

**Framing Science:  
A New Paradigm in Public Engagement**

Matthew C. Nisbet, Ph.D.  
School of Communication  
American University  
Washington, DC

July 21, 2008

**Chapter scheduled for 2009 in  
*New Agendas in Science Communication*,  
LeeAnne Kahlor and Patricia Stout (Eds). Taylor & Francis Publishers.**

## **Framing Science: A New Paradigm in Public Engagement**

In January 2008, an interdisciplinary panel of leading scientists gathered for a press conference at the National Academies headquarters in Washington, DC. The experts had been charged with authoring a revised edition of *Science, Evolution, and Creationism* (2008). As the news conference participants described, the report had been carefully designed to provide an authoritative account of evolutionary science, communicated in a manner that would be more accessible to an audience of school board members, journalists, teachers, activist parents, and clergy. “Where evolution debates occur in the country, scientists and others call us for help and the major tool we provide is this booklet” said committee member Bruce Alberts, editor of *Science*, and past president of the National Academies.

At least a dozen different ways of explaining evolutionary science were available to the committee. But instead of relying on intuition and personal experience to decide among competing narratives, the experts took an “audience-based” approach to communication. As staffers would later recount, the Academies commissioned focus groups and a national survey to gauge the extent of citizens’ understanding of the processes, nature, and limits of science. They also specifically wanted to test various “frames,” interpretative storylines that explained why alternatives to evolution were inappropriate for science class (Labov & Pope, 2008).

The committee had expected that one of the most convincing storylines for the public would be the authority of past legal decisions and the Constitutional separation of Church and state. Yet the data revealed that audiences were not persuaded by this framing of the issue. Instead, somewhat surprisingly, the committee discovered that emphasizing evolutionary science as the modern building block for advances in medicine was the most effective frame for translating the importance of teaching evolution. The research also pointed to the effectiveness of reassuring the public that

there was no conflict between teaching evolution and the beliefs of many religious traditions.

Taking careful note of this feedback, the committee decided to structure and then publicize the final version of the report around these two central frames (Labov & Pope, 2008).

The National Academies' innovative "audience-based" approach is part of an emerging paradigm shift in how the scientific community in the United States views public engagement. Left behind is the assumption that simply "informing the public" of the facts of science will meaningfully alter the perceptions of either policymakers or citizens. Instead, one can detect a growing recognition that communication is not simply a translation of facts but more importantly a negotiation of meaning. In this light, science and its policy implications need to be communicated in ways that address an intended audience's values, interests, and worldviews.

Several decades of social science research on framing underpin this paradigm shift and my own work has contributed modestly to this new line of thinking. Across a number of studies and articles, I have argued that there is nothing essentially unique about science policy debates from other political controversies and that given this interpretative reality, scientists must strategically "frame" their communications in a manner that connect with diverse audiences. I identify a consistent set of frames that appear over and over again in science policy debates and then explain how this research might be turned into an innovative public engagement technology to be used by scientists and press officers. This means remaining true to the underlying science, but as in the National Academies case, turning to audience research to design messages that are personally relevant and meaningful to diverse publics. The mark of any paradigm shift is controversy: In suggesting that scientists need to take a more scientific approach to public engagement, my proposals have triggered a heated exchange of letters at the journal *Science*, sparked a global blog debate, generated considerable media attention, and launched a speaking tour that has taken me to more than three dozen universities, cities, and venues across North America and Europe.

In this chapter, I synthesize the findings and conclusions from these many previously published studies and articles. Drawing on the cases of nuclear energy, evolution, and climate change, I demonstrate the generalizable ways that framing drives the dynamics of science controversies. For researchers, this previous theory building and empirical work contributes importantly to the careful conceptualization and identification of campaign strategies, media messages, and their influence. For scientists and communication professionals, the research offers valuable lessons for effective public engagement strategy, though these lessons are not without several important ethical and normative considerations.

### **A Scientific Approach to Public Communication**

Historically, a prevailing assumption has been that ignorance is at the root of social conflict over science. As a solution, after formal education ends, the popular science media should be used to educate the public about the technical details of the matter in dispute. Once citizens are brought up to speed on the science, then they will be more likely to judge scientific issues as scientists do and controversy will go away. In this traditional “popular science” model, communication is defined as a process of transmission. The facts are assumed to speak for themselves and to be interpreted by all citizens in similar ways. If the public does not accept or recognize these facts, then the failure in transmission is blamed on journalists, “irrational” beliefs, or both (Nisbet & Goidel, 2007).

The heavily referenced symbols in this traditional paradigm are popular science media such as *Scientific American* or PBS’ *Nova* along with famous popularizers such as Richard Feynman and Carl Sagan. Rhetorically, whenever the relationship between science and society breaks down, science illiteracy is often blamed, the absence of quality science coverage is bemoaned, and there is a call put out for “the next Carl Sagan.” Of course, in the context of these controversies, such condescending claims only risk further alienating key audiences. Moreover, by emphasizing what is

wrong with the public and the media, many scientists ignore the possibility that their communication efforts might be part of the problem or that there might be legitimate reasons fueling public concern (Irwin & Wynne, 1996).

Not only does this traditional paradigm unfairly blame the media and the public, arguments in favor of this decades old model are not very scientific. “Popular science” assumptions cut against more than sixty years of research in communication and public opinion, a body of work that depicts citizens as preferring to be miserly in their information seeking rather than being fully informed. Instead of weighing and deliberating issues, citizens rely heavily upon their social values to pick and choose among ideologically-friendly interpretations in news coverage, often making up their minds about a topic in the absence of knowledge (Popkin, 1991; Nisbet, 2005; Ho, Brossard, & Scheufele, 2008).

The popular science model also does not hold up well against the realities of the digital age. The great paradox of today’s media world is that by way of cable TV and the Internet, the wider public has greater access to quality information about science than at any time in history, yet public knowledge of science remains low. One major reason is the problem of choice: citizens not only select media content based on ideology or religious views, but also based on their preference, or lack thereof, for public affairs and science-related information (Prior, 2006). As a result, in a fragmented media system, information rich science enthusiasts get richer whereas the broader American audience literally tunes out.

As a long term engagement strategy, continued investments in formal education and traditional science media remain centrally important. Alternatively, public dialogue settings such as deliberative forums, science cafes, and town meetings may be particularly effective at addressing activists and stakeholders (see Brossard & Lewenstein; Besley in this volume). Yet, in combination with these efforts, scientists and their organizations must also learn to focus on “framing” their

messages in ways that engage specific audiences and that fit with the constraints of a diversity of media outlets.

