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'It is of Inestimable Benefit': Communicating American Science Policy in the Post-Cold War Era

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MSc in Politics and Communications

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‘It is of Inestimable Benefit’: Communicating American Science Policy in the Post-Cold War Era

Mercedes Wilby

ABSTRACT

Since the invention of the atomic bomb, American science policy has been inexorably tied to crisis. Building on the academic literature regarding the crisis thesis, communications theory, and science policy, this paper examines how crises are used to justify science policy, and what, if any, other justifications are given to explain science policy to the public.

Using short case studies and content analysis of 131 U.S. National Aeronautics and Space Administration (NASA) press releases, this study illustrates that various crisis frames are used to justify science policy; military, economic, superiority, weather, and budget crises are used to frame policies and / or to prime the public to think that science policy is essential to America’s security. Additionally, NASA uses ‘origins’ frames, real world applications frames, and international competition frames to justify policy. They often use these frames to compliment more general justifications such as education and investment, varying their justifications and frames depending on the type of policy and science in question.

The paper concludes that the existing literature on science policy covers military, economic, and superiority crisis frames admirably but lacks a comprehensive account of other frames and justifications.

INTRODUCTION

'Now, I am become Death, the destroyer of worlds.' J. Robert Oppenheimer quoted this line from Hindu scripture in 1965 to describe his reaction to the Trinity Test conducted on 16 July 1945 (Allenby and Rejeski, 2008: 267). The Trinity Test, the culmination of years of government funded scientific research, was the first successful detonation of an atomic bomb (Office of Management, n.d.b). Not only did the Trinity Test—and the United States' development of nuclear weapons—significantly alter the geopolitical landscape of the world, it also ushered in an era of government funded scientific research (Office of Management, n.d.a).

In the wake of the Soviet launch of *Vostok I*, the first successful manned space mission (Walker, 1994: 116), President John F. Kennedy (1961b) announced to a Joint Session of Congress that 'the nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth.' This commitment to space exploration cemented the relationship between the government and scientific enterprise (Walker, 1994: 116).

Similarly, after the terrorist attacks on September 11, 2001, President George W. Bush (2002) announced the creation of the Department of Homeland Security, with a well funded Science and Technology Directorate. This new agency, Bush (2002) explained, was necessary because 'in this new war, we will rely upon the genius and creativity of the American people.' Echoing Kennedy's sentiment, Bush (2002) told an audience of scientists, 'It is in our interests that we [scientists and the government] work together.'

The Manhattan Project, the Apollo Program, and the Department of Homeland Security were products of very different national and international circumstances. What these initiatives have in common is a sense that scientific and technological advancement are fundamentally linked with international conflict and crisis. There is also a sense that the government uses these crises to justify science and technology policy. Crises, of course, are by definition disruptions in the standard order. The fact that crises are anomalies means that while the connection between crisis and science policy may be strong at times of crisis—such as WWII, the height of the Cold War, and the immediate aftermath of 9/11—it may be tenuous during better times.

In this paper, I briefly examine cases of science policy during crises and thoroughly analyze post-Cold War press releases from the National Aeronautics and Space Administration [NASA], one of the leading government science agencies, in order to discover whether crises

are currently used to justify science policy as a rule or as an exception. In other words, cognizant of communications theory, I examine how the American government articulates science policy to the public and whether they do indeed invoke crises even when no overwhelming crisis exists.

This research will build on literature from three main fields of study: crisis theory, communications theory, and science policy theory and history. The former two fields will help guide my research while the latter field will lay the historical foundation needed to contextualize the current state of science policy. I turn to these three topics in Section II, which concludes with a discussion of the theoretical framework used to develop my methodology and guide my research. In Section III, I discuss my research methodology, as well as its development and application. In Section IV, I present my data and analyze the results. Finally in Section V, I draw conclusions about the communication of American science policy and discuss the potential for further research.

THEORY

Below I present a review of the literature on the crisis thesis, government leading communications theory, and science policy theory and history. I conclude this section by tying these disparate fields together to develop the conceptual framework that guided my research.

The Crisis Thesis

In the wake of the September 11, 2001 terrorist attacks, the American government took numerous actions to ensure national security. The USA PATRIOT Act, passed by Congress and signed into law by the President in October 2001, was prominent among these actions. This controversial law was not an unexpected result of a national crisis. It is often the case that the political branches—the executive and the legislative branches—will curtail individual freedoms in order to protect the country and that the judicial branch will uphold such measures (Posner, 2006: 37). Take for instance Lincoln's suspension of *habeas corpus* after the start of the Civil War, the restrictions on free speech during World War I, and Japanese internment following the attack on Pearl Harbor. As Justice William Rehnquist (1998: 218) put it, 'without question the government's authority to engage in conduct that infringes civil liberty is greatest in time of…war.'

This phenomenon is often termed the crisis thesis (Posner, 2006). While specifics of the crisis thesis are debated, there is general consensus on one main point: the American government uses crises to justify extreme measures (Posner, 2006: 4, 7). For example, as mentioned above, the USA PATRIOT Act, which the Supreme Court upheld, was passed weeks after 9/11. Judge Richard Posner (2006: 46) argues that the Supreme Court would not have upheld the law and that, in fact, 'it never would have passed, or in all likelihood even have been proposed, had the attacks been thwarted.'

Not all crises are military in nature, however. Financial meltdowns or natural disasters might create similar crisis conditions. For example, 'imagine strict quarantining and compulsory vaccination in response to a pandemic, or the imposition of martial law in response to a catastrophic earthquake, volcanic eruption, tsunami, or asteroid strike' (Posner, 2006: 3).

Additionally, not every government reaction to crises involves restricting civil liberties. Arthur Schlesinger, Jr. (2009: 339) describes how during the crisis of the Great Depression President Franklin Delano Roosevelt pushed through fifteen major laws in 100 days. These laws included the Tennessee Valley Authority [TVA] Act, the Glass-Steagall Banking Act, and the Farm Credit Act (Schlesinger, 2009: 339). These and other laws—most having nothing to do with civil liberties—passed by the Federal government during the Depression were all in the name of responding to a crisis (Schlesinger, 2009: 334-341). The Court, in fact, upheld the TVA as constitutional partly because they accepted the argument, made during peacetime, that the Federal government had the right to regulate waterways and supply [hydroelectric] power because of provisions in the war powers clause (King, 1959: 12). In other words, as the crisis thesis predicts, because of 'the continuing world crisis' due to the Great Depression, the Judicial Branch granted the political branches increased power (King, 1959: 12).

Similarly, according to Theodore Lowi (1967: 300), 'crisis situations are special conditions underlying special operations of the foreign policy establishment.' As a result, 'crisis decisions involve less bargaining than … consensus' (Lowi, 1967: 300). Crisis decisions are considered 'highly legitimate' with 'largely ceremonial and affirmative' public responses (Lowi, 1967: 300). Put another way, Lowi claims that the legislative and judicial branches of government accept foreign policy decisions made by a select foreign policy elite under the President, when these decisions are made in response to a crisis. This is, in essence, the crisis thesis, with a focus on foreign policy instead of civil liberties.

Lowi (1967: 315) goes further than the basic crisis thesis however, explaining, 'Presidential behavior since World War II can be summarized as "oversell."' In other words, the President

oversells threats, 'to create the moral equivalent of war' (Lowi, 1967: 315). Overselling 'is the conversion of…challenges into crises for the purpose of imposing temporary and artificial cohesion upon the members of the foreign policy establishment' (Lowi, 1967: 320). This extends the crisis thesis from a theory of governmental behavior during crises to a theory of governmental behavior in which the government exploits or even creates crises (Lowi, 1967: 320-322).

Marc Raboy and Bernard Dagenais' (1992: 3) discussion of media and crises in democracies helps explain how the government creates crises to create political unity. Labeling a 'situation as a "crisis,"' they explain, 'is itself an ideological and political act.' The structure of the media—and their power in the status quo—causes the media to resist the change that might occur from a real crisis (Raboy and Dagenais, 1992: 4). They, therefore, 'pay even more attention to a fabricated crisis than to one that can stake a material claim to reality' (Raboy and Dagenais, 1992: 4). This can empower social actors in the media, the public, and, of course, the government if they know how to 'provok[e] a crisis' (Raboy and Dagenais, 1992: 4). Thus, the government—with its vast media resources—can be motivated to communicate a crisis to the public through the willing media establishment in order to promote the political unity afforded by crises according to the crisis thesis.

What is striking about the crisis thesis, in its narrow structure or Lowi's broader construction, is that it presents a coherent explanation of government behavior. None of the crisis thesis scholars or jurists, however, make reference to how the government—as opposed to the media—communicates these extreme policies to the public. In other words, while the crisis thesis acknowledges that crisis justifications are disseminated to the public, it disregards the body of literature on government communications, instead focusing on inter-branch dynamics and legal arguments. In summary, the political branches of the Federal government use crises to justify any number of extreme actions to each other, to the judicial branch, and to the public—Roosevelt, for example, used two major crises to justify government programs as varied as the Manhattan Project, as alluded to above; the TVA; and Japanese internment.

Government Communications

People used to consider smoking a personal choice and, therefore, health complications a personal risk (Lawrence, 2004: 59). Once the dangers of secondhand smoke and the addictive qualities of tobacco were fully understood, however, smoking was framed as a public health *crisis* (Lawrence, 2004: 59-60). Suddenly the government stepped in to protect 'innocent' nonsmokers and smokers who had been duped by the tobacco companies

(Lawrence, 2004: 60). In other words, when smoking became framed as a public health crisis and not a personal health risk, the government took decisive action to limit the freedom to smoke in favor of the public's freedom from smoke (Lawrence, 2004: 58-59).

Studies show that this is the case for other public health issues too. Childhood obesity is increasingly framed as 'a public health crisis' (Zernike, 2003.) The debate is increasingly being 'reframed' away from 'realms of biology and personal behavior toward the realm of environmental causation' (Lawrence, 2004: 69). This reframing seems to have created a policy space that has allowed the government to take action; from the White House's 'Let's Move' Campaign to the 'Healthy, Hunger-Free Kids' Act, the government is making strides combating the public health crisis of childhood obesity (Obama, 2014).

These cases of public health 'crises' are an example of the power of frames and the media's usage of them. The power of the media to change the prevailing discourse and even influence government action is often termed 'media effects' (see Scheufele and Tewskbury, 2007: 57). Whether media effects exist, what exactly they are, and their normative value are hotly debated issues in political communications literature (see Chong and Druckman, 2007: 103-126; Scheufele and Tewskbury, 2007; Weaver, 2007: 142-147). These debates, however, are outside the scope of this paper. Instead of examining the effect of media on government policy and communications, I examine how the government communicates policy. With that limited scope in mind, I turn to the theories of priming and framing.

Priming 'occurs when news content suggests to news audiences that they ought to use specific issues as benchmarks for evaluating the performance of leaders and governments' and their policies (Scheufele and Tewskbury, 2007: 11). In other words this theory says that 'by increasing the salience of issues' the media 'may suggest which issues to use in evaluating political actors' (Weaver, 2007: 145). This process is well described by cognitive psychologists who explain that people will make judgments based on information that is easily retrievable from memory; information that is more salient—that is perceived to be more important—is more easily remembered (Weaver, 2007: 145). Put another way, priming increases 'the priority and the weight that individuals assign to particular attitudes already stored in their memories' (Jacobs and Shapiro, 2000: 50). For example, debates over President Clinton's health care reform were framed to evoke negative attitudes already associated with 'big government' and positive attitudes associated with 'universal healthcare' (Jacobs and Shapiro, 2000: 51).

The key to priming is that it has a temporal aspect; it is based on memory models of information processing and assumes that the media can influence both what issues people

remember and how they recall these issues in other contexts (Scheufele and Tewskbury, 2007: 15). For example, by discussing at length the Federal budget deficit in the early 1990s, the media primed viewers to judge presidential performance based, in part, on the deficit (Weaver, 2007: 145). Priming is therefore distinguished from the related theory of agenda setting because agenda setting makes 'some issues more salient' instead of shaping 'the considerations that people take into account when making judgments' (Scheufele and Tewskbury, 2007: 11) about these salient issues.

