ideology while climate scientists employ the scientific method pioneered by Galileo. The analogy is not only inappropriate, it is an inversion of reality.
- **Association Fallacy.** This argues that because two things share a property, they are the same. For example, the Heartland Institute, a conservative think-tank that generates climate misinformation, displayed a billboard featuring a photo of terrorist Ted Kaczynski (the Unabomber) with the text “I still believe in global warming. Do you?” This argued that climate science is invalid because a terrorist believed in global warming. This is the logical equivalent to arguing that vegetarianism is invalid because Hitler was a vegetarian. It also implies that climate scientists are equivalent to terrorists.
- **Non Sequitor.** This is Latin for “it does not follow” and applies to arguments where the stated conclusion is not supported by its premise. The most common example of this (in fact, the most popular climate myth) is “climate has changed naturally in the past therefore current warming must be natural”. This is equivalent to arguing that people have died from natural causes in the past so no one ever gets murdered now. Ironically, the main lesson from past climate change is that our climate is highly sensitive due to reinforcing feedbacks. Past climate change is not a cause for comfort but a cause for concern.
- **False Dilemma.** This is the case where only two alternatives are considered, while there may be another alternative or both options may be simultaneously viable. For example, the argument “The ice core record shows CO₂ lags temperature thus proving temperature drives CO₂, not the other way around”. The fallacy here is the assumption that one must choose between either CO₂ driving temperature

or temperature driving CO₂. In reality, both occur. The result is a reinforcing feedback, amplifying the modest warming from planetary orbital changes to bring our planet out of an ice age.

Note – some logical fallacies such as argument from authority (fake experts) or cherry picking are so common, they have been elevated to one of the five main characteristics of denial.

23.3.4 Impossible Expectations

Impossible expectations involve demanding unrealistic standards of proof before acting on the science. Uncertainty is an important element to the scientific method, which is often probabilistic rather than deterministic. However, opponents to the scientific consensus misrepresent the nature of science by perpetuating the misconception that science is about providing absolute proof. This technique of using uncertainty as an attack point is labeled by sociologist William Freudenburg as “Scientific Certainty Argumentation Methods” (with the apt acronym SCAM). The SCAM strategy is remarkably effective even in cases where scientific results are robust with a clear consensus (Freudenburg et al. 2008).

A leading pioneer of the SCAM strategy was the tobacco industry who attacked the scientific consensus that cigarette smoking caused cancer. A key element to their strategy was summed up by one tobacco executive: “Doubt is our product”. Their goal was to highlight the uncertainty and obscure the fact that a consensus existed (as documented by Oreskes and Conway 2010).

An articulation of impossible expectations regarding climate science is found in the Luntz memo to Republicans which suggests that:

Should the public come to believe that the scientific issues are settled, their views about global warming will change accordingly. Therefore, you need to continue to make the lack of scientific certainty a primary issue in the debate...

This strategy misrepresents the nature of science, arguing that we should wait for 100% proof before acting. This is not how science operates and is especially not how we operate in real life when managing risk. To wait for 100% certainty is to never act. Greater uncertainty means a higher chance that the climate response will be larger than expected. In the case of climate change, uncertainty is not our friend.

23.3.5 Conspiracy Theories

A conspiracy is a secret plan among a number of people, generally to implement a nefarious scheme of some sort. The fact that the world’s experts, scientific organizations and peer-reviewed journals find agreement requires explanation and a convenient alternative is the accusation of corruption or a conspiracy among scientists.

One identifying feature of a conspiracy theory is exaggerated claims about the power of the conspirators. The more widespread and powerful the conspiracy, the more implausible that such a conspiracy could remain undetected. Thus the notion of a conspiracy among scientific organizations across the globe and thousands of scientists in dozens of countries pushes the realms of credibility.

Claims of climate conspiracy theories have been around for many years. In 1996, the Intergovernmental Panel on Climate Change released their Second Assessment Report (SAR), concluding that ‘the balance of evidence suggests a discernible human influence on climate’. Within one month, retired scientist Frederick Seitz published an op-ed in the *Wall Street Journal*, accusing the IPCC of a “major deception on global warming” (Seitz 1996). Seitz made no scientific arguments but attacked the IPCC’s procedures, successfully shifting much of the public discussion from the science to issues of personalities and motivations.