At a theoretical and descriptive level, research in the area of framing and media influence offers a rich explanation of how various actors in society define science-related issues in politically strategic ways, how journalists from various beats selectively cover these issues, and how diverse audiences differentially perceive, understand, and participate. Perhaps even more importantly, at an applied level, this basic research can serve as an effective public communication technology. As the cases and research reviewed in this chapter will show, effective framing can result in a range of outcomes. Scientists can use framing to motivate greater interest and concern thereby expanding the audience for science; to shape preferences for policies informed by or supportive of science; to influence political or personal behavior; to go beyond polarization and unite various publics around common ground; to define policy choices or options; and/or to rally fellow scientists around shared goals or strategy.

From a research perspective, framing is not new to the literature in the area of science communication, yet scholars have a tendency to “reinvent the wheel” in identifying and labeling the frames that exist in any debate. Not only does this lead to a troubling level of inconsistency in understanding the nature of disputes over science, but it also leads to major differences in the measurement of media trends and in the observation of any influences. As I will outline in the rest of this chapter, too frequently scholars overlook previous research that offers a deductive source for doing frame analysis. This typology is generalizable and directly applicable to understanding the communication dynamics of many science-related issues.

### **Framing and Media Influence**

The earliest formal work on framing traces back four decades to the anthropologist Erving Goffman. In his ethnographic research, he described frames as "schemata of interpretation" that

allow individuals to "locate, perceive, identify, and label" issues, events, and topics. Words, according to Goffman, are like triggers that help individuals negotiate meaning through the lens of existing cultural beliefs and worldviews. In the 1970s and 1980s, cognitive psychologists Daniel Kahneman and Amos Tversky applied framing in experimental designs to understand risk judgments and consumer choices. The two psychologists discovered that the different ways in which a message is presented or "framed"--apart from the content itself--can result in very different responses, depending on the terminology used to describe the problem or the visual context provided in the message. They concluded in their Nobel Prize-winning research that "perception is reference dependent" (Kahneman, 2003).

Over the past two decades, research in political communication and sociology has started to explain how media portrayals in interaction with cultural forces shape public views. Frames, according to the classic definition, organize central ideas on an issue. They endow certain dimensions of a complex topic with greater apparent relevance than the same dimensions might appear to have under an alternative frame (Gamson & Modigliani, 1989). Frames are used by audiences as "interpretative schema" to make sense of and discuss an issue; by journalists to condense complex events into interesting and appealing news reports; and by policy-makers to define policy options and reach decisions (Scheufele, 1999). In each of these contexts, frames simplify complex issues by lending greater weight to certain considerations and arguments over others. In the process, they help communicate why an issue might be a problem, who or what might be responsible, and what should be done (Ferec, et al., 2002).

Aside from any impact on news portrayals or public perceptions, frames are also a useful tool for controlling policy attention to an issue while managing the "scope of participation" within a given policy arena such as Congress, including the types and numbers of groups who are involved in decision making. In fact, across the history of many science debates, power has turned on the

ability to not only control attention to an issue across policy arenas, but also to simultaneously define the nature of the problem and what should be done (Nisbet and Huges, 2006; Nisbet, Brossard, & Kroepsh, 2003).

### **A Frame Typology for Science**

Previous studies describe a set of frames that appear to reoccur across science-related policy debates. Originally identified by the sociologists William Gamson and Andre Modigliani (1989) in an examination of nuclear energy, the typology was further developed in studies of food and medical biotechnology in Europe and the United States (Dahniden, 2002; Durant, Bauer, & Gaskell, 1998; Nisbet & Lewenstein, 2002).

Before elaborating on the typology, a two key details need to be covered. First, frames as general organizing devices should not be confused with specific policy positions. As the sociologist William Gamson and his colleagues describe, individuals can disagree on an issue but share the same interpretative frame. In other words, as I will demonstrate in several examples, each frame as an organizing device for arguments and interpretations is valence neutral, meaning that it can take pro, anti, and neutral positions, though one position might be in more common use than others. Second, the latent meaning of any frame is often translated instantaneously by specific types of frame devices such as catchphrases, metaphors, sound bites, graphics, and allusions to history, culture, and/or literature (Feree et al., 2002).

Consider the controversy over embryonic stem cell research, which I have detailed in several studies (Nisbet, Brossard, & Kroepsch, 2003; Nisbet & Scheufele, 2007). A dominant frame is that the debate is really a question of "morality/ethics." Both sides use this valence neutral frame to argue their case in the debate. For example, research opponents say it is morally wrong to destroy embryos, since they constitute human life. Research supporters say it is morally wrong to hold back on research that could lead to important cures. The "morality/ethics" frame is communicated by the

use of several kinds of “frame devices” that include a) metaphors such as "scientists are playing God," or "scientists racing to find a cure," b) comparisons to historical exemplars such as the Holocaust or discovering the cure for Polio, c) catch phrases such as "respect for life," “crossing an important moral boundary,” or "it is pro-life to be pro-research" and d) photo-ops such as Bush posing with "snowflake" babies.

In Table 1, I outline this generalizable typology, describing the latent meanings of each interpretation. These frames consistently appear in science policy debates, though as we will later see in the case of climate change, unique issue-specific frames can also emerge. (With the reader in mind, throughout this section and others, references to frames from the typology are italicized and frame devices are in quotes.) To first introduce this typology, let’s first take an updated look at Gamson and Modigliani’s classic framing analysis of the longest and most durably intense debate in science policy.

[Insert Table 1 About Here]

*The Rise and Fall of Nuclear Energy.* Few Americans associate nuclear energy with slogans like “Atoms for peace” or “electricity too cheap to meter.” Yet before the 1970s, nuclear energy production was framed almost exclusively in these terms, with the technology defined as leading to *social progress, economic development*, and a better way of life. When President Dwight Eisenhower in 1953 delivered his “atoms for peace” speech before the United Nations, demand for electricity in the U.S. was doubling each decade, while Europe faced severe energy shortages. The construction of nuclear power plants at home was defined by the president as giving the U.S. an important economic advantage, and the promotion of civilian nuclear technology abroad was heralded as a key diplomatic tool in winning allies against the Soviet Union.