Priming is also related to the theory of framing. Priming, in this light, can be defined as 'activating an association between an item highlighted in the framed text and an audience's thinking about a related concept' (Entman, 2004: 27). In other words:

> [Framed texts] possess the potential to prime interpretations and evaluations, typically by advancing problem definitions and remedies. The frames prime the audience members' responses by activating associations between the information highlighted in the texts and concepts already stored in their schema systems.
>
> (Entman, 2004: 28)

This is not to say that framing and priming are the same thing; priming [and agenda setting] are accessibility effects and framing is an applicability effect (Scheufele and Tewskbury, 2007: 15). In other words, priming assumes that people recall certain accessible information to make judgments whereas framing can tell them what to recall (Scheufele and Tewskbury, 2007: 15). For example, public opinion varies drastically regarding public displays of hate speech—such as rallies—when the issue is framed as 'free speech' rather than the 'risk of violence' (Chong and Druckman, 2007: 104) because the former primes the audience to protect their right to free speech while the latter primes them to worry about their safety. Similarly, when childhood obesity is framed as a 'public health crisis,' as alluded to above, the public accept—even encourage—government intervention; when it is framed as a 'personal choice' the public blames the obese person and does not care to get involved.

Framing tells people how to make judgments by 'selecting and highlighting some aspects of a perceived reality, and enhancing the salience of an interpretation' (Entman, 2004, 26). This involves 'selecting and highlighting some facets of events or issues, and making connections among them so as to promote a particular interpretation, evaluation, and/or solution' (Entman, 2004, 5). This often works by evoking a primed response; however, it is not in itself priming. Robert Entman (2004: 95) discusses how the 'Cold War paradigm' made it very easy for the government to frame issues. He explains that 'virtually any problematic

situation that arose in the world could be, and was, assimilated' into this paradigm of good American capitalism versus evil Soviet communism (Entman, 2004: 95). He gives the example of the Soviet downing of a Korean passenger jet, saying, 'the habitual Cold War schema made for overwhelming domination of the news by the "murder" frame' (Entman, 2004: 95). In contrast, the American downing of an Iranian flight under very similar circumstances was given the 'technical glitch' frame (Entman, 2004: 95). In essence, Entman (2004: 97) is showing that the public accepted vastly different interpretations or frames of largely similar events because they were primed to consider 'automatic anxieties about the communist conspiracy.' Similarly, in the example of Clinton's healthcare initiative above, the initiative was *framed* as 'big government' by opponents in order to evoke primed negative feelings toward government intrusion instead of [more weakly] primed positive feelings about affordable healthcare that were evoked by the 'universal healthcare' *frame* (Jacobs and Shapiro, 2000: 51).

One implication of these theories is that, while the government may provide the dominant frame, the media can provide counter frames and even influence the government's frame (Entman, 2004: 9-11). Similarly, the government will adopt the best frames or priming methods to get things done. It is often the case that they will bend policy frames to fit circumstances to sell them (Jacobs and Shapiro, 2000: xiii). They can see the circumstances by looking at media framing as well as opinion polls—which, of course, reflect how the public has been primed by media frames. This is, for example, how the media framing of smoking or childhood obesity as public health crises allowed, perhaps encouraged, the government to legislate on these issues. As mentioned above, this is an example of media effects. While I will not discuss media effects further it is important to remember that media frames may affect government policy—or at least government policy frames—before / when the policy is communicated. Thus, while they are not directly covered by my study, it is important to be cognizant that media effects exist.

'A Great Adventure in Science [Policy]'

As discussed above, the government often uses crises to justify their policies, including science policy such as the Manhattan Project. The Manhattan Project, while certainly one of the most famous examples, is not the only one. Crises—or the evocation of a potential crisis by means of appeals to increased national security or economic competitiveness—were used to justify everything from the bomb to the International Space Station. Before going further into this examination of the union of science policy and crisis, it is important to note that while I focus on relatively recent American science policy this phenomenon is not uniquely modern or American. Galileo (quoted in Attlee, 2011: 16) for example, explained the

importance of the telescope to the Doge of Venice by saying, 'This is a thing of inestimable benefit…we can detect [the enemy] before he detects us.' As one scholar (Attlee, 2011: 16) put it, Galileo's telescope was the 'missile defense shield of its day.'

Much of the literature on American science policy looks to explain history—far more recent history than the 17th century—rather than policy, *per se*, examining government actions rather than explanations for these actions. Still, much of the literature explains how crises motivate government policy—just as crisis frames motivated government policy on tobacco products. For example, Alfred Mann (2000: 8) points to the 1939 formation of the National Defense Research Committee (NRDC), calling it the 'first attempt to put U.S. science and technology on a wartime footing.' The 'courtship,' as he (Mann, 2000: 43) calls it, between the government and scientific research was prompted by military necessity due to a crisis (WWII commencing in Europe). Mann goes further, examining government science policy from the 1930s through the 1990s. He sees the government's relationship with science waxing and waning based on national circumstances; the government, he shows, operates under the premise that science should be utilized only in response to—or to avert—a military crisis (Mann, 2000: 1-7).

Many other scholars agree with Mann that the relationship between government and science is precipitated by military necessity. Audra Wolfe (2013), for example, sees that the Cold War was the leading motivation behind government investment in science for decades. She also observes the contrary: 'the collapse of Communism stripped the American scientific community of much of the justification for its existence' (Wolfe, 2013: 135). However, writing in 2013, she (Wolfe, 2013: 139) now sees a new role for science to play in national security in the ongoing 'War on Terror.'

Similarly, Juan Lucena (2005: 3) sees science policymakers calling on scientists and engineers to 'save the American nation from an external [but not always military] threat.' Government 'policymaking to create scientists and engineers' over the last five decades, he explains, has been conducted to secure a nation under threat (Lucena, 2005: 2). Lucena takes this observation about policy motivation and flips it to show how policy is justified:

> We have seen how the dominant image of the American nation shifted from being under threat by Soviet communism in the 1960s, domestic social and environmental problems in the 1970s, Japanese technological competitiveness in the 1980s, global competition in the 1990s, and more recently by terrorism.
>
> (Lucena, 2005: 148)

Scientists, he (Lucena, 2005: 156) explains, use this 'dominant image'—a nod to communications literature, perhaps—of threat or crisis in order to push their science policy agenda. This does not, however, explain how the government justifies science policy to the public; rather, it shows how scientists justify research to the government.

Similarly, John H. Marburger III (2011: 14) observes that the crisis thesis has implications for science policy; in absence of a crisis, consensus is difficult to achieve, so 'the [science research and development] advocacy communities work…to create a sense of national crisis to motivate the process.' In other words, he agrees with Lucena that scientists use or create crises to motivate science policymakers. Harvey M. Sapolsky and Mark Zachary Taylor (2011), also see scientists—as well as policymakers—creating crises. They point to 'the scares about Soviet nuclear weapons buildups, Japan's competition, energy shortages, and the rise of China,' as well as 'the global warming crisis, the aging of America, the rise of India, and [America's] continuing decline in manufacturing' (Sapolsky and Taylor, 2011: 15). 'Surely a fearful patron is a generous one,' they observe with a note of cynicism, 'We are always on some edge' (Sapolsky and Taylor, 2011: 15).

Sapolsky and Taylor touch upon what Marburger (2011: 14) terms the 'competitiveness campaign,' in which competition is made into a crisis. Marburger (2011: 13) points to the creation of a crisis in the economic competitiveness motivation for policy in the 1990s and 2000s. These competitiveness campaigns have 'resulted in important changes in the pattern of appropriations for science…' (Marburger, 2011: 13). These changes, according to Wolfe (2013: 121), have resulted from a shift from competition to prove American democracy is superior to Soviet communism, to competition 'in the global marketplace as well as in the marketplace of ideas.' This shift reflects the fact that the fundamental drive for national competitiveness or superiority is often conflated with national and / or economic security in order to point to a crisis to justify increased spending on science policy (Marburger, 2011: 13-14). This is the case because often 'national prestige [is] an important element of national power' (Logsdon, 1970: 134).

Daniel Greenberg (2001) similarly explains that, with the lessening threat from the USSR, the Cold War did not provide enough motivation for science policy in the 1980s. Crises of a domestic nature became the focus of scientific research, with social, medical, economic, and environmental security—in other words, real world applications—motivating policy instead (Greenberg, 2001: 7). Still, like Wolfe and Lucena, Greenberg (2001: 7) does see that national security [and the aversion to military crises] plays a major role in science policy.

Unlike the others however, Greenberg observes how the government uses crises to *justify* policy—and the contrary.

Using the examples of the International Space Station [ISS] and the Superconducting Supercollider [SSC], Greenberg (2001: 403-414) demonstrates that national security still plays a role in science policy decisions. Both these projects were proposed in the 1980s and both faced tough political challenges in the early 1990s. The SSC failed, however, while the ISS was successful. This happened, he explains (2001: 412-414), because the ISS had a value that the SSC did not: it would involve collaboration with Russia. This, proponents claimed, would occupy Russian scientists. Since the formerly strong Soviet space program had crumbled along with the USSR, the US feared that Russian scientists would 'sell their skills to Iraq, Iran, North Korea, and other regimes seeking to develop missile capabilities' (Greenberg, 2001: 414). This national security justification, coupled with pork barrel politics, gave the ISS 'unmatchable survival advantages over the SSC' (Greenberg, 2001: 414).

A decade before the ISS faced off with the SSC in the 1990s, the project received support from President Reagan, who, in his 1984 State of the Union address, announced:

> America has always been greatest when we dared to be great. We can reach for greatness again. We can follow our dreams to distant stars, living and working in space for peaceful, economic, and scientific gain. Tonight, I am directing NASA to develop a permanently manned space station… (Reagan, 1984)

In other words, he justified the decision to go forward with the ISS because it would help secure peace in near-earth space in order to prevent any escalation of the Cold War. Additionally he claimed that the ISS would ensure economic competitiveness and scientific superiority—or greatness. Lucena and Greenberg, as discussed above, identify the 1980s as a time of economic crisis due to international technological competition. The ISS, therefore, was advanced as national policy in the 1980s and 1990s because of various crises.

Similarly, John Logsdon (1982: 404) sees the space station as an example of how 'competition for international markets…national prestige and military power [are] influential motives for being in space.' However, unlike Lucena and Greenberg, Logsdon does not necessarily link economic motives to economic crises. He sees the 'profit incentive and competition for international markets *join* national prestige and military power as influential motives for being in space' (Logsdon, 1892: 404; emphasis added.). Put another way, profits and market share are joining 'national [military] competition, national security, and national pride' as factors determining investment in space (Logsdon, 1982: 404). Former Deputy

Administrator of NASA, Hans Mark (1987: 175), similarly sees economics removed from crisis as a contributing factor—but certainly not the only factor—in President Reagan's decision to pursue the ISS program. In fact, according to NASA's International Space Station Commercialization Manager Lance Bush (2002: 74), the push to commercialize space logically extends not from a crisis but from the 'historical role' of the US government of 'lead[ing] the market by investing in new ventures.'

Bush (2002: 74) further discusses scientific research, explaining that while it may be for the 'benefit of humanity' and 'have positive economic impacts,' it is not always motivated by economics. In fact, 'much scientific effort is aimed at satisfying human curiosity, the need to know, explain and relate to things around us' (Tisdell, 1981: 9). For example, the SSC was originally proposed by scientists and supported by President Reagan in order to 'advance our understanding of the universe' (Drell, 1993: 48). In fact, 'it was well understood, in both science and politics, that practical results were not the object' of the SSC (Greenberg, 2001: 404). Of course in the end, as noted above, Congress stopped supporting the SSC as policy in the early 1990s.