An often-attacked figure is Michael Mann who was lead author of the hockey stick graph in 1998. Since then, Mann has endured relentless attacks on his research and credibility, as documented in his book “The Hockey Stick and the Climate Wars”. One of Mann’s major public critics has been Senator James Inhofe, who published his conspiracy theories in the 2012 book “The Greatest Hoax” (Inhofe 2012).

Climate conspiracy theories achieved mainstream consciousness in late 2009 when a server at the Climate Research Unit at the University of East Anglia was hacked with years of private email correspondence posted on the web. This led to an international scandal that the media dubbed “Climategate”. Climate deniers quoted-mined selected emails as evidence that scientists were engaged in a conspiracy to falsify climate data to exaggerate the warming trend.

Since ‘Climategate’, nine (9) independent investigations across the globe have concluded there is no evidence of data falsification or wrongdoing by climate scientists. To the conspiracy theorists, however, investigations that find no wrongdoing are only further evidence that there is a conspiracy. This is the world that the conspiracy theorist inhabits – where every piece of evidence that opposes their world-view is further confirmation of the conspiracy.

A survey of American adults was conducted to determine the impact of Climategate (Leiserowitz et al. 2010). Around 13% of Americans reported becoming more certain that global warming was not happening and to have less trust in scientists. However, a key finding of the survey was that conservatives already predisposed to disbelieve climate science were the most likely to report lost trust in climate scientists. Meanwhile liberals did not lose trust in scientists. Political ideology was a strong predictor in whether Americans lost trust in scientists or not. This underscores the important role of political ideology in shaping public views on climate change.

The unlikelihood of a climate conspiracy is apparent when one considers the global nature of the climate consensus. Academies of Science from countries all over the world endorse the consensus. A survey of 12,465 papers found scientists from all over the world endorsing the consensus. This would require a conspiracy of such scope, human history would never before have seen its equal.

There are several variations of conspiracy theory to be aware of:

- **Religious orthodoxy.** A more subtle form of climate conspiracy theory is not the accusation of a cabal of deception but that of a mainstream orthodoxy suppressing a minority view. The Galileo fallacy feeds into this conspiracy theory. This narrative is often couched in religious terms, referring to climate scientists as dogmatic priests while endorsement of the consensus is framed as faith and belief. This is of course an inversion of reality where climate scientists are driven by evidence and the scientific method.
- **Funding Gravy Train.** An alternative version of the conspiracy theory is the myth that scientists who endorse the consensus are motivated by funding. Again, this inverts reality. Research grants and papers aren't accepted for merely repeating accepted knowledge. On the contrary, scientific research is only accepted (and funded) if it expands our knowledge and understanding.
- **Inversionism.** Another variation of conspiracy theory is explored by Diethelm and McKee in their paper on science denialism, "in which some of one's own characteristics and motivations are attributed to others" (Diethelm and McKee 2009). Psychologically, this is known as projection. This is seen in accusations of climate deniers that climate scientists are politically motivated (whereas much evidence has been produced that climate denial is ideologically driven). Climate deniers accuse scientists of being motivated by money when much of the funding and even leading voices of the climate denial movement are funded by the fossil fuel industry.

23.3.6 Denial Characteristics at a Psychological Level

While the five characteristics of denial are manifested as misleading, rhetorical arguments need not be always deliberately deceptive. Science denial can operate at a psychological level and bias how one processes evidence. The behavior resulting from unconscious, psychological bias can be indistinguishable from deliberately misleading rhetorical techniques. Thus it is possible for deniers to display the five characteristics of denial while genuinely believing these false rhetorical arguments.

- **Fake Experts.** The reliance on fake experts can derive from the way people form their beliefs about expert opinion. Greater expertise is attributed to people who agree with one's existing beliefs and values (Kahan et al. 2011). When confronted with the term 'scientific consensus', people perform a mental survey of the experts they have observed, more readily recalling experts who are consistent with their own beliefs. This leads to a distorted view of the state of consensus, with the group of experts they agree with taking on a magnified role.
- **Cherry picking.** This can derive from the psychological phenomenon of confirmation bias. This is the process where people attribute greater weight to information that confirms prior beliefs while downplaying any disconfirming

evidence. We remember the hits but tend to forget the misses. This is observed in experiments where people with different prior beliefs are shown the same information and yet their beliefs update in different directions. One experiment presented information about a nuclear breakdown to both supporters and opponents of nuclear power. The nuclear supporters concentrated on the fact that the safeguards worked while nuclear opponents focused on the fact that the breakdown happened at all. Both parties strengthened their original belief.