Frames changed, however, in the mid-1970s as Ralph Nader and other consumer advocates re-interpreted nuclear energy in terms of *public accountability*, arguing that the industry had

become a “powerful special interest.” Environmentalists also began to emphasize a *middle way*, focusing on alternative paths to energy independence, advocating energy conservation, and solar, hydro, and wind generation. Other groups such as the Union of Concerned Scientists turned the *economic competitiveness* frame against nuclear power, emphasizing that production was simply not “cost-effective.” Civilian nuclear energy production was also linked to the “nuclear freeze” movement, as President Carter’s administration limited the export of civilian technology abroad, and as protestors swarmed nuclear power plants at home. (See also Weart, 1988.)

The tipping point for the image of nuclear energy was the Three Mile Island (TMI) accident in 1979. Several weeks before the TMI incident, the popular *China Syndrome* movie was released. With its focus on industry secrecy and incompetence, the film emphasized an interpretation of *public accountability*. More importantly, with the film’s reactor meltdown climax, the movie amplified a new frame focusing on the *Pandora’s Box or runaway* nature of the technology. In this interpretation, the risks of nuclear power were portrayed as a Frankenstein’s monster beyond the ability of citizens to control. When news reports of TMI galvanized national attention, these frames became the major modes of interpretation. In a classic example of a frame device instantly signaling a *runaway technology*, *Time* magazine featured a cover with an ominous picture of the TMI reactor and the headline “Nuclear Nightmare.”<sup>1</sup> The accident helped set in motion a dominant media narrative of lingering *scientific uncertainty* that went on to spotlight additional examples of construction flaws, incompetence, faulty management, and potential risks at nuclear power plants across the country. The frames of *public accountability*, *runaway technology*, and *scientific uncertainty* were only strengthened in 1986 with the Chernobyl disaster. The event generated worldwide attention, with few media providing context on the comparative safety record of the American nuclear energy industry. Since 1979, no new nuclear power plants have been built in the

---

<sup>1</sup> An image of the cover is available online: <http://www.time.com/time/covers/0,16641,19790409,00.html> . The full cover story is available at: <http://www.time.com/time/magazine/article/0,9171,920196,00.html>.

U.S, though more than 100 power plants remain in operation (Friedman, Gorney, & Egolf, 1992; Gamson & Modigliani, 1989)

At the start of this decade, however, new focusing events began to shift the interpretative packages and mental categories applied to nuclear energy. In 2001, against the backdrop of rising energy costs, the newly elected George W. Bush administration launched a communication campaign to promote nuclear power as a *middle way* path to energy independence. The terrorist attacks of September 11 dampened the viability of this frame package, as subsequent media reports focused on nuclear power plants as potential terrorist targets. But since 2004, as energy prices have climbed and as the dependence on overseas oil has been defined as a major national security issue, a renewed emphasis on the energy independence interpretation has surfaced.

This framing effort has been complemented by an attempt to sell nuclear energy as a *middle way* technofix for greenhouse gas emissions. Former EPA administrator Christine Todd Whitman along with Greenpeace co-founder Patrick Moore are among the sponsors of this interpretative package. Their tagline is that nuclear energy is “cleaner, cheaper, and safe.” According to their argument, if Americans are going to satisfy their energy demands while achieving the goal of cutting greenhouse gas emissions, the country needs to re-invest in nuclear energy (Whitman & Moore, 2006). Both former President George W. Bush and John McCain have argued a similar *middle way* interpretation. “If we're looking for a vast supply of reliable and low-cost electricity, with zero carbon emissions and long-term price stability, that's the working definition of nuclear energy,” declared McCain in a 2008 campaign speech.

The frames used to oppose nuclear energy also remain familiar, paralleling the interpretations first introduced in the mid-1970s. Groups like the Union of Concerned Scientists push *uncertainty* and *public accountability* interpretations, demanding on that nuclear plants be tightly regulated in light of safety problems, the “public’s right to know,” and a “failure of

regulators to take effective action.” Other environmental groups emphasize in their opposition not only the potential *runaway* dangers, but also the absence of cost-effectiveness. They use the tagline that nuclear power is “not safe, not cost effective, and not needed.”

Nuclear energy remains a classic example and it is easy to see how the typology of frames applies, but what about other issues? In the next section, as a way to further illustrate the types of generalizable latent meanings that apply over and over again across science debates, I provide a detailed analysis of the frame contest over the teaching of evolution. As in the case of nuclear energy, strategic messaging has been used to trigger favorable interpretations among key stakeholders and audiences. In fact, framing has been the central tool used by anti-evolutionists to gain traction among opinion leaders, journalists, and a swing public of Americans. It is only recently that the scientific community has adapted to the realities of the modern interpretative landscape, though several maverick communicators continue to send mixed messages about the important differences between science, religion, and atheism.

### **Conflict and Consensus in Communicating about Evolution**

For 150 years, Charles Darwin’s original theory of evolution has served as the basis for major advances in the sciences and these breakthroughs have only further strengthened the evidence in support of evolution. Based on these discoveries along with corroborating evidence from the fossil record and comparative anatomy, the National Academies in their recent report calls evolutionary biology the “cornerstone of modern science.” Questions exist about particulars in evolution, but the vast majority of scientists maintain that the theory remains the best tool for understanding these lingering uncertainties and that there is no scientifically credible alternative explanation for the vast diversity of organisms that exist today.

Despite the overwhelming evidence in support of evolution, cultural conservatives in the United States have long opposed the teaching of the theory in public schools. Decades ago

fundamentalist Christian activists first proposed “creation science,” a doctrine that claimed archeological evidence for Noah’s flood and other biblical stories. Defining the issue in terms of so-called educational balance, these creationists framed the matter in terms of *public accountability*, calling for “equal time” in public schools and decrying the issue as a matter of “free speech.” Yet court decisions have repeatedly ruled that creation science was a religious doctrine and that its inclusion in public school curricula violated the Constitutional separation of church and state.

In response to these defeats, during the late 1990s, creation science “evolved” by way of a modern repackaging and re-framing. A small group of conservative intellectuals came together to develop a new account called intelligent design (ID), which argues that the complexity of life on earth is best explained by the intervention of an intelligent force, rather than the process of macro-evolution. With this premise as their foundation, ID proponents set about to re-frame the validity of one of the most widely supported theories in science by offering up what appeared to be their own scientifically good enough compromise. The ID public relations campaign proved politically successful, at least initially. In less than ten years, this alternative take on life’s development earned endorsements from President Bush, Senate majority leader Bill Frist, state and local school boards, political reporters, pundits, and a majority of Americans as measured in opinion polls.