The failure of the SSC, which more than any of the other science policies discussed above was justifiable only on the grounds of curiosity, does not mean that scientific discovery for the sake of scientific discovery is never government policy. Often this motivation contributes to policy initiatives along with other factors, such as national security and economic gains—as was the case with the ISS (Gibson, 1984: 625). To illustrate how numerous factors converge to motivate government science policy, I will conclude with physicist Richard P. Feynman's response in 1963 to the question "why go to the moon?":

> Because it's a great adventure in science. Incidentally, it also develops technology. … Also it makes scientists happy, and if scientists are happy maybe they'll work on something else good for warfare. Another possibility is a direct military use of space. … Another good reason is a propaganda reason. We've lost some face in front of the world by letting the other guys get ahead in technology. …
>
> (quoted in Feynman, 2007: 113-114)

Conceptual Framework

Feynman's quote—as well as much of the literature on American science policy—alludes to non-crisis reasons for conducting science policy. These scholars—Feynman included—however, emphasize crises or the prevention of a crisis as a primary motivation for science

policy. This helps to extend the crisis thesis (that the government will often take decisive and unified action during crises) by demonstrating that the government will often initiate large scientific endeavors during crises. The communications theory discussed above generally agrees with crisis theorists that the government uses crises to justify or advance policy. These connections can be observed between these fields taken as a whole and between individual theories within the respective fields. For example, in the field of science, it appears to science policy scholars such as Sapolsky and Taylor (2011: 50) that the government scientists who work primarily in executive branch agencies frame policies in terms of crises to ensure continued support for research from the political branches, namely Congress with their power of the purse. This view dovetails nicely with Lowi's (1967: 315) theory of 'oversell,' discussed above, and Entman's (2004: 9-11) theory that frames tend to originate with the executive branch and 'cascade' down through the rest of the government to the media and finally the public.

These three topics, as discussed in the literature review, are independent academic fields but they are, clearly, interrelated. The connection between the fields, however, is seldom examined methodically and it is in this gap that I conduct my research. The crisis thesis helps to explain how and even why crises might be used to justify science policy; but rarely do crisis thesis scholars explicitly look at how this justification is communicated outside the government and to the public. Similarly, science policy scholars see how crises motivate science policy, but ignore how the policy is communicated. Conversely, communications theories tend to be more abstract and removed from specific policy areas. Entman (2004: 9-11), for example, uses his cascading frames theory to explain how foreign policy is communicated generally, rather than looking at specific aspects of foreign policy—those aspects, of course, are sometimes covered by the crisis thesis. Additionally, all three of these disciplines take for granted government behavior during non-crisis periods, focusing instead on crisis policy and communication.

This is where my research comes in. Using the crisis thesis and related literature to understand crises, I examine science policy discussed during crisis and non-crisis times. I then use the communications literature on framing and priming to analyze science policy press releases for the presence or absence of crisis-related justifications. I also look for the presence of other justifications, using the literature on science policy and specifically Feynman's quote in order to pick out what these other justifications might be.

I do all this to answer a simple question: *what justifications does the American government use to communicate science policy to the public?* I also answer two sub-questions: first, *does the government use the existence of crises or the threat of impending crises either to frame*

their policy or to prime the public to think a policy is necessary? Second, *what other frames / primes do they use to advance science policy?*

Answering these questions will help increase awareness of the nexus between science policy, communications theory, and the crisis thesis. This knowledge is essential to understanding how and why the American government spends billions of dollars of taxpayer money each year on scientific and technological research that may not offer any tangible results for the taxpayers. Equally, the increased understanding of how the government uses communications techniques and crises—or other rationale—to communicate science policy provides insight into the larger workings of government and into policy communication.

METHODOLOGY

In this section, I discuss my research strategy and tools. I also address the ethical concerns and possible methodological errors related to my research methods and the steps I took to mitigate these issues.

Research Strategy

In order to answer my research questions, I employ two complementary methodologies: analysis of case studies and semantic-pragmatic content analysis. Case studies can be considered to be a 'meta-method' (Johansson, 2003: 4) because a researcher can use any number of methods to analyze cases. A case, at its most basic, is a specific event or issue bounded by time and place (Ragin and Becker, 1992: 5). Case studies are generally considered to be most useful in the early stages of a study—hypothesis forming and pilot studies (Flyvbjerg, 2006: 220-221). They are, however, also useful alone or as a complement to other methods to prove or disprove hypotheses (Flyvbjerg, 2006: 223).

As case studies are, by definition, studies of select cases, they are more difficult to make generalizations from than other methodologies (Flyvbjerg, 2006: 227-228). This is not to say that generalizations are impossible (Flyvbjerg, 2006: 227), however there is a possibility that when a small number of cases are handpicked to demonstrate certain phenomena they may be black swans (Flyvbjerg, 2006: 231). Cases must be picked carefully to avoid basing generalizations on anomalies or they should be complemented by additional research (Flyvbjerg, 2006: 232-236). For the purposes of my research, simplified case studies of governmental policies will serve as a foundation for a more rigorous study using content

analysis. As such, I am not concerned with the risk of selecting anomalies; rather I want to use 'the power of the example' (Flyvbjerg, 2006: 221) to set the stage for the content analysis.

Content analysis complements case studies nicely as it is a systematic method for analyzing a large body of texts (Krippendorf, 2004: 3). In other words, 'the purpose of [content analysis] is to identify and count the occurrence of specified characteristics or dimensions of texts, and through this, to be able to say something about the messages…of such texts and their wider social significance' (Hansen, 1998: 95). Further, content analysis is well suited to analysis over time (Krippendorf, 2004: 12). I use this method in order to discover how the government articulates a specific type of policy over time.

As my research questions are broad 'what' questions, a semantic-pragmatic approach is best suited to answering them (Titscher et al, 2000: 63). Additionally, content analysis is well suited to my research because it looks at the breadth of the corpus in contrast to other methods of textual and discourse analysis, which look in depth at a narrower selection of texts (Titscher et al, 2000: 31-36). This broad but shallow approach can be a weakness; for example, content analysis says nothing about causation. My research questions ask nothing about causation, however, so this is not problematic for this study. In summary, as my research is aimed at analyzing the *content* of many years worth of government policy communications, it is logical to use *content* analysis as my primary methodology.

Ethics

Before discussing how I applied my chosen methodological tools, it is important to discuss the ethical concerns involved in conducting social science research. One of the main ethical concerns in case study research is protecting participants (Stake, 2003). As the subjects of my case studies are *public* documents—published governmental reports and presidential addresses—there are no concerns about this (Stake, 2003). Additionally, there are no concerns about consequences, such as job loss, for sources; all the cases I analyze involve presidents and other public officials whose job performance has already been judged by the public during elections (Simons, 2009: 78-79).

Similarly, there are few ethical concerns involved with content analysis. This is because content analysis is considered 'unobtrusive' as it deals with documents and not people and, therefore, there are few ethical concerns (Association for Education in Journalism and Mass Communication, 2014). In addition, the documents in question are all *published* governmental press releases, rather than private communications or other personal

materials, reducing the ethical concerns further (Association for Education in Journalism and Mass Communication, 2014).

The primary ethical concern with documentary analysis and case studies of public documents lies in the way the documents are sampled and the data are reported (Association for Education in Journalism and Mass Communication, 2014). As such, I aim to be clear and straightforward in my methods and result reporting. In light of this, the sections that follow detail the sources I use, my sampling strategies, the development of my research tools, and the inter-coder reliability for my content analysis framework.

Sources and Sampling

In order to identify sources for the case studies, I looked to the academic literature on science policy. I chose to examine multiple cases of crisis-time science policy that were discussed in the literature. Specifically, I selected cases in which science policy was articulated by or at the behest of the President in response to crises. I selected these cases because they help illustrate the main point of much of the science policy literature—that the government uses crises to justify science policy—thus providing powerful examples of this phenomenon and linking the crisis thesis, communications theories, and ideas about science policy.

As discussed above, these particular case studies are anecdotal in nature and, therefore, do not provide enough evidence to make generalizations about science policy over time. I selected 1992-2013 as my working time period. As the Cold War officially ended with the fall of the Soviet Union in December 1991 (Walker, 2004), January 1992 was a logical start date. This time period spans a period of relative peace and economic stability in the 1990s (Norton, 2014: 873-875), the military crisis triggered by the 9/11 terrorist attacks (Norton, 2014: 876-886), and the so-called 'Great Recession,' allowing me to examine science policy initiated under various national circumstances (Rampell, 2009).

I chose to examine digitized press releases from NASA's archives (NASA, 2014) rather than newspaper articles or other mediated documents. I focused on NASA, as analysis over time is more useful than analysis across agencies to answer my research questions. Additionally, NASA conducts scientific research that is costly and is rarely understood by the congressmen who fund this research (Goldston, 2011: 329). As a result, NASA generally must try harder to justify their policies to the public than, say, the National Institutes of Health. This makes NASA policy a particularly interesting and revealing test case of governmental science policy generally.

Examining every NASA press release issued since 1992 would be unfeasible and unnecessary. As a result, I chose to sample six press releases per year—one every other month—starting with January in even years and February in odd years. I did this to ensure that the sample was representative and did not coincide with 'any natural cycle' (Hansen, 1998: 104). Additionally, in order to reduce the bias that could result from hand-selecting press releases, I used a random number generator (Haahr, n.d.) to pick one press release for each sampled month (Hansen, 1998). This resulted in a sample of 131 press releases, as there were no available press releases for November 1992.

Research Tools

As mentioned above, case studies are a 'meta-method.' In other words, one or more methods may be used to analyze case materials (Johansson, 2003: 4). For my research, I use basic discourse analysis, focusing on the overall meanings and messages in the case materials. I also ensure that I ground the cases historically by presenting very brief analysis of the socio-political circumstances that led to the policies discussed.

The content analysis tools were somewhat more complicated to develop. I coded for twelve variables not including month and year (see Appendix 1). I looked at the type of science and policy involved, as well as the primary and secondary justifications given. I coded for the word 'crisis,' textually implied crises, and crises implied by the time period (see Appendix 2)—i.e. primed crises—as well as what type of crisis was referenced. Additionally, I looked at references to international conflict and competition. I developed this code based on findings in my pilot study that showed references to international 'races' in addition to more traditional military conflict. I also coded for countries/regions mentioned either here or as part of the 'international cooperation' justification. Similarly, based on the 'discovery' justification, I coded for references to 'origins,' 'creation,' and similar terms. Finally, I looked for references to 'real world' applications.

I opted to hand code press releases. This technique is significantly more time consuming than computer aided analysis (Cuilenburg et al, 1988: 66) and, therefore, limited the number of articles I analyzed. It also provided a level of flexibility as it allowed me to tailor my coding frame as I—as opposed to a computer—encountered content I had not been anticipating. Additionally, I chose to hand code because computers may not reliably recognize subtext (Krippendorf, 2004: 14). This was a special concern for my research because justifications are, generally, not explicitly stated. This is not to say it is impossible to use computers for this type of analysis. On balance, however, I was more comfortable with human coding, given the subjective nature of political communications, the flexibility afforded by hand coding,

and the practical fact that my sample of 131 press releases was small enough to be hand coded.

Inter-Coder Reliability

Before presenting my results, it is essential to assess the coding frame's reliability; the chances that multiple coders using the same coding frame will get the same results. To conduct this test I compared a second coder's coding results to mine using a simple agreement test (n_{agreed}/n_{total}). This test is best applied on nominal variables, which mine are, as it gives no credit for 'closeness' (Lombard et al, 2002: 591). Simple agreement test results can be inflated by adding extra categories that are easy to agree on (Lombard et al, 2002: 591). As such I have dropped these variables—year and month—from the test. There is no accepted level of agreement; scholars often use a 70 percent agreement threshold, although 80 percent is considered more desirable (Lombard et al, 2002: 593). When I piloted my coding frame, the overall agreement was in excess of 96 percent. I substantially altered the frame in order to reflect changes I made in the study after the pilot, however the agreement remained 95 percent overall, with no individual variable agreement dropping below 85 percent.