- **Logical fallacies.** These can also arise from cognitive bias (Correia 2011). For example, the straw man fallacy, where one misrepresents an opponent's position, can result from focusing on an opponent's weaker arguments while ignoring their stronger arguments (Talisce and Aikin 2006). In many cases, the arguer is unaware of the logical fallacy and the unconscious biases that cause them.
- **Impossible Expectations.** The demand for impossible expectations can arise from disconfirmation bias. This is the flip side of confirmation bias, which is the uncritical acceptance of confirming evidence. In the case of disconfirmation bias, threatening evidence is vigorously opposed. The result is that presenting evidence to correct a person's false beliefs can often have a backfire effect. A non-climate example is an experiment where participants who believed Saddam Hussein was linked to the 9/11 terrorist attacks were shown conclusive evidence that there was no link, including a quote from George W. Bush (Prasad et al. 2009). One response to the evidence was counter arguing or directly rebutting the information, which resulted in participants holding to their false beliefs stronger than ever.
- **Conspiracy Theories.** People who deny a scientific consensus are more likely to distrust science. However, science denial has further implications than just conspiracy theories about scientists. Climate deniers are more likely to hold to a number of conspiracy theories. This includes not just conspiracy theories about climate science but also related to non-climate issues such as the 9/11 terrorist attacks and the 'faked' moon landing (Lewandowsky et al. [in press](#)).

23.4 Drivers of Climate Denial

In 1988, global warming was a bi-partisan issue. Republican George H. W. Bush pledged to "fight the greenhouse effect with the White House effect" (Boykoff and Boykoff 2004). However, within a few years, the mainstream media was portraying climate change as an unresolved issue, giving climate deniers equal voice with the consensus views of the climate science community. While the scientific consensus strengthened, public opinion on climate change stagnated with a growing divergence between scientists and the general public. There is also an increasing gap between liberals and conservatives, with liberals becoming more accepting of the science while more conservatives are rejecting the science. We shall now explore the driving forces behind the climate denial movement and the growing polarization.

23.4.1 Conservative Ideology

Belief that humans are not causing global warming is closely associated with free-market ideology (Heath and Gifford 2006). This ideology opposes the government regulation of industry, insisting that the market should be free of government intervention. In the case of climate change, the industries most affected are related to the burning of fossil fuels, emitting greenhouse gases that cause global warming. Rather than seek solutions to the problem of global warming, many choose not to believe there is a problem in the first place, denying the scientific evidence.

Over the period 1998 to 2008, overall public opinion about climate change has shifted very little. This is not to say there hasn't been any change. Opinion has been shifting but for two different groups, they're shifting in opposite directions. In the U.S., the percentage of Democrats who agree that global warming is happening has increased from 47 to 76%. At the same time, the percentage of Republicans agreeing has dropped from 46 to 41% (Hamilton 2009).

The polarization between Democrat and Republican is not just over time but also across education levels. As Republicans and Democrats become more educated, their concern about climate change moves in opposite directions. More educated Republicans are less concerned about climate change while more educated Democrats have a greater concern. This startling result undermines the intuitive view that more education is the answer to reducing climate denial. For a significant percentage of the general public, denial is not due to a deficit of information but is rooted in ideology.

In a series of Gallup surveys from 2001 to 2010, conservative white males were significantly more likely than other adults to report denialist views (McCright and Dunlap 2011). For instance, 59% of conservative white males deny there's a scientific consensus compared to 35% of all other adults. Similarly, 58% of conservative white males deny that recent temperature increases are primarily caused by human activities, nearly double the percentage of all other adults.

The other striking statistic from these surveys is that a greater percentage of conservative white males (30.4%) report that they understand global warming very well compared to all other adults (18.0%). In fact, among conservative white males, the higher they rate their own understanding of climate, the more likely they are to deny the science. Thus there is strong evidence for a conservative white male effect that has them both confident that they understand climate science and more likely to deny the scientific consensus on climate change.