*Re-defining evolution as a social problem.* The origins of the ID movement can be traced to *The Wedge Document*, a 1998 fund raising memo that was later mysteriously posted on the Internet. With clearly stated Christian motives, the document lays out a multi-pronged strategic communication campaign for replacing the theory of evolution with “the theistic understanding that nature and human beings are created by God.” In order to mobilize a base of Christian conservatives, the movement drew heavily upon the *social progress* and *morality/ethics* frames, emphasizing that evolution is responsible for moral decay in society. As the Wedge document

proclaims, at some point in the past, man was in harmony with God, but this equilibrium—along with morality--was lost with the introduction of evolution into public schools.

Yet, for the most part, the loss of *social progress* and *morality* frames were not the interpretations offered by the ID movement to the mainstream media or the wider American public. To these audiences, the so-called social problem of evolution was communicated around other dimensions. In fact, ID proponents attempted to use the authority of science to argue their case to journalists and swing publics. First, camouflaging their religious motivations, the ID movement promoted a *scientific uncertainty* frame, insisting that there are supposedly holes in the theory of evolution, and therefore, by default, ID must therefore be true. The movement relied heavily on the reasoning of Michael Behe, a biochemist at Lehigh University who argues in his top selling book *Darwin's Black Box* that certain features of organisms are “irreducibly complex,” meaning that some form of supernatural intelligence must have intervened to create them. Playing on the vernacular meaning of the term, ID proponents further translated this uncertainty motif by way of the slogan: “Evolution is a theory, not a fact.” In other words, argued ID proponents, if the theory of evolution, could not account for irreducible complexity or other so-called holes in the science, then rival interpretations need to be taught in class (see Forrest & Gross, 2005 for an overview).<sup>2</sup>

Second, ID proponents paired their manufactured uncertainty message with an equally effective *public accountability* frame that played on public belief in critical thinking as a corner stone of education. In 2005, President Bush echoed this theme in public statements supporting the teaching of ID. As Bush boiled down the complexity of the matter when asked by a political reporter: “Both sides ought to be properly taught, so people can understand what the debate is

---

<sup>2</sup> Despite making for a great catchphrase and a deceptively compelling argument, Behe's claims, however, have never been published in the peer-reviewed literature, the process by which scientific claims are tested and validated. More importantly, as the National Academies recently summarized, the peer-reviewed research has shown that each of these “design” examples can in fact be explained by natural selection alone.

about. Part of education is to expose people to different schools of thought. . . . You're asking me whether or not people ought to be exposed to different ideas, and the answer is yes."

By 2005, when the president had weighed in on the debate, ID had been introduced into several local school boards and states across the country. Most notably, that same year, in Dover, Pennsylvania, parents had filed suit in opposition to the local school board's resolution that students be read a statement in science class asserting that evolution was a theory and not a fact. The statement went on to declare that ID was a scientifically credible alternative account of life's origins, and that students wanting more information could turn to an ID textbook available in the school library.

*Balance as bias.* Local governments and political leaders were not the only important players adopting the ID movement's preferred framing of the issue. As school boards, state legislatures, and the courts paid increasing attention to intelligent design, journalists relied heavily on the agenda of these political venues to guide coverage decisions. What followed in 2004 and 2005 was a major spike in national and regional media attention to ID, but perhaps more importantly, as science was debated within these political contexts, there was a transfer across news beats, with coverage no longer dominated by context-oriented science writers, but now the subject of stories contributed by political reporters, opinion writers, and cable TV news.

As I detailed with Chris Mooney in a cover article for the *Columbia Journalism Review*, coverage at the political and opinion beats de-emphasized the technical background favored by science writers and replaced it with the type of *strategy and conflict* frame more familiar to election coverage or issues such as abortion. Though these types of stories provided important details about the tactics, fundraising, and campaign activities of the ID movement, they would also ignore scientific background. Instead they would carefully balance arguments from both sides, thereby

lending credibility to the claim by ID proponents that there was a growing “scientific controversy” over evolutionary theory, when in fact, there was none (Mooney & Nisbet, 2005).

Given the strong paired messages of uncertainty and critical thinking that were pushed by elected officials, pundits, and political journalists, national surveys showed that the American public remained unsure about the scientific basis of both evolution and intelligent design. In one national survey study I conducted, only a bare majority of adult Americans (56% percent) agreed that an overwhelming body of scientific evidence supported evolution, while a very sizeable proportion (44%) thought precisely the same thing about ID. Perhaps even more troubling, roughly 60% of the public believed intelligent design should be taught as an alternative to evolution in public school science courses (Nisbet & Nisbet, 2005). The ID movement, through careful tailoring and targeting of their message, had literally created a public perception wedge, defining intelligent design as the compromise between teaching "atheistic evolution" and constitutionally unacceptable biblical doctrine.

Unfortunately, in the initial response from many evolution defenders there was the assumption that the factual basis of evolutionary science would simply win out, without any real attempt to sell those facts. Filmmaker Randy Olson’s 2006 documentary *Flock of Dodos* powerfully depicts the awkward communication posture of some scientists, drawing a sharp contrast to the seductive style of many ID proponents. Olson’s film has served as a catalyst for self-reflection, putting on display the inherent weaknesses in scientists’ traditional thinking about public communication. In what has become a heavily referenced scene, Olson gathered biologists together for poker, beer, and an informal discussion of the ID challenge. One participant’s comments capture perfectly the faulty instincts of some evolution defenders:

It's not my position, it's not my position to persuade people, you shouldn't believe in god, or you should believe in god. But, when they come into the scientific arena, and they start saying things that

are manifestly wrong, that are manifestly ignorant, *I think people have to stand up and say, you know, you're an idiot.*

With these types of statements and assumptions, some scientists played directly into the perceptual trap set by the ID campaign, reinforcing the movement's preferred mental box of *uncertainty* by arguing, sometimes condescendingly, the technical arguments against ID and in favor of evolution. While all of these arguments are objectively true and may be persuasive to a highly attentive and informed audience, these scientific and technical arguments are likely to be ignored by a wider public and/or interpreted as a confusing "he said, she said" fight among dueling experts.