RESULTS

Below I discuss three short case studies as well as the results of my content analysis. Additionally, I present analysis of this data. I conclude with a discussion of the utility of my methodology and how I might modify it for use in future studies.

The Final Frontier: Science Policy Case Studies

Before turning to my content analysis data and results, I present three short case studies based on examples used by science historians to support the claim that crises are given as the primary justification for government science policy. These anecdotes help establish a preliminary answer to my primary research question and provide a foundation for my more intensive and generalizable research on the topic.

In November 1944, President Franklin D. Roosevelt observed, 'New frontiers of the mind are before us…' (Bush, 1945). He asked Dr. Vannevar Bush, an electrical engineer and Director of the Office of Scientific Research and Development (OSRD), to evaluate science's position in

the government after the War. Bush's response, a jargon-free report entitled *Science: The Endless Frontier* (1945), addressed Roosevelt's concerns with constant reference to national and social security frames. 'Scientific progress,' Bush (1945) wrote, 'is one essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living, and to our cultural progress.' In other words, he framed scientific research in terms of 'real world' applications and American cultural superiority. In the report, Bush (1945) outlines the need for a 'National Research Foundation' to guide science policy, funnel grant and scholarship money, and ensure continued 'long-range research on military matters.'

Scholars use Bush's report to explain the underpinnings of much of America's science policy; in fact they consider it the 'founding document of postwar science policy' (Wolfe: 26). This claim is apt, if a bit overbroad. Bush's National Research Foundation would come into being, with some alterations, as the National Science Foundation (NSF), one of the leading governmental science agencies. Additionally, his pipeline model of scientific development of 'real world' technology—'New products, new industries, and more jobs require continuous additions to knowledge of the laws of nature, and the application of that knowledge to practical purposes' (Bush, 1945)—has informed much of the government's policy when it comes to grant awarding for pure science (as opposed to applied science) (Bonvillian, 2011: 307). However, while it is clear that Bush's report provided the government with useful designs and justifications for science policy, it is unlikely that justifications—even those that echo *The Endless Frontier*—are all based on the document, especially over half a century later.

President Kennedy's, and later President Lyndon Johnson's, commitment to a manned space program does echo many of the sentiments put forward in Bush's report. In Kennedy's (1962a) speech at Rice University, given after the 'Special Message to the Congress on Urgent National Needs' mentioned above, he explained that '…the space effort itself, while still in its infancy, has already created a great number of new companies, and tens of thousands of new jobs.' Just as Bush would have predicted, research into pure science had—at least according to the President—spawned economic benefits.

Of course the space program was, in many ways, a military benefit in and of itself. Before the Rice speech, Kennedy (1962b) called on Congress, the scientific community, and the American people 'to take longer strides—time for a great new American enterprise…to take a clearly leading role in space achievement, which in many ways may hold the key to our future on earth.' This goal was essential, he explained, in order to help 'win the battle that is now going on around the world between freedom and tyranny…' (Kennedy, 1962b). Put another

way, Jerome Wiesner (1985: 24-25), President Kennedy's science adviser explained that the Apollo program had 'deep military implications' and 'very important political significance.'

The program was so politically significant because the Soviet launch of *Vostok I*—the first successful manned space mission—shook America's 'self-confidence in its security' (Walker, 2004: 115), causing the government to call on scientists to win the 'brain race' and the space race in order to ensure national security and supremacy (Walker, 2004: 117). In other words, *Vostok* 'served as … a "trigger event" for Kennedy…bringing him to the conclusion that the United States should win the space race' (Logsdon, 1970: 144). The fact that *Vostok* produced 'a crisis atmosphere' is, of course, essential 'in understanding why the decision was made at all and especially how the decision was made' (Logsdon, 1970: 144). It is this crisis atmosphere, of course, that makes the decision to go to the moon a possible anomaly rather than proof of a rule.

The terrorist attacks on September 11, 2001, like the *Vostok* launch, created a crisis atmosphere and elicited a similar response. While the geopolitical situation had changed drastically since the dissolution of the Soviet Union in 1991, the call to arms in the scientific community remained similar (Lucena, 2005: 3). At Argonne National Laboratory, a Department of Energy funded research facility, President George W. Bush (2002), echoing Kennedy's language to Congress, announced, 'to prevail in this war, we will fight on the frontiers of knowledge and discovery.' He went on to discuss his proposed Department of Homeland Security. One 'important' aspect of their mission would be to 'harness our science and our technology in a way to protect the American people' (Bush, 2002). Like Vannevar Bush's report before it, President Bush's speech emphasized the importance of advanced research on the scientific frontier because of science's power to ensure national and economic security.

As you can see, these three cases of science policy do *imply* that the government uses crises to justify their science policy. The circumstances that led to the policies discussed above—WWII, the Soviet launch of *Vostok I*, and 9/11—are clearly exceptional rather than the norm, and one cannot make a general rule based on exceptions. These anecdotes, therefore, are not enough to *prove* that the government uses crises to justify science policy.

Content Analysis Results

The data collected from 131 NASA press releases, unlike the analysis of the three case studies above, goes a long way towards proving that the government—or at least NASA—uses crises

to justify science policy and towards answering my first research sub-question. Before answering them, however, it is important to understand what science and policy measures NASA is trying to justify.

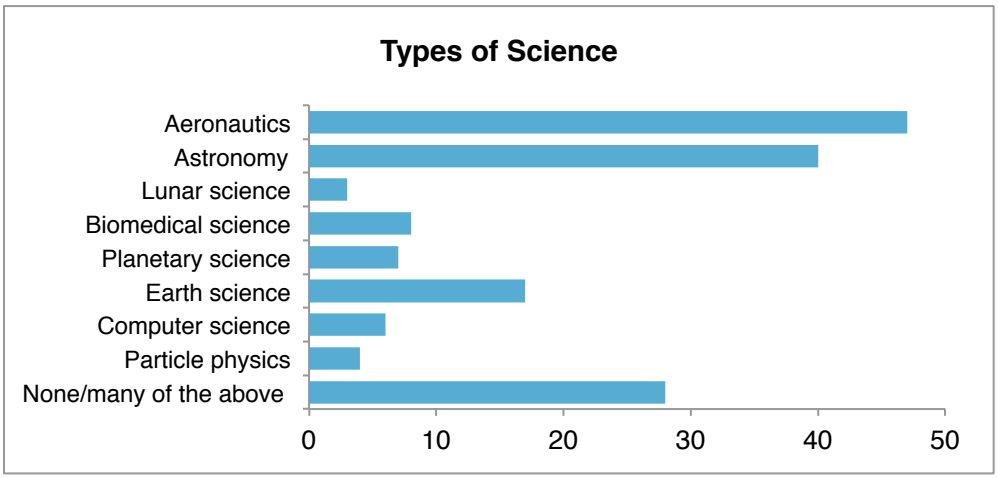

Figure 1

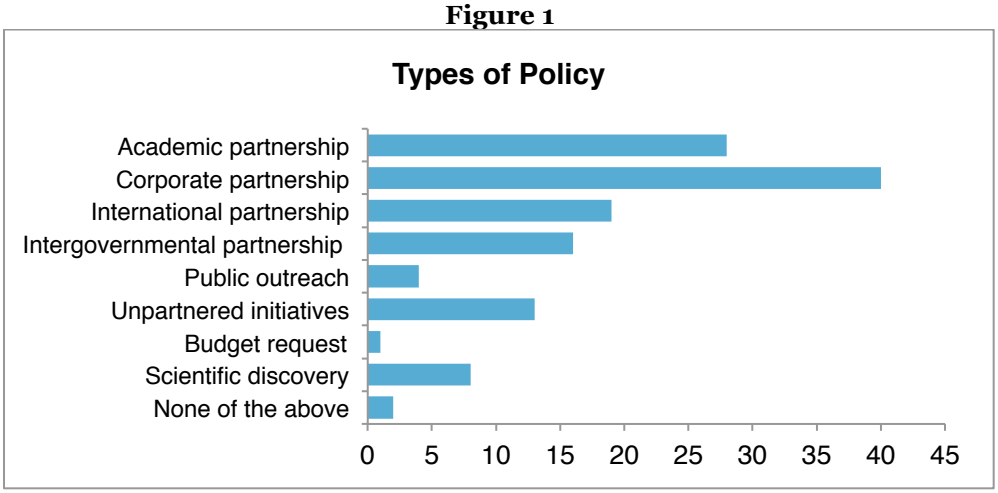

Figure 2

As you can see in Figure 1, NASA deals primarily with aeronautics / 'rocket science' and astronomy. They also, quite often discuss 'science' generally (coded as none / many of the above), usually in the context of science education. Their policies, as shown in Figure 2, are primarily partnerships with corporations, as well as with educational institutes ranging from research universities to public elementary schools. They also partner with other international agencies—typically other countries' space agencies—and with other American governmental agencies, such as the Air Force and the National Oceanic and Atmospheric Agency.

Of the 131 press releases on these varied topics, 44 contained an explicit or implicit reference to a crisis frame. These crisis press releases referred to multiple types of crises. There were military, economic, and superiority crises as I had expected based on the literature. There were also frequent references to environmental and meteorological crises such as hurricanes

and stray asteroids. Additionally there were a few references to internal crises, such as the Space Shuttle Columbia tragedy, and one reference to the 'Y2K' crisis (Bilton, 2009).

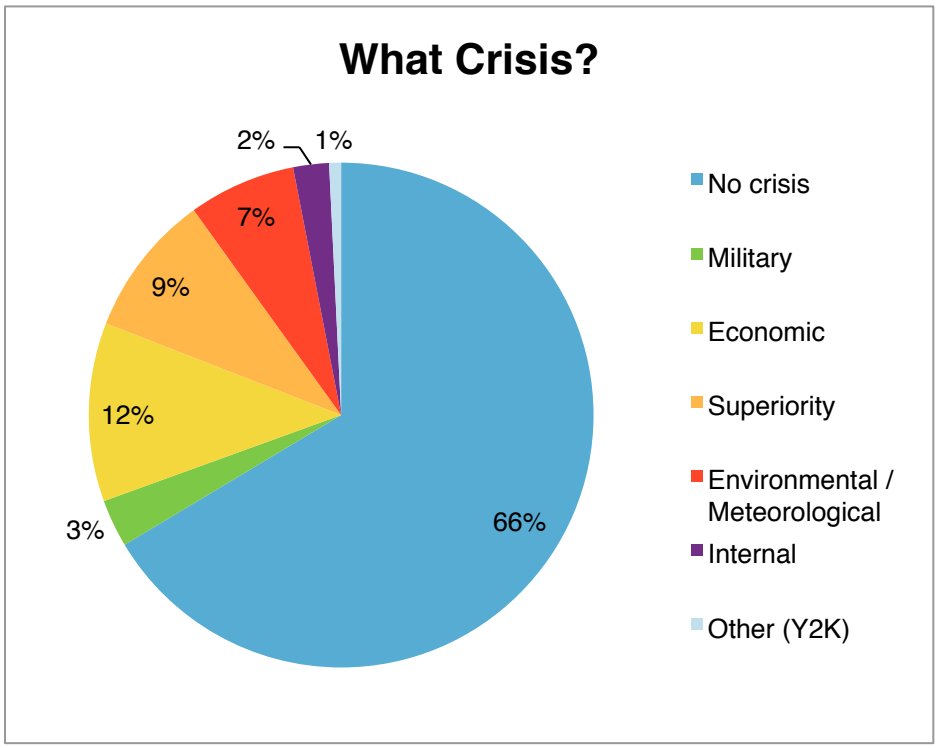

Figure 3

Figure 3 shows that economic crises are more often referenced than any other single type of crisis, with superiority and environmental crises coming in second and third, respectively. It is clear from this data that, with one-third of the press releases referring to some type of crisis, the government does use crises to justify science policy. In fact, crises are used to justify nearly every type of science—with the exception of biomedical science—and every type of policy (see Appendix 3, Figures 10 and 11).