23.4.2 Conservative Think Tanks

Significant responsibility for the growth of climate denial is attributable to conservative think tanks. These are non-profit, advocacy organizations that promote core conservative ideals such as 'free enterprise' and 'limited government'. Funded by wealthy conservative foundations and corporations (often from the fossil fuel

industry), they act as a means of influencing public opinion and policy makers. They began to take form in the 1970s but increased in activity in the early 1990s (Jacques et al. 2008).

Their primary tactic is to cast doubt on environmental science, alleging that the science is corrupt and either fabricated or exaggerated. Underlying the attack on science is the campaign against government regulation. A survey of online news media from 1995 to 2000 searching for the term ‘junk science’ (a common phrase used by conservative think tanks) found the overwhelming majority of articles also contained an anti-regulatory message.

Conservative think tanks promote their anti-regulatory, anti-science message through a constant stream of published content ranging from books to newspaper editorials, coupled with TV and radio appearances. From 1972 to 2005, 92% of English-language books that promoted environmental skepticism had a clear link to conservative think tanks.

Another successful outcome of the misinformation campaign has been to establish their in-house “experts” as having equal legitimacy to qualified climate scientists in the eyes of the media and public. This is especially significant considering most of their ‘experts’ are economists, policy analysts and legal scholars rather than scientists.

While advancing non-experts, they have also campaigned aggressively to bring down the actual experts, intimidating or threatening climate scientists. Throughout the 1990s, members of conservative think tanks regularly labeled mainstream climate scientists as ‘junk scientists.’ The goal was to sully the image of mainstream climate science by association.

Having ready access to the media, conservative think tanks have effectively exploited the journalistic norm of balance, achieving a disproportionate amount of media attention for skeptical non-experts. They have also achieved the same amount of representation as climate scientists at Congressional hearings on climate change.

Thus conservative think tanks have been a significant influence in the campaign to confuse the public about the science and delay climate policy.

23.4.3 Mainstream Media’s Balance-as-Bias

The general public obtains most of its scientific information from mainstream media such as newspapers, radio and television. Consequently, the handling of climate science by the media is crucial to the shaping of public opinion. The journalistic norm of balance requires that the views of conflicting sides are both presented with roughly equal attention. The conservative movement has exploited this ‘balancing norm’ by promoting a handful of climate deniers to national prominence. This has allowed a small, vocal minority to have their views amplified.

Thus, despite the fact that there is agreement among the scientific community, the media have granted equal time to climate deniers alongside mainstream climate

scientists. From 1988 to 2002, just over half (52%) of news reports covering climate change granted equal attention to denialist and mainstream views, while 6% exclusively presented the denialist viewpoint. Only 41% of media portrayed climate change as predominantly anthropogenic. This skewed presentation has led to a perception of continued division among the scientific community that doesn't actually exist. The so-called balanced media coverage actually presents a distorted, inaccurate picture, characterized by the term 'balance-as-bias' (Boykoff and Boykoff 2004).

One experiment tested the impact of giving climate deniers equal weight with scientists by measuring the effect of showing (1) a news story with only a mainstream scientist (2) compared to a news story with a mainstream scientist followed by a skeptical scientist. Including the skeptic in the news report significantly reduced the number of people who believed that scientists agreed about climate change from 48 to 36% (Malka et al. 2009).

The fragmentation of mainstream media, with the development of cable TV and specialized radio shows, has further contributed to climate polarization. Specialized media sources allow people to select information sources consistent with their beliefs, reinforcing their pre-existing attitudes (Hamilton 2009).

23.4.4 *Government*

Significant opposition to climate science has originated from government. There is a significant body of literature documenting cases where the George W. Bush administration censored scientists and distorted scientific evidence while promoting fringe science that conflicted with the scientific consensus (McCright and Dunlap 2010). Some examples of government intervention in climate science include:

- **Editing Scientific Reports.** A prominent example of government distortion of scientific results is that of Philip Cooney, chief of staff for the White House Council on Environmental Quality under George W. Bush. Cooney made a number of edits to the Environmental Protection Agency's 2003 'State of the Environment' report, editing out references to a 2001 National Academy of Science (NAS) report and inserting references to a discredited paper by two climate deniers.
- **Magnifying uncertainty.** The George W. Bush White House mischaracterized the 2001 NAS report by placing the focus on any mention of uncertainty. In justifying why the U.S. would not be party to the Kyoto Protocol, President Bush characterized the report as saying "we do not know how much our climate could, or will change in the future. We do not know how fast change will occur, or even how some of our actions could impact it."
- **Intimidating scientists.** Various government representatives have attempted to intimidate or threaten sanctions on individual scientists. Congressman Joe Barton targeted Michael Mann and other authors of the 1998 hockey stick graph, demanding that they turn over their data and research materials for the previous 15 years. Both Joe Barton and Senator James Inhofe have convened Congressional

hearings where invited witnesses associated with conservative think tanks testified against the scientists.

- **Censoring scientists.** Scientists from government agencies have been silenced or censored by members of the George W. Bush administration. Dr. James Hansen, renowned climate scientist from NASA, had his public statements and media interviews filtered by NASA public affairs officials in order to prevent him from airing any views conflicting with the government's position on climate (Hansen 2009).

23.4.5 *Corporate Vested Interests*

While the driving force behind climate denial is ideology, the denial movement has received significant financial support from corporate vested interests. Specifically, this involves fossil fuel industries whose profits are threatened by regulation of carbon dioxide emission. Vested interests have funded the dissemination of climate misinformation, by funding a number of conservative think tanks responsible for producing climate denial material (Jacques et al. 2008).

In 1991, the Western Fuels Association combined with a number of other fossil fuel related associations and institutes to produce a series of campaigns casting doubt on climate science (Hoggan 2009). These included a video extolling the positive benefits of carbon dioxide, with hundreds of free copies distributed to public and university libraries.

In the decade after the Kyoto Protocol was introduced in 1997, Exxon-Mobil invested more than \$20 million in think tanks that promoted climate denial. This inspired the Royal Society of London to challenge Exxon-Mobil to stop funding organizations that disseminated climate denial.

An investigation by Greenpeace has revealed that from 1997 to 2008, the oil, chemical and polluting corporations of Koch Industries has contributed over \$48 million to front groups that cast doubt on climate science (Greenpeace 2011). Ironically, they also funded the Berkeley Earth Surface Temperature (BEST) study, an independent project that purported to check other surface temperature records by NASA and HadCRUT. The BEST results confirmed the other temperature records, finding a nearly identical global warming trend.

23.4.6 *Internet*

The Internet has facilitated the quick and easy dissemination of climate misinformation across the globe. Some of the negative effects of the Internet are as follows.

- **Cyber ghettos.** The Internet contributes to the polarization surrounding public opinion on climate change. It provides an environment where individuals can selectively source their information from websites that support their existing views. This leads to the development of 'cyber-ghettos' where 'people go to support

their own opinions and attack opposing ones' (Johnson et al. 2009). This creates pockets of denial that can become significant sources of misinformation. One of the highest trafficked climate blogs is wattsupwiththat.com, a website that publishes climate misinformation on a daily basis.

- **Expedient publishing of misinformation.** The Internet also enables expedient publishing of information without the rigorous quality controls in the peer-reviewed system. This places the peer-reviewed system, which can take months to process, at a severe disadvantage. What makes peer-review so strong is a weakness in terms of communication, where myths can propagate and take hold in the public consciousness before scientists can even draft a response to submit to a journal.
- **Instant dissemination.** Winston Churchill once said “*A lie gets halfway around the world before the truth has a chance to get its pants on.*” This was before the existence of the Internet where a catchy myth can go viral instantly via social media websites such as Twitter and Facebook. A tweet can propagate the globe in seconds in stark contrast to scientific research which often requires months of peer-review and subsequent months before publication. Social media features many tools enabling readers to quickly and easily share information with their network of contacts.

Of course the Internet is a two-edged sword. It also enables scientists and communicators to rebut myths and communicate the science. Thus it is imperative that scientists and communicators make use of the technologies available on the Internet and social media to communicate science to the general public as a counterbalance to the climate denial online machine.

23.5 Responding to Climate Denial

Once misinformation takes root, it is notoriously difficult to dislodge. In fact, debunking a myth runs the danger of actually making matters worse and reinforcing the myth! Scientists and communicators need to be aware of the numerous psychological processes that come into play when correcting misinformation. However, once all the various backfire effects have been successfully navigated, the psychology of misinformation reveals that debunking myths presents an opportunity to educate.