Although evolution defenders may have been losing the battle in the court of public opinion, Federal Judge John E. Jones' December 2005 decision in the Dover, Pennsylvania case, appeared to turn-the-tables, at least temporarily, on the ascent of the ID movement. Jones' ruling re-defined the controversy away from the ID movement's preferred emphasis on so-called critical thinking and free speech, towards a new master *public accountability* frame that focused on a powerful special interest group seizing power and promoting its religious agenda. According to Jones' interpretation of the evidence, what had happened in Dover was that a small group of Christian conservatives had been elected to the school board, and had proceeded to pass the curriculum change as a way to push their preferred religious beliefs on a community of diverse faith, an act that was unconstitutional.

In the wake of the Dover case, the emphasis on the wrong-headedness of a special interest group pushing their religious values on students, combined with the fear of lawsuits, appeared to spill-over to affect the moderate members of the Ohio school board. In February 2006, these board members voted against their Christian conservative counterparts in reversing the 2002 policy that allowed the teaching of ID in Ohio schools. "We allow a Dover risk to remain if we leave this lesson plan on the shelf," Robin C. Hovis, a board member, told *The New York Times*.

*An Expert Consensus on Communication Strategy?* Motivated by the public communication failures that preceded the Dover case, as described at the opening of this chapter, the National Academies decided to carefully explore the types of frames that might best translate evolution for an ambivalent public. Indeed, somewhat surprisingly, the focus group and survey research by the National Academies revealed that a *social progress* emphasis on evolutionary science as the building block for medical advances was the most effective frame among swing publics. Moreover, not unexpectedly, the research also concluded that by emphasizing the *middle way* interpretation of science and religion as compatible, scientists could begin to reduce audience reservations and confusion.

Reinforcing these twin storylines, the National Academies report was co-sponsored by the prestigious Institute of Medicine, with the authoring committee chaired by Francisco Ayala, a biologist who had once trained for the Catholic priesthood. The report opens with a compelling “detective story” narrative of the supporting evidence for evolution, yet placed prominently in the first few pages is a call out box titled “Evolution in Medicine: Combating New Infectious Diseases,” featuring a picture of passengers on a plane wearing SARS masks. A lede quote in the report’s press release echoed this emphasis. "Understanding evolution is essential to identifying and treating disease," said Harvey Fineberg, president of the Institutes of Medicine. "For example, the SARS virus evolved from an ancestor virus that was discovered by DNA sequencing. Learning about SARS' genetic similarities and mutations has helped scientists understand how the virus evolved. This kind of knowledge can help us anticipate and contain infections that emerge in the future."

To communicate the *middle way* frame, at the end of the first chapter, following a definition of science and how it is different from religion, there is a prominent three page special color section that features testimonials from religious scientists, religious leaders and

official church position statements, all endorsing the teaching of evolution in schools. As the report states and as quoted in the press release: “The evidence for evolution can be fully compatible with religious faith. Science and religion are different ways of understanding the world. Needlessly placing them in opposition reduces the potential of each to contribute to a better future.”

*Mixed Messages and Maverick Communicators.* While the National Academies has taken the lead in providing carefully researched resources for scientists and others to rely on communication about evolution, what continues to be the loudest voice of science on the matter takes a decidedly different interpretation. In a series of best-selling books, several authors, led by Richard Dawkins (2006), argue that religion is indeed a scientific question, and that evolution in particular undermines not only the validity of religion but also respect for all religious faith. These maverick communicators, dubbed “The New Atheists,” fuel the favored conflict frame of the news media, generating magazine covers, sound bites and other frame devices that emphasize “God vs. Science,” or “Science versus religion” to name just a few examples. Quickly translated by the conflict-hungry press, the underlying message for the wider public is that science--exactly as the ID proponents claim--does indeed undermine religious values.

This conflict narrative is powerfully employed in the 2008 documentary *Expelled: No Intelligence Allowed*. By relying exclusively on interviews with outspoken atheist hardliners such as Dawkins, *Expelled* reinforces the false impression that evolution and faith are inherently incompatible and that scientists are openly hostile to religion. In the film, the comedic actor Ben Stein plays the role of a conservative Michael Moore, taking viewers on an investigative journey into the realm of “Big Science,” an institution where Stein concludes that “scientists are not allowed to even think thoughts that involve an intelligent

creator.” The film goes so far as to outrageously suggest that “Darwinism,” as Stein calls evolution, led to the Holocaust, and that today scientists have been denied tenure and that research has been suppressed, all in the service of an atheist agenda to hide the supposedly fatal flaws in evolutionary theory.<sup>3</sup>

By the end of its Spring 2008 run in theaters, *Expelled* ranked as one of the top grossing public affairs documentary of all time.<sup>4</sup> Even more troubling have been the advanced screenings of *Expelled* for policymakers, interest groups, and other influentials. These screenings have been used to promote "Academic Freedom Acts" in several states, legislation that would encourage teachers (as a matter of “academic freedom”) to discuss the alleged flaws in evolutionary science. In June 2008, an Academic Freedom bill was successfully passed into law in Louisiana with similar legislation under consideration in other states (see Nisbet, 2008 for more on *Expelled*).

As just reviewed, applying framing to the communication battle over evolution is a valuable way to decode the message strategy of competing camps and to arrive at clues about how audiences are likely to make sense of the debate. In the next section, I review how these same generalizable principles and latent meanings also play out in the debate over climate change.

### **Climate Change: A Consistent Pattern of Strategies and Meanings**

By the end of 2007, conventional wisdom had pegged the year as a major breakthrough for mobilizing the public on climate change. As evidence, many journalists, bloggers, and advocates pointed most notably to former Vice President Al Gore and his Nobel prize winning efforts at

---

<sup>3</sup> For detailed responses to the film’s claims, see the special report by *Scientific American* at <http://www.sciam.com/article.cfm?id=sci-am-reviews-expelled> and the Web site maintained by the National Center for Science Education at <http://www.expelledexposed.com/>.

<sup>4</sup> Only Al Gore’s *An Inconvenient Truth*, Morgan Spurlock’s *Super Size Me*, and Michael Moore’s *Fahrenheit 9/11*, *Sicko*, and *Bowling for Columbine* have grossed more than *Expelled*. (After controlling for inflation, add Moore’s 1989 *Roger & Me*.)

communicating about the “climate crisis.” Perhaps more importantly, Gore’s *Inconvenient Truth* media campaign had been backed up by ever stronger and louder expert agreement from the Intergovernmental Panel on Climate Change (IPCC) that man-made global warming posed serious environmental and societal consequences.