Digging a little deeper, there is a strong and not unexpected correlation between time period and type of crisis referenced (χ^2 test p-value is 0.0005).

Figure 4(overleaf) shows that overall evocation of crises peaks in the early 1990s and again around 2010. In the early 1990s this spike was due to the presence of multiple crises—military instability and a crisis of superiority after the Cold War, and an economic downturn. After 2010, it is clear that the crises are financial in nature—presumably due to the sub-prime mortgage and Euro crises. In fact, in 2010 the only crisis referenced was the economic crisis. Other crises—primarily environmental crises—are referenced less frequently each year but are brought up most years.

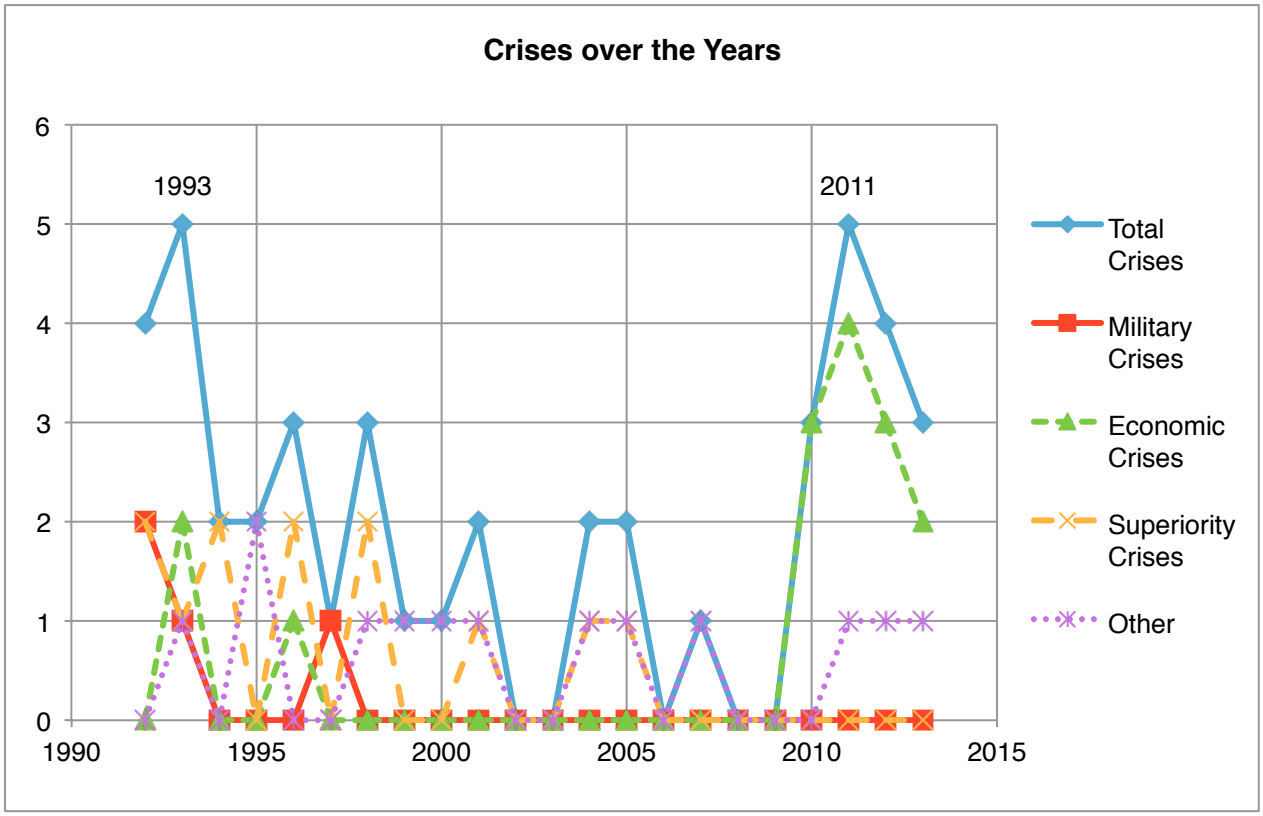

Figure 4

The government communicates these crises using various techniques—but only once did they actually use the word 'crisis.' In the other 43 press releases that mention crises, the government implied there was a crisis either textually or by references to the time period or both.

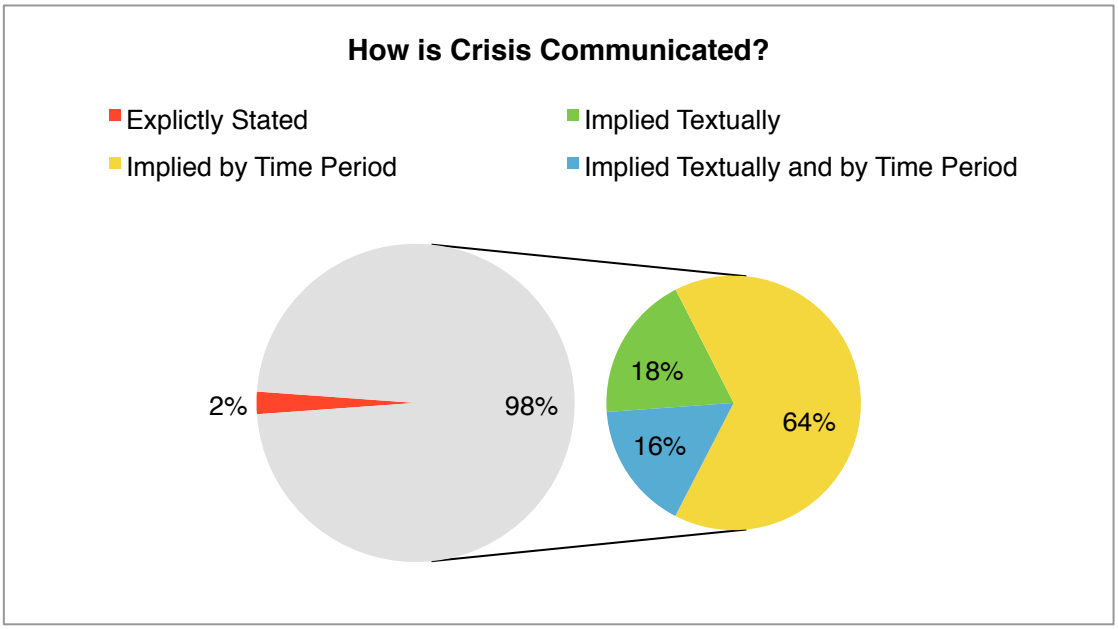

Figure 5

Figure 5 shows that 98 percent of the crises discussed were never explicitly called crises. Of that 98 percent, framing—that is the textual implication that there a crisis—was used 64 percent of the time (in 28 cases), while another 18 percent of the time (8 cases) the government relied on priming—that is, the assumption that the reference to a time period or just the occurrence during a time period is enough to evoke a sense of crisis in the reader. In the remaining 16 percent (7 cases) the government specifically used a crisis frame and relied on the time period to further evoke primed feelings of crisis.

The technique the government uses appears to be correlated with the type of crisis they are trying to evoke (χ^2 test p-value is 0.007).

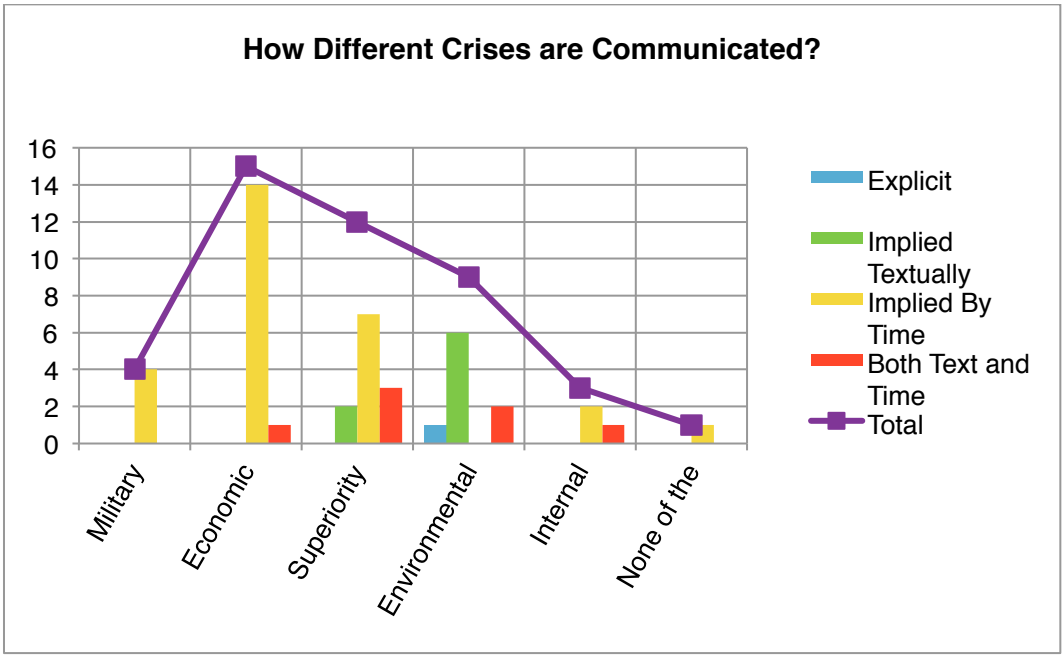

Figure 6

As in Figure 3, Figure 6 shows how many of each type of crisis is communicated (the purple line). It further shows how each type of crisis is communicated. For example, military crises are only implied by the time period—primed—while environmental and meteorological crises always have some textual element. This is sensible; military crises are, presumably, pervasive, while environmental and meteorological crises may require more verbiage to ensure that the crisis frame is properly conveyed. Clearly, **the government uses crises to frame their policy or to prime the public to think a policy is necessary.**

Turning to the second sub-question of what other specific frames or primes are used, I was struck by the frequent appeals to real world applications. In other words, NASA often frames a particular scientific policy as having real world applications in order to prime the audience

to think that the policy is justified. I also noted a lack of appeals to international competition—a coding value that I added during my pilot study because of references to 'global race' for clean energy (Department of Energy, 2012) and similar evocations of international conflict and competition in other agency press releases included in the pilot sample. The few times there are appeals to international competition and conflict it is in order to justify policies by priming the audience to feel that the policies are important and potentially urgent. It is, perhaps, a less dramatic version of the crisis frame discussed above, which can be used instead of a crisis or to further augment one.