Educators are beginning to discuss misinformation in the classroom in order to educate students about the nature of scientific consensus and strengthen critical thinking (Bedford 2010).

The next section summarizes research into the most effective ways of refuting misinformation and avoiding backfire effects that reinforce the myth.

23.5.1 Familiarity Backfire Effect

When refuting a myth, one runs the risk of making people more familiar with the myth. However, the more familiar people are with information, the more likely they are to accept it as true. Thus debunking misinformation runs the risk of provoking a

‘Familiarity Backfire Effect’, with people remembering the myth more clearly after the debunking. This can be avoided by placing the emphasis on the facts you wish to communicate rather than the myth. Communicate your core fact in your headline and opening text before mentioning the myth.

Also, explicit warnings prior to mentioning misinformation ensure that people are ‘cognitively on guard’ when exposed to the myth. This reduces influence from the misinformation.

23.5.2 Overkill Backfire Effect

While it is tempting to include as much information as possible, overloading people with too many facts can backfire. Generating just a few arguments is more successful in reducing misperceptions than generating a large number of arguments. This is because processing many arguments takes more effort than some people are willing to give. A simple myth is cognitively more attractive than an over-complicated correction. To avoid the ‘Overkill Backfire Effect’, communicators need to make their content easy to process using simple language, short sentences and subheadings. End on a strong and simple message that is memorable and easy to pass on. Graphics have been shown to be more effective in refuting misinformation than text so if appropriate, use graphics to illustrate your points.

23.5.3 Worldview Backfire Effect

As seen earlier, climate denial is driven by ideology and worldview. One consequence is that presenting evidence that threatens a person’s worldview can often have the result of strengthening false beliefs. The cognitive process that contributes to this is confirmation bias, where people selectively seek out information that supports their pre-existing views. The flip side is disconfirmation bias, where people spend significant time and thought actively arguing against arguments that contradict their beliefs.

If evidence and arguments cannot correct a person’s false beliefs, what can one do? The Worldview Backfire Effect is greatest among those strongly fixed in their views. One stands a greater chance of correcting misinformation among those not as firmly fixed in their views. This suggests effort should be directed towards the undecided majority rather than the unswayable minority.

A promising approach to presenting evidence to those whose worldview is threatened is to frame information in a way that is less threatening, or even affirms a person’s worldview. Climate change science is more acceptable to conservatives when accompanied with calls for nuclear power compared to calls to regulate carbon pollution. It’s important to stress that these techniques aren’t about manipulating people but about giving the facts a fighting chance (Kahan et al. 2007).

23.5.4 *Alternative Explanation*

When people assimilate misinformation, they build a mental model with the myth providing part of the explanation. When you refute a myth, you create a gap in their mental model. If this gap isn't filled, people can still be influenced by the original misinformation, even if they know it to be untrue. In the absence of a better explanation, they opt for the wrong explanation.

The solution is to provide an alternative explanation. Consider what gaps are created by your refutation and fill them with an explanation that is plausible and explains all the observed features of the event/phenomenon.

This practice is summed up concisely by Chip and Dan Heath in their book *'Made to Stick'* which explores the concept of "sticky ideas" and how to communicate ideas that capture attention and stick in the memory. When they address the question of how to unstick a sticky idea (e.g., debunk a myth), they recommend:

Fight sticky ideas with an even stickier idea.

This is simple advice that is difficult to implement. Not only must a debunking provide an alternative narrative, the idea presented must be simple, compelling, engaging: stickier than the myth being debunked.

23.5.5 *Summary*

In summary, when responding to misinformation, one must emphasize the facts but not too many facts. One must create a gap by removing the myth then fill the gap with an alternative explanation. Here lies the educational opportunity. The process of creating gaps by raising questions then answering them is a standard communication tool used to provoke curiosity and interest, making the message 'stickier'. Scientists and other communicators can use refutations to communicate the facts of climate science in a 'create gap/fill gap' structure to provoke curiosity.

The next chapter will refute some of the most common climate myths, adopting the principles outlined in this section. Look for the emphasis on core facts and alternative explanations.

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