Conventional wisdom, however, cut against the reality of public opinion. Despite the strongest conclusions to date by the scientific community about the urgency of the issue, polling revealed that global warming still scored consistently as a bottom tier political priority for the public (Nisbet & Myers, 2007). Partisan judgments of the objective reality of global warming also varied widely, forming what I call a “Two Americas” of climate change perceptions. According to Gallup surveys, between 2006 and 2008, worry about global warming grew to a record high of 85% among Democrats, while the percentage of concerned Republicans remained unchanged at less than 50% (Dunlap, ). When you factor in education, an even deeper chasm is revealed. According to recent Pew surveys, less than a quarter of college educated Republicans believe that global warming is due to human activities compared to more than three quarters of their Democrat counterparts (Pew, 2008).

So by 2008, despite Gore's breakthrough success with *Inconvenient Truth*, American opinion was little different from when the film premiered in May 2006. Gore and the spike in mainstream media attention had intensified the beliefs of Americans who were already concerned about climate change, but a deep perceptual divide between partisans remained. What explains then the difference between the objective reality of climate change and its perceived subjective conditions? As I argued with Chris Mooney in the pages of *Science*, if mainstream news attention and expert consensus alone drove public responses, we would expect increasing public confidence in the validity of the science, and decreasing political gridlock. However, instead of scientific

reality, ideologically friendly frames are providing the perceptual cues for the public (Nisbet & Mooney, 2007).

*The climate skeptic playbook.* Several conservative think tanks, political leaders, and commentators continue to hew closely to the decade old playbook on how to downplay the urgency of the issue. Moreover, even as Republican leaders such as John McCain and Arnold Schwarzenegger assert the need for action on global warming, the strength of these decades-old oppositional frames remain salient in popular culture, political discourse, and the memory store of many citizens. During the 1990s, the climate skeptic message strategy was in part devised by Republican pollster Frank Luntz. Based on focus groups and surveys, Luntz recommended emphasizing repeatedly that the "scientific debate remains open," that further research is needed before government action is taken, and as that any U.S. policy action would lead to "unfair" economic burden on Americans since countries like China and India were not also taking action. This "paralysis by analysis" emphasis on *uncertainty* and *economic development* was effectively implemented by conservative think tanks and members of Congress to defeat adoption of the Kyoto treaty and other major policy proposals (McCright & Dunlap, 2003). The strategy also led to distortions in news coverage. As political reporters applied their preferred *conflict and strategy* frame to the policy debate, they engaged in the same type of false balance that was common to their coverage of intelligent design (Boycoff & Boycoff, 2004).

*A Pandora's Box of looming disaster.* Al Gore, many environmentalists, and even some scientists have attempted to counter the *uncertainty* and *economic development* frames with their own *Pandora's box* emphasis on a looming "climate crisis." To instantly translate their preferred interpretation, environmentalists have relied on depictions of specific climate impacts including powerful hurricane devastation, polar bears perched precariously on shrinking ice floes, scorched earth from drought, blazing wild fires, or a future where sea level rise has put famous cities or

landmarks under water. With an accent on the visual and the dramatic, this strategy has been successful in triggering similarly framed media coverage. For example, a much talked about *Time* magazine cover from 2006 featured the image of a polar bear on melting ice with the tagline: “Be worried, be VERY worried.”<sup>5</sup> Yet given that the uncertainty for each of these climate impacts is greater than the general link between human activities and global warming, these claims are quickly challenged by climate skeptics as liberal “alarmism,” shifting debate back into the mental box of *scientific uncertainty* and partisanship.

*The “war on science.”* A second preferred frame by environmentalists, liberals, and many scientists resonates with a larger political debate over the use of expertise and evidence in the Bush administration. To these claimants, Bush and Republican leaders in Congress have created a culture of “anti-science” that favors populism and ideology over expertise. In the 2004 election, Democrats attempted to make strategic use of this *public accountability* frame, connecting climate change to a wider debate over Bush decision making on Iraq and other issues. The following year, my friend Chris Mooney’s best-selling book *The Republican War on Science* (2005) helped crystallize the *public accountability* train of thought among scientists, turning the book’s title into a rallying cry. In 2007, the lingering resonance of this frame device was evident in candidate Hillary Clinton’s speech marking the 50<sup>th</sup> anniversary of Sputnik, with the Senator promising to end the “war on science” in American politics.

*Switching trains of thought on climate change.* Not every citizen cares about the environment or defers to the authority of science, yet among climate change advocates, these mental points of reference continue to be the dominant emphasis. In order to generate widespread public support for meaningful policy action, the communication challenge is to figure out how to shift climate change from the traditional mental boxes of “uncertain science,” “unfair economic burden,”

---

<sup>5</sup> The *Time* cover is archived at: <http://www.time.com/time/covers/0,16641,20060403,00.html>.

a "Pandora's box" of disaster, or a "war on science," towards a new perceptual context that resonates with something a specific intended audience already values or understands.

In one possible example, Ted Nordhaus and Michael Schellenberger (2007) have stirred debate among fellow environmentalists with their book advocating a move away from what they call the "pollution paradigm," a familiar storyline that emphasizes dire environmental consequences if greenhouse gas emissions are not radically reduced. Their alternative communication strategy is to turn the traditional *economic development* frame in favor of action on climate change, redefining policy action not as an "unfair economic burden," or a pollution problem but as an energy challenge. Their goal in re-framing the debate is not just to engage the wider public, but also to catalyze a more diverse social movement, activating support for energy policies among Republicans who might think predominantly in terms of market opportunities or labor advocates who value the possibility of job growth. As they argue, only by refocusing messages and building diverse coalitions in support of "innovative energy technology," "green collar jobs," and "sustainable economic prosperity" can meaningful action on climate change be achieved.

A second potentially unifying interpretation is offered by scientist and atheist EO Wilson. In his top-selling book *The Creation*, by framing environmental stewardship as not only a scientific matter, but also one of *morality and ethics*, Wilson has engaged a religious audience that might not otherwise pay attention to popular science books, or for that matter, appeals on climate change. Paralleling Wilson's interpretation, an increasing number of religious leaders, including Pope Benedict and mega-church author Rick Warren, are emphasizing the religious duty to be "stewards" of God's creation.