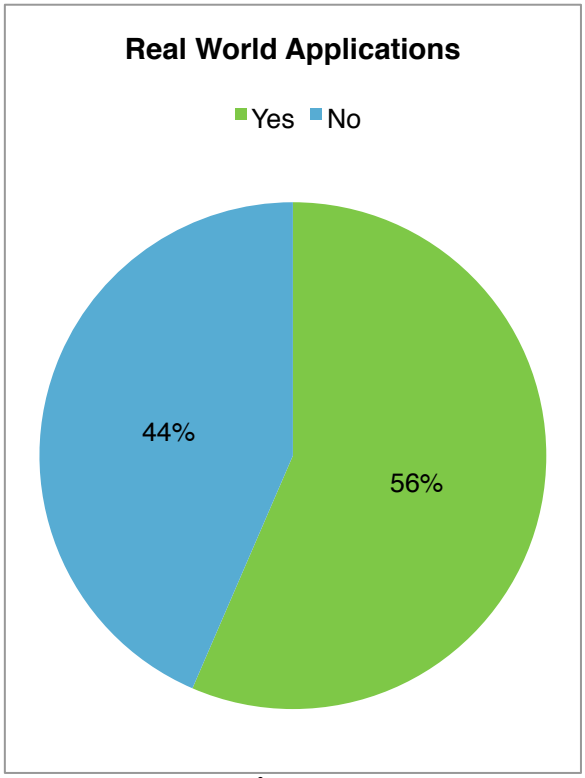

Figure 8

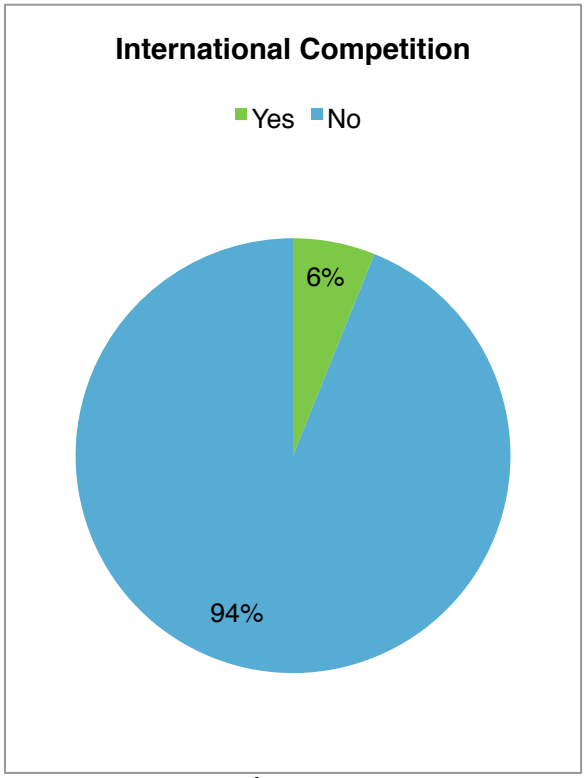

Figure 7

Figure 7 shows that NASA refers to the 'real world' applications of their policy in well over 50 percent (or 74) of the press releases. Real world applications—as opposed to academic or military applications—turn up so often, in fact, that they are used to justify every type of science and policy advanced by NASA (see Appendix 3, Figures 12 and 13). Figure 8 shows that they only referred to international competition or conflict in 6 percent (or eight) of the press releases. This shows that real world applications are a more important—or at least thought by NASA to be a more useful—justification for NASA's policy than international competition. Still, *it is apparent that NASA uses these two frames, in addition to crises, to justify policies.*

Crises, real world applications, and international competitions are specific frames and evoke specific primed reactions, however they are not generally justifications. Justifications, as I coded for them, are broader excuses for policies that may or may not be paired with narrower crises, international competition, and real world application justification frames. I coded each document for two justifications in order to ensure that no justification was overlooked.

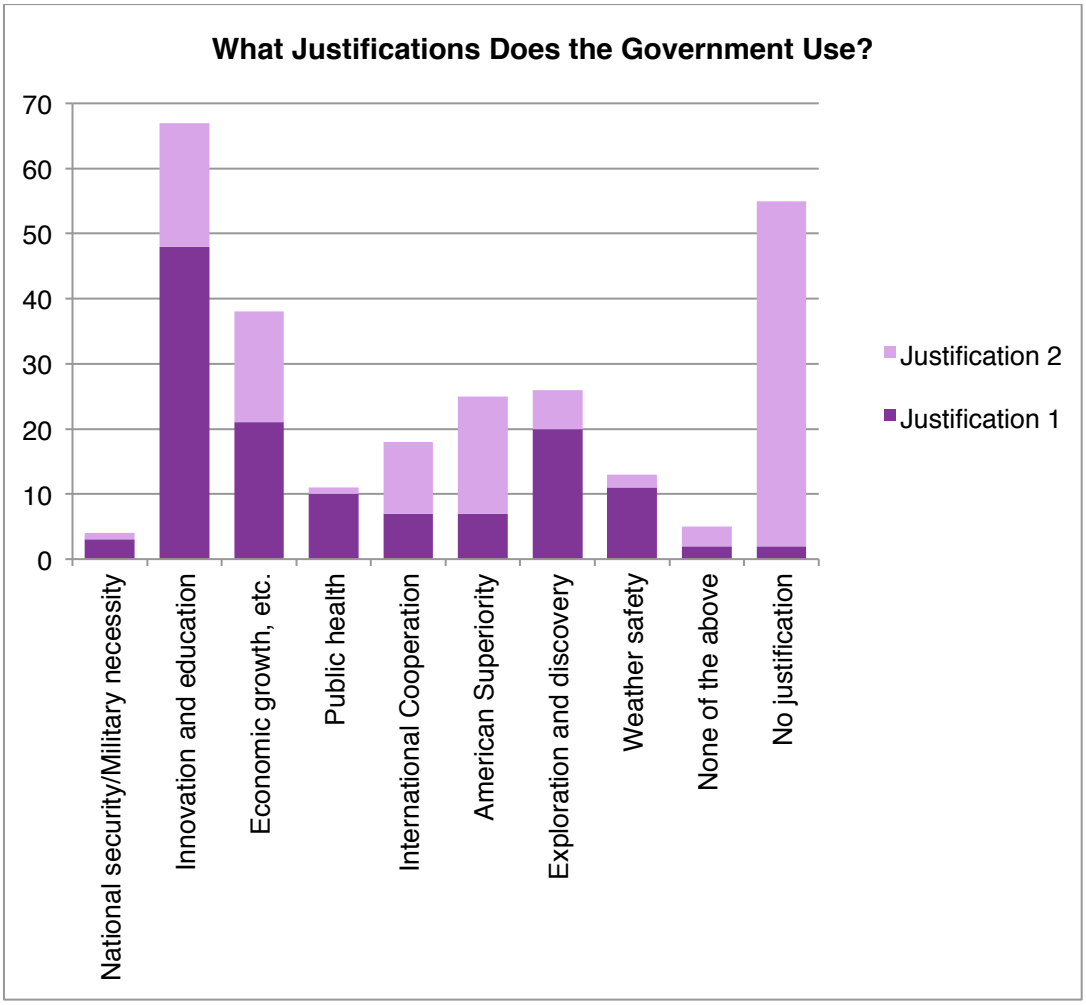

Figure 9

When taken together, as in Figure 9, it becomes clear that the government used certain justifications more than others. 'Technological innovation and education' is the most used justification by far. 'Economic growth, jobs, and corporate investment and vision' is the next most cited justification, with 'exploration and discovery' coming in third. I have, of course left 'no justification' out of this discussion because, as Figure 9 shows, often no second justification is given; only two policies, however, give no *first* justification.

While this clearly answers my main research question — what justifications does the American government use to communicate science policy to the public? — it is interesting to drill down further to see when these justifications are given. For example, many of the justifications are, logically, paired with certain types of science. Biomedical research is, for instance, most often first justified by medical necessity. Similarly, there is a relationship between policy and first justifications. Corporate partnerships are, unsurprisingly, most often justified by a discussion of their economic benefits; economic justifications are, in turn, most often cited to justify corporate partnerships, although innovation and education are cited frequently in these cases as well. Likewise, international partnerships are most often justified with claims of increased benefits from international cooperation.

Like justifications and policies, general justifications are often paired with the expected crisis. For example, weather safety justifications often coincide with evocations of weather-related crises (see Appendix 4, Figure 14). Similarly, justifications related to corporate and economic investment are given when economic crises are evoked. American superiority crises, on the other hand, are an exception to this rule and are often *not* cited when American superiority is used as a general justification (see Appendix 4, Figure 15).

Not all detailed examinations of this data are useful. I coded for the region mentioned thinking that it might have some relationship to the crisis and international competition frames discussed above or the international cooperation or American superiority justifications. At least in the case of NASA, however, region has no statistically significant correlation with any frames or justifications of science policy.

One final justification bears further examination: 'exploration and discovery.' This justification is used to justify every type of science except computer science and every type of policy except for budget requests. As this justification was so pervasive, I added a variable to code for references to concepts like 'creation' or 'origins of life' when discovery was given as a first or second justification. While there were only five mentions of these ideas in the 29 press releases that mention exploration and discovery, it seems telling that NASA justifies policies and scientific endeavors in outer space by describing how they can explain human existence. It is even more telling that there is a weak negative correlation between references to creation and references to real world applications (χ^2 test p-value is 0.12). This means that there were fewer references to real world applications in press releases with references to origins.

Analysis

The first finding from these results is that crises are used much less often than the case studies and the academic literature on science policy would imply. This is not to say that they are not used. One-third of the sampled press releases cited some type of crisis in addition to, or to support, more general justifications; that is not insignificant. Scholars such as Sapolosky and Taylor (2011), Wolfe (2013), and Marburger (2011), to name but a few, however, would have predicted more. They all noted the link between crisis and science during the Cold War and they all assumed that the link had remained strong since then, citing the competitiveness crisis and the conflation of national superiority with national security (Marburger, 2011: 13-14). Even Greenberg (2001: 7), the one scholar to stress the importance of the real world applications that motivate science policy, sees that national security and economic crises play a major role in science policy. Crises overall play a large, though perhaps not major, role in justifying science policy. With only 31 military, economic or superiority crises, however, these scholars are not describing the whole picture.

Sapolsky and Taylor (2011: 50) do touch on one thing that is missing from much of the scholarly literature: crises come in many forms. They mention environmental and energy crises as well as certain medical crises, saying that any crisis can and will be used. The fact that there were nine environmental and meteorological crises, three internal crises, and one indefinable crisis—Y2K—supports their claim. That said, Sapolsky and Taylor (2011: 50) imply that the government depends almost solely on crises to justify science policy and this is clearly not the case.

Another piece that is missing from the academic literature on science policy, including Sapolsky and Taylor's (2011) work, is the government's reliance on real world applications as justification for science policy. As I alluded to above, Greenberg (2001: 7) briefly mentions real world motivations for science policy. Using his main case study of the International Space Station, he sees that the government relied not only on the ISS's potential to increase national security, but also on its pork barrel benefits (Greenberg, 2001: 414). Congressional pork—the distribution of funds and earmarked projects to specific constituencies—is one example of a real world application of science policy.

Not all real world applications are as political as Greenberg's (2001) example would imply. In fact many of the real world examples cited in the press releases were direct products of the science. As former NASA Administrator Daniel Goldin (quoted in NASA, 2000) explains, 'What most people don't know is that [NASA's] efforts to open the space frontier are largely based on our quest to understand our own planet.' For example research grants for use of

NASA's bioreactor to simulate microgravity conditions in order to stimulate cell growth has led to advances in cancer research (NASA, 1995). Similarly, the development of an ultra-light, solar powered aircraft will enable scientists to make more accurate weather predictions, monitor forest fires, and even 'provide early warning of crop damage' (NASA, 1998). Of course some applications are less tangible, especially investment in education to form the future workforce. As NASA's Deputy Associate Administrator for Education Programs Clifford Houston put it in a 2003 press release, 'One of NASA's core goals is to inspire the next generation of explorers, a diverse group of young people who will replenish our aging workforce.' Similarly, NASA provides financial, technical, and personnel support to the FIRST robotics competition in order to allow and encourage grade school students to 'investigate careers in the sciences and engineering' and to allow NASA to discover the 'leaders of tomorrow' (NASA, 2011). Digressing slightly, my coding frame combined technological innovation and education into one justification. It was documents such as this one discussing FIRST that made me link these topics; I feel that separating them into two separate justifications, however, would have allowed me to make a more accurate analysis of issues such as the link between education and real world justifications.

Some real world applications, on the other hand, are not intangible so much as they are farfetched. For example, when announcing the 2001 decision to green-light MESSENGER, the first Mercury orbiter mission, NASA (2001b) justified the mission by explaining, 'unlocking Mercury's secrets will help us understand the forces that shaped Earth and the other terrestrial (rocky) planets.'

It makes intuitive sense that real world applications would be an important tool for justifying science policy. Most of the government and the public are not trained in advanced science and have a limited interest in such matters (Goldston, 2011: 329). As a result, if abstract scientific research into Martian ice caps can be framed as relevant to understanding permafrost regions on Earth (NASA, 2005), then certainly it is easier for the public to see the importance of the policy and, therefore, it is easier for NASA to justify a mission to Mars. The logic behind justifying policies based on their important real world applications is quite similar to the logic that it is easier to justify a policy if its importance is indicated by the presence of a crisis.

As you can see, various types of real world applications are mentioned in 74 of the press releases analyzed. That means that in 56 percent of the cases the government uses real world applications as part of the justification for science policy. Certainly Marburger's (2011) limited treatment of this topic does not do it justice—yet it is the only literature to place any

importance on real world applications as a justification at all. It is obvious that this substantial gap in the literature demands further exploration.

A related point that begs further research is the slight negative correlation between the real world application frame and the 'origin' framing of discovery and exploration justifications. When I started reading press releases as part of my preliminary research—well before I started coding them—I noticed that there were occasional references to discovering our 'origins' (for example NASA, 1999). Scientific discovery, as it is presented in Vannevar Bush's report, President George W. Bush's speech at Argonne National Lab, and Goldin's quote above, is conducted at the frontier of knowledge. It is a push further away from what we know. To learn about the origins of humans, earth, and the universe takes us past anything we know, and is a logical frontier to explore.

This frame is used infrequently—only five press releases mention it—however it seems to be quite powerful. In four of the five cases, it was given as the first justification and emphasized throughout the press releases. In these same four releases, no real world applications were mentioned. In the fifth case, the government seemed to be throwing every excuse at the wall; they used both these frames and also alluded to an economic crisis. While five cases is a very small sample, it does seem telling that 80 percent of them *do not* mention real world applications when in the whole sample 56 percent *do* mention them. I believe this is the case because the 'origins' frame primes the public to see a policy as important based on the human drive to understand where we come from, just as the real world applications frame primes the public to see a policy as important because it could help cure cancer or encourage children to study science or something equally earth-bound and comprehensible. Had I fully appreciated the importance of this frame before conducting this analysis, I would not have tethered it to the discovery justification as I did. While I am inclined to believe that the 'origins' frame is used primarily, if not exclusively, when discovery is given as a justification, I may have missed associations with other justifications.

As discussed above, superiority crises were only discussed in 12 press releases. However, American superiority, without a hint of crisis, was cited as a justification 19 times, and another six times in conjunction with superiority crises. There is a noticeable increase in superiority justifications starting in 2010 associated not with superiority crises but with the economic crisis. I speculate that this is because national and economic security are often conflated with national superiority. As discussed above, this is not enough to result in a strong presence of crisis frames during the 1990s and 2000s as predicted by Marburger (2011: 14) and others. However this connection between economics and superiority may have caused NASA to justify policies during the 'Great Recession' by appealing to a sense of

American superiority as a tacit way of reminding the public that, even during the economic downturn, it is important to spend money to ensure that America remains superior.

Similarly, in December 2001, only three months after the September 11 terrorist attacks, NASA (2001a) announced that the campaign theme for the upcoming yearlong celebration of the 100th anniversary of the Wright brother's first successful flight would be 'Born of Dreams—Inspired by Freedom.' In other words, in order to justify their policy NASA invoked a sense of national pride rather than using a crisis frame when Americans were concerned about national security. Notice how this language echoes President Kennedy's (1962a) call to 'win the battle that is now going on around the world between freedom and tyranny…' made just after the *Vostok* launch shook Americans' confidence in national security. One difference, of course, is that NASA is telling Americans to be 'inspired by Freedom' whereas Kennedy is asking them to fight for it—thus NASA avoids using a crisis frame while Kennedy embraces it. This difference stems from the fact that, as Entman (2004: 95) points out, the Cold War provided an overarching crisis framework, but 9/11 has not.

It seems likely that the shift away from the Cold War paradigm has caused a shift away from appeals to crisis and to other justifications such as American superiority. This change of mentality may also account for other results. For example, it may explain why, when there are crisis frames, they are unlikely to be military in nature, even when the U.S. does have troops on the ground abroad. Additionally the shift from a Cold War, bipolar world to a globalized one may illuminate why region is not associated with crisis—or any other variable—in my data set. Finally, it may account for one inter-coder reliability issue.

The second coder identified three more cases of American superiority as a justification—one more as Justification 1, two more as Justification 2—in the 33 documents she coded than I identified. While this demands further investigation, I hypothesize that this is due to the fact that she, as a baby-boomer, was primed to see space travel as associated with American superiority because she grew up during the Cold War. I, on the other hand, lived my formative years after the Cold War and, therefore, am slightly less likely to see evocations of American superiority in space policy.

A related inter-coder reliability issue could have been solved by adding a third justification code—I coded for two—to account for the fact that there were, occasionally, more than two justifications given. For example, there were cases where the second coder coded a justification I saw but did not code for, as I believed two other justifications were more important—allowing for a tertiary justification as I did in my pilot study might have avoided this problem. I removed the third justification after the pilot because it made the coding

process and data analysis unwieldy while adding little value. However, in this study I feel it might have allowed for a slightly more refined analysis of issues such as the presence of superiority justifications. On balance, given the high level of inter-coder reliability and the quantity of useful data from my study I do not regret leaving out the tertiary justification code however I would consider adding it back in if I were to do the study again.

If I had the coding to do over again, I might also code justification for explicitness—as I did with crises. In this way I would have been able to analyze what general justifications are explicitly stated, implied by the text, or implied by reference to external circumstances. This might have given me more insight about how the government uses different communications techniques to communicate all their justifications, instead of just those related to crises, real world applications, and—to an extent—discovery.

While I would make these discussed changes in a future study, the coding frame I used was sufficiently refined to answer my research sub-question related to communications; the government does use crisis frames and priming techniques. Additionally, I discovered more than I anticipated regarding other frames and primes; as discussed above, the government uses the real world applications frame to help the public understand science and related policies, as well as 'origin' frames to evoke primed associations with the importance of understanding where we come from. I was also able to examine how often the government uses nine different justifications (see Figure 9) regardless of what framing and / or priming techniques are used to communicate them. Finally, by looking at these nine justifications, as well as the three additional frames, I am confident that I have comprehensively examined all major, and some minor, justifications used by NASA to communicate science policy.

CONCLUSION

The goal of this paper was to gain an increased understanding of the way in which the American government communicates science policy. In order to achieve this goal, I first examined literature on the crisis thesis of government behavior. This theory states that the government will implement large and often questionable policies during crises because crises create an atmosphere that enables consensus within each branch (Lowi, 1967: 300), between the branches (Posner, 2006: 37), and between the government and public (Lowi, 1967: 300).

I then turned to literature on communications, which shows how the government can create crises, what Lowi (1967: 300) calls 'oversell,' by framing challenges as crises. Framing is, at its most basic, a method of explaining an event or policy in such a way as to tell people how

to think about it (Entman, 2004: 26). Framing often works by priming—the method of evoking a primed, or pre-programmed, emotional response or other reaction—the audience to have a positive reaction to a policy, though priming may also be used alone (Scheufele and Tewskbury, 2007: 15).

Finally I looked at literature on science policy. This field is underdeveloped compared to crisis theory and communications theory, with scholars focusing more on history than theory. The leading consensus across the literature, based on thorough analysis of American political and scientific history, says that the government—and scientists themselves—will use crises in order to justify science policy (for example Lucena, 2005; Mann, 2000; Wolfe, 2013). Additionally, like Lowi's 'oversell' theory, the literature on science policy sees the government as manipulating circumstances to justify policy, typically by creating crises.

Based on these theories, I sought to find out what justifications the government uses to communicate science policy and how, specifically, they use crises and other frames. Using preliminary case studies I saw that the government—as all the literature seemed to predict—used crises to justify science policy. I then applied a rigorous coding frame to 131 NASA press releases, proving that the government justifies science policy by using crises—as both frames and by evoking primed responses—though not as frequently as the literature implies. They also use the real world applications frame and the 'origins' frame to justify policy, neither of which are discussed in the literature**.** Additionally, NASA uses more general justifications, such as education, economic investment, and American superiority to explain science policy.

This research provides a glimpse into a lesser-understood area of government policy that costs billions of dollars a year and has produced, arguably, some of the most spectacular feats humankind have accomplished. This study, of course, has only examined one facet of government policy. As such, there are many directions for future research, including further investigation of science policy communications—perhaps by looking at other agencies' communications—or moving on from science policy to determine whether the government uses these frames outside of science policy in areas such as military or education spending.

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APPENDICES

Appendix 1: Coding Frame

Year: Enter year

Month: Enter standard numerical value for month (i.e. May=5)

Policy Type: (if multiple policies mentioned, code for most emphasized)

Academic partnership/ scholarship/award	**1**
Corporate partnership/ prize/award	2
International partnership	3
Inter-governmental partnership (i.e partnerships with military)	4
Public outreach	5
New initiative / extension of existing initiative (w/o specific mention of partnerships)	6
Budget request/ Congressional testimony	7
Announcement of scientific discovery	8
None of the above	9

Type of Science:

Engineering / 'rocket science' / aeronautics	1
Astronomy / space science	2
Lunar science	3
Biomedical / health science	4
Planetary science	5
Earth / environmental science	6
Computer science	7
Particle physics	8
None of the above / multiple types	9

Justification One:

National security / terrorism prevention	1
Technological innovation / education	2
Economic growth / investment / jobs / corporate vision / financial reasons	3
Public health / medical advancements	4
International cooperation	5
American superiority	6
Military necessity	7
Exploration / discovery	8
Meteorological / environmental safety / protection	10
None of the above	9
No justification	0

Justification Two:
Same code as above

If discovery, are words such as "origin," "creation" etc. used?

Yes	1
No	2
None mentioned	0

International conflicts / competition mentioned (ie. troops in Iraq or space race with USSR):

Yes	1
No	2

If country other than U.S. is mentioned for any reason, what country/region?:

Western Europe	1
Russia / Eastern Europe / Former Soviet Satellite States	2
Asia	3
Middle East	4
South America	5
Canada	6
Russia and another area	7
Other (combos)	9
None mentioned	0

Word "crisis" used?

Yes	1
No	2

Any type of crisis implied textually?:

Yes	1
No	2

Over→

Any type of crisis implied—not textually, but by your understanding of the time period or reference to another time period (refer to Major Events Reference Sheet)?:

Yes	1
No	2

What type of crisis is explicitly or implicitly discussed?:

Military	1
Economic	2
Superiority (i.e. lagging in international competition)	3
Environmental / Meteorological	4
Internal (i.e. budget, operational)	5
None of the above	9
No crisis	0

*'Real world' applications discussed? **Not** including military. (i.e. observations of Venus will help scientists understand volcanoes OR development of commercial or medical applications.)*

Yes	1
No	2

Appendix 2: Major Events Reference Sheet

1990s: Concerns about global competition in technology and other markets increase

December 1991: Soviet Union dissolves

January 1992: polling shows that 80% of Americans rate economy as "fairly" or "very" bad

November 1992: President George H. W. Bush defeated by Bill Clinton

Mid-1990s: Federal deficit declines; economy recovers from early-1990s low

April 1995: Oklahoma City bombing – the worst terrorist attack on US soil to that time

1995: American troops sent to Bosnia as a peacekeeping force

Late 1995-early 1996: Government shutdown due to budget crisis

November 1996: President Bill Clinton reelected

1999: Concerns about Y2K bug

August - September1999: Hurricanes Dennis and Floyd East Coast

November 2000: George W. Bush elected president

September 11, 2001: Terrorist attacks on the World Trade Center and Washington, D.C.

2001 - present: American "War on Terror"

February 1, 2003: Space Shuttle *Columbia* disintegrates on re-entry – Shuttle program suspended until 2006

2003: Operation Iraqi Freedom commences

November 2004: President George W. Bush reelected

August 2005: Hurricane Katrina devastates Gulf Coast

December 2007: Sub-prime mortgage bubble bursts – US plunged into "Great Recession"

November 2008: Barack Obama elected president

2009: Euro Crisis starts

April 2010: BP Deepwater Horizon oilrig explodes in the Gulf of Mexico – considered the largest marine oil spill in history

September 2011: Occupy Wall Street movement begins, in response to continued economic stagnation

November 2012: President Barack Obama reelected

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Appendix 3: Crisis as a Justification for Science and for Policy & Real World Applications as a Justification for Science and for Policy

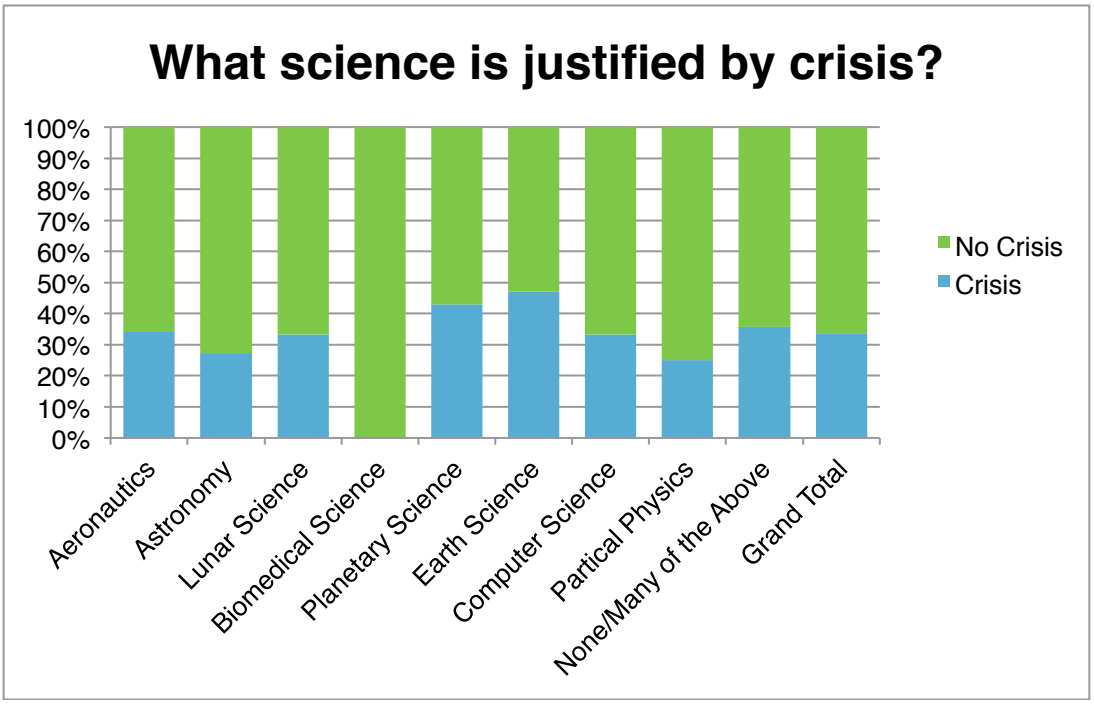

Figure 10

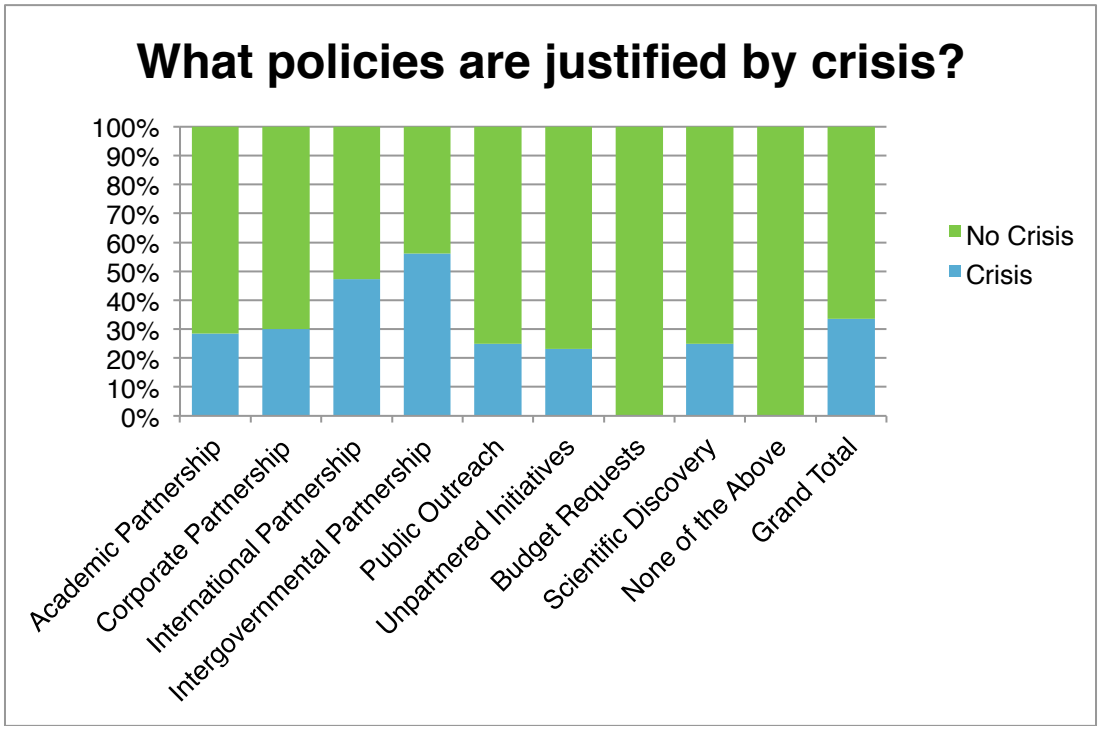

Figure 11

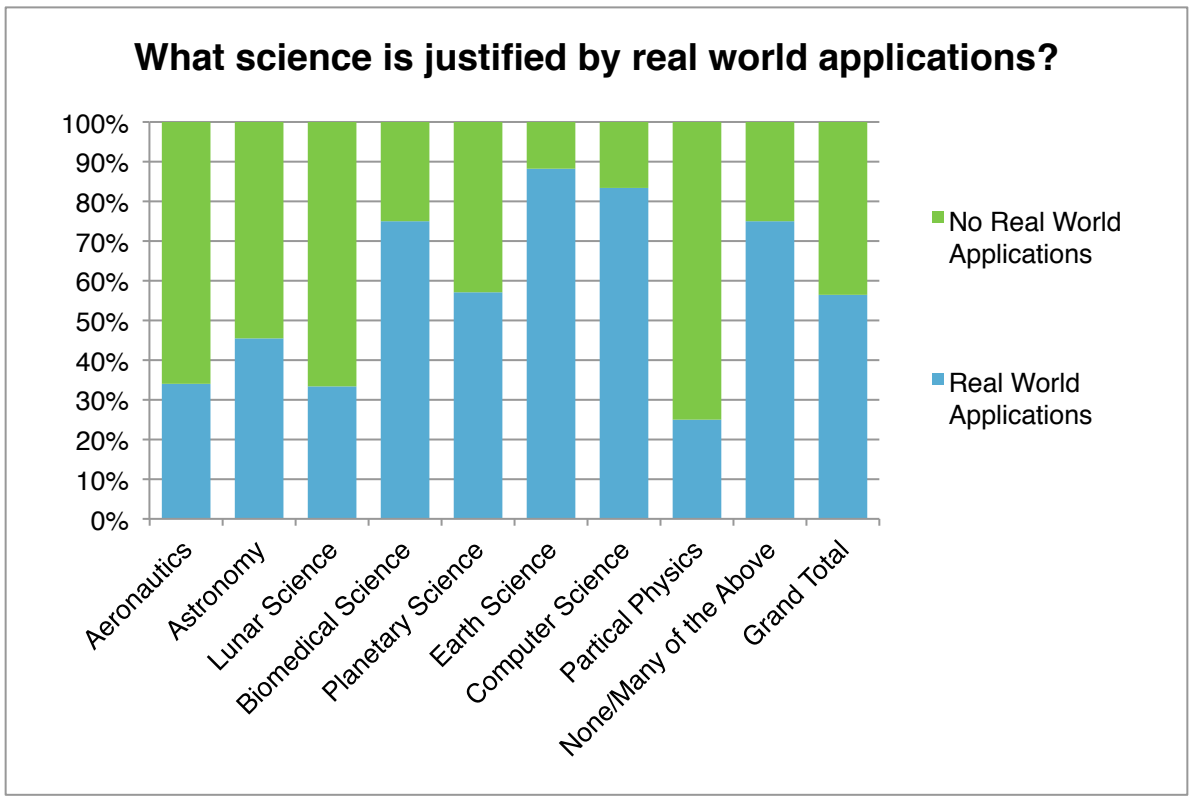

Figure 12

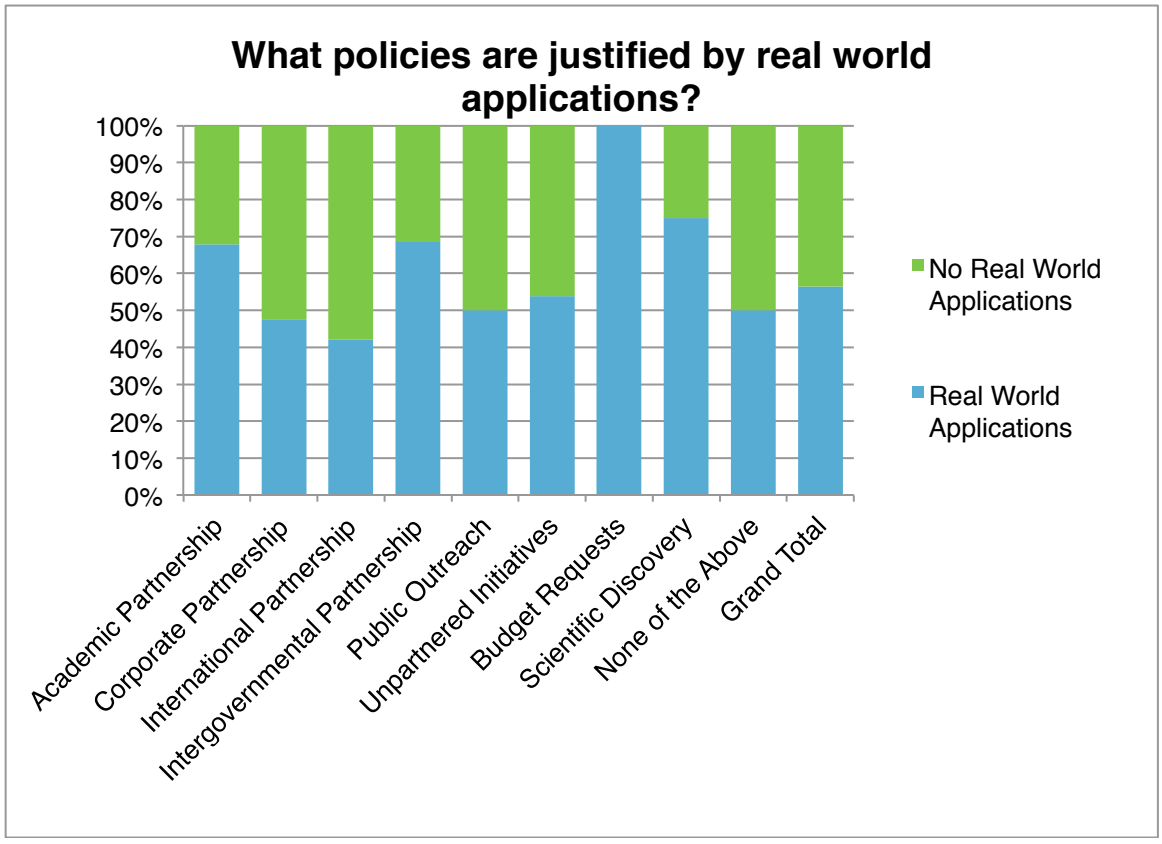

Figure 13

Appendix 4: Justifications and their Related Crises