Launched in spring 2008, Gore's \$300 million dollar *We Can Solve It*, or "WE" campaign, focuses heavily on the *morality/ethics* frame. Replacing *Inconvenient Truth's* storyline of looming disaster is a call to arms for the country to unify behind solving a mortal challenge. In television and

print advertisements titled "strange bedfellows" and "unlikely alliances," the WE campaign tries to break through partisan perceptions by pairing spokespeople such as Nancy Pelosi with New Gingrich and Al Sharpton with Pat Roberston. Other ads compare action on global warming to the Civil Rights movement, the Space Race, World War II, and the recovery from the Great Depression. Importantly, these ads are placed during day time talk shows, entertainment programming, and at leisure magazines, reaching non-news audiences who might not otherwise be paying attention to news coverage of the issue.

Similar to the Pandora's Box emphasis of 2006, journalists have also started to echo this moral framing of climate change. For example, *Time* magazine devoted its 2008 Earth Day cover to the interpretation, shape-shifting the iconic Iwo Jima flag raising photograph into an illustration of soldiers struggling to plant a tree, with the tagline "How to Win the War on Global Warming."<sup>6</sup> Managing editor Richard Stengel described the cover as: "Our call to arms to make this challenge—perhaps the most important one facing the planet—a true national priority."

Over the past few years, the public health implications of climate change have also emerged as a potentially powerful interpretative resource for advocates. This trend is an example of how specific to any issue, a unique frame may appear that is not predicted by the generalizable typology outlined and reviewed thus far in this chapter. The public health frame emphasizes the potential of climate change to increase the incidence of infectious diseases, asthma, allergies, heat stroke, and other salient health problems. Importantly, not only does the public health frame make climate change personally relevant to new audiences, it also adds a new "public face" to the debate, shifting the visualization of the issue away from remote arctic regions, peoples, and animals to more socially proximate neighbors and places. In the process, not only do the symbols of global warming change,

---

<sup>6</sup> To see the *Time* cover, go to this link: <http://www.time.com/time/covers/0,16641,20080428,00.html>.

but the issue begins to cut across media zones, triggering coverage at local news television news outlets and specialized urban media.

## **CONCLUSION**

### **The Future of Public Engagement**

For researchers, framing offers a powerful theoretical tool for understanding the communication dynamics of science debates and the relationship to public opinion, media coverage, and policy decisions. Perhaps more importantly, this body of work is catalyzing new approaches to public engagement. Leading science organizations and industry members are aware of the research presented here and they are actively trying to adapt this body of work to their communication goals. In bringing together in one place the implications of multiple published research studies and articles, in this chapter I hope to offer researchers, communication professionals, and scientists a clearer path forward.

As this chapter describes, a generalizable set of factors, principles, and social meanings appear over and over again across science debates. These generalizable features reveal important clues about the intersection between media frames and audience dispositions, the role of journalistic routines in altering the definition of an issue, and how science policy decisions are made. However, in order to put theory and principles into practice, as was the case with the National Academies' report on evolution, science organizations should work with communication researchers to commission surveys, focus groups, and other analyses that can identify effective messages and media platforms. Drawing on the typology of frames presented, on any particular issue, research needs to pinpoint the mental associations and cognitive schema that make a complex science topic accessible and personally meaningful for a targeted audience along with the particular frame devices that instantly translate these intended meanings.

Critics argue that framing on the part of scientists means engaging in false spin, as intelligent design proponents and climate skeptics have done in the past. However, if scientists have a duty to figure out what is approximately true about the world, they also have a responsibility to communicate this truth effectively. Framing is a major tool for doing this. As the cases of intelligent design and climate change underscore, it is literally a matter of “frame” or be “framed.”

Other critics have argued that scientists should stick to research and let media relations officers and science writers worry about translating the implications of that research. This is certainly ideal, but in the real world, when controversies erupt or when new issues emerge, it will be scientists, because of their authority and expertise, that will end up giving the media interviews, testifying before Congress, addressing community groups, writing blog posts, or authoring popular books, op-eds, and magazine articles. Perhaps even more importantly, as senior decision-makers, many scientists are ultimately responsible for setting communication policy at scientific institutions, universities, agencies, and organizations. These leaders need to understand the research, its implications, and how to put framing into action.

Yet as an innovative new communication technology, strategic framing needs to be used responsibly. If scientists go beyond the uncertainty inherent to any technical question, engaging in hyperbole, then they risk public trust. Moreover, if framing is used for what is perceived as political purposes, there is the risk that science will be quickly and easily reinterpreted by the public via their partisan lenses, only leading to increased polarization.

The ethics of framing is also central to the future of science journalism. Faced with a profusion of think tanks and maverick experts, many journalists seek ways to move beyond the trap of ‘false balance’ even if it jeopardizes their perceived partisan objectivity. Like scientists, they are discouraged that the public still fails to accept the urgency of climate change and the validity of evolution. In addition, as victims to market forces, veteran science writers have been forced to

leave their jobs at major news organizations while early career journalists encounter limited job prospects. As an alternative career path, some science reporters have joined with universities or foundations to forge a new brand of not-for-profit journalism where reporting and commentary merges in outlets such as blogs, interactive Web sites, books, and documentary films. The focus at these outlets is not just to inform but also to alert and mobilize the public.

Given these shifting roles for scientists and journalists, there is more work to be done in applying the relevant work on ethical persuasion. Still missing from the new “framing science” paradigm is an ethics of science communication that is as solid as the research fueling the important innovations in public engagement strategy.

**Table 1. Frames that Consistently Appear Across Policy Debates**

Frame	Defines Science-Related Issue As...
Social progress	...improving quality of life, or solution to problems. Alternative interpretation as harmony with nature instead of mastery, “sustainability.”
Economic development/competitiveness	...economic investment, market benefits or risks; local, national, or global competitiveness.
Morality/ethics	...in terms of right or wrong; respecting or crossing limits, thresholds, or boundaries.
Scientific/technical uncertainty	...a matter of expert understanding; what is known versus unknown; either invokes or undermines expert consensus, calls on the authority of “sound science,” falsifiability, or peer-review.
Pandora’s box / Frankenstein’s monster / runaway science	...call for precaution in face of possible impacts or catastrophe. Out-of-control, a Frankenstein’s monster, or as fatalism, i.e. action is futile, path is chosen, no turning back.
Public accountability/governance	...research in the public good or serving private interests; a matter of ownership, control, and/or patenting of research, or responsible use or abuse of science in decision-making, “politicization,”
Middle way/alternative path	...around finding a possible compromise position, or a third way between conflicting/polarized views or options.
Conflict/strategy	...as a game among elites; who’s ahead or behind in winning debate; battle of personalities; or groups; (usually journalist-driven interpretation.)

## REFERENCES

- Boykoff, M. & J. Boykoff. (2004) Bias as Balance: Global Warming and the U.S. Prestige Press. *Global Environmental Change (14)* 2, 125-136.
- Dahinden, U. (2002). Biotechnology in Switzerland: Frames in a Heated Debate. *Science Communication*, 24, 184-197.
- Dawkins, R. (2006). *The God Delusion*. New York: Houghton Mifflin.
- Dunlap, R.E. (2008, May 29). Climate-Change Views: Republican-Democratic Gaps Expand. *Gallup News Service*. Available at <http://www.gallup.com/poll/107569/ClimateChange-Views-RepublicanDemocratic-Gaps-Expand.aspx>.
- Durant, J., Bauer, M.W., & Gaskell, G. (1998). *Biotechnology in the Public Sphere: A European Sourcebook*. Lansing, MI: Michigan State University Press.
- Ferree, M.M., Gamson, W.A., Gerhards, J., & Rucht, J. (1992). *Shaping Abortion Discourse: Democracy and the Public Sphere in Germany and the United States*. New York, NY: Cambridge University Press.
- Forrest, B. & Gross, P.R. (2004). Creationism's Trojan horse: The wedge of intelligent design. New York: Oxford University Press.
- Friedman, S.M., Gorney, C.M., and Egolf, B.P. (1992). Chernobyl coverage: How the U.S. media treated the nuclear industry. *Public Understanding of Science*, 1, 305-323.
- Ho, S. S., Brossard, D., & Scheufele, D. A. (2008). Effects of value predispositions, mass media use, and knowledge on public attitudes toward embryonic stem cell research. *International Journal of Public Opinion Research*, 20 (2), 171-192.
- Gamson, WA. & Modigliani, A. (1989). Media Discourse and Public Opinion on Nuclear Power: A Constructionist Approach. *American Journal of Sociology*, 95, 1-37.
- Goffman, E. (1974). *Frame analysis: An essay on the organization of experience*. New York, NY: Harper & Row.
- Goidel, K. & Nisbet, M.C. (2006). Exploring the Roots of Public Participation in the Controversy over Stem Cell Research and Cloning. *Political Behavior*, 28 (2), 175-192.
- Kahneman, D. (2003). Maps of bounded rationality: A perspective on intuitive judgment and choice. In T. Frängsmyr (Ed.), *Les Prix Nobel: The Nobel Prizes 2002* (pp. 449-489). Stockholm, Sweden: Nobel Foundation.
- Labov, J. & Pope, B.K. (2008). Understanding Our Audiences: The Design and Evolution of Science, Evolution, and Creationism. *CBE-Life Sciences Education*.

McCright, A.M. & Dunlap, R.E. (2003). Defeating Kyoto: The Conservative Movement's Impact on U.S. Climate Change Policy. *Social Problems*, 50, (3), 348-373.

Mooney, C. (2005). *The Republican War on Science*. New York: Basic Books.

Mooney, C. & Nisbet, M.C. (2005, Sept./Oct.). When coverage of evolution shifts to the political and opinion pages, the scientific context falls away, unraveling Darwin. *Columbia Journalism Review*, 31-39.

National Academies of Science and Institute of Medicine (2008). *Science, Evolution, and Creationism*. National Academies Press: Washington, DC.

Nisbet, M.C. (2005). The Competition for Worldviews: Values, Information, and Public Support for Stem Cell Research. *International Journal of Public Opinion Research*, 17, 1, 90-112.

Nisbet, M.C. (2008, Fall/Winter). Expelled? Conflict and consensus in communicating about evolution. *Kean Review*.

Nisbet, M.C., Brossard, D., & Kroepsch, A. (2003). Framing science: The stem cell controversy in an age of press/politics. *Harvard International Journal of Press/Politics*, 8 (2), 36-70.

Nisbet, M.C. & Goidel, K. (2007). Understanding citizen perceptions of science controversy: Bridging the ethnographic-survey research divide. *Public Understanding of Science*, 16, 4, 421-440.

Nisbet, M.C. & Huge, M (2006). Attention cycles and frames in the plant biotechnology debate: Managing power and participation through the press/policy connection. *Harvard International Journal of Press/Politics*, 11, 2, 3-40.

Nisbet, M.C. & Lewenstein, B.V. (2002). Biotechnology and the American media: The policy process and the elite press, 1970 to 1999. *Science Communication*, 23 (4) 359-391.

Nisbet, M.C. & Mooney, C. (2007). Policy Forum: Framing Science. *Science*, 316, 5821, 56.

Nisbet, M.C. & Myers, T. (2007). Twenty years of public opinion about global warming. *Public Opinion Quarterly*, 71, 3, 444-470.

Nisbet, M.C. & Nisbet, E.C. (2005). Evolution and intelligent design: Understanding public opinion. *Geotimes*, 50, (8), 28-33.

Nisbet, M.C. & Scheufele, D.A. (2007, October). The future of public engagement. *The Scientist*.

Nordhaus, T. & Schellenberger, M. (2007). *Break Through: From the Death of Environmentalism to the Politics of Possibility*. New York: Houghton Mifflin.

Pew (2008, May 8). A Deeper Partisan Divide on Global Warming. *Pew Research Center for the People and the Press*. Available at <http://people-press.org/report/417/a-deeper-partisan-divide-over-global-warming>.

Popkin, S.L. (1991). *The Reasoning Voter*, Chicago, IL: Univ. of Chicago Press.

Price, V., Nir, L., & Capella, J.N. (2005). Framing public discussion of gay civil unions. *Public Opinion Quarterly*, 69, (2), 179-212.

Prior, M. (2005). News v. Entertainment: How Increasing Media Choice Widens Gaps in Political Knowledge and Turnout. *American Journal of Political Science*, 49, 577, 2005.

Scheufele, D.A. (1999). "Framing as a Theory of Media Effects." *Journal of Communication*, 29, 103-123.

Wilson, E.O. (2006). *Creation*. New York: W.W. Norton.

Weart, S. R. (1988). *Nuclear Fear: A History of Images*. Cambridge, MA: Harvard University Press.

Whitman, C. & Moore, P. (2006, May 15). Nuclear should be part of our future. [Boston Globe](#).

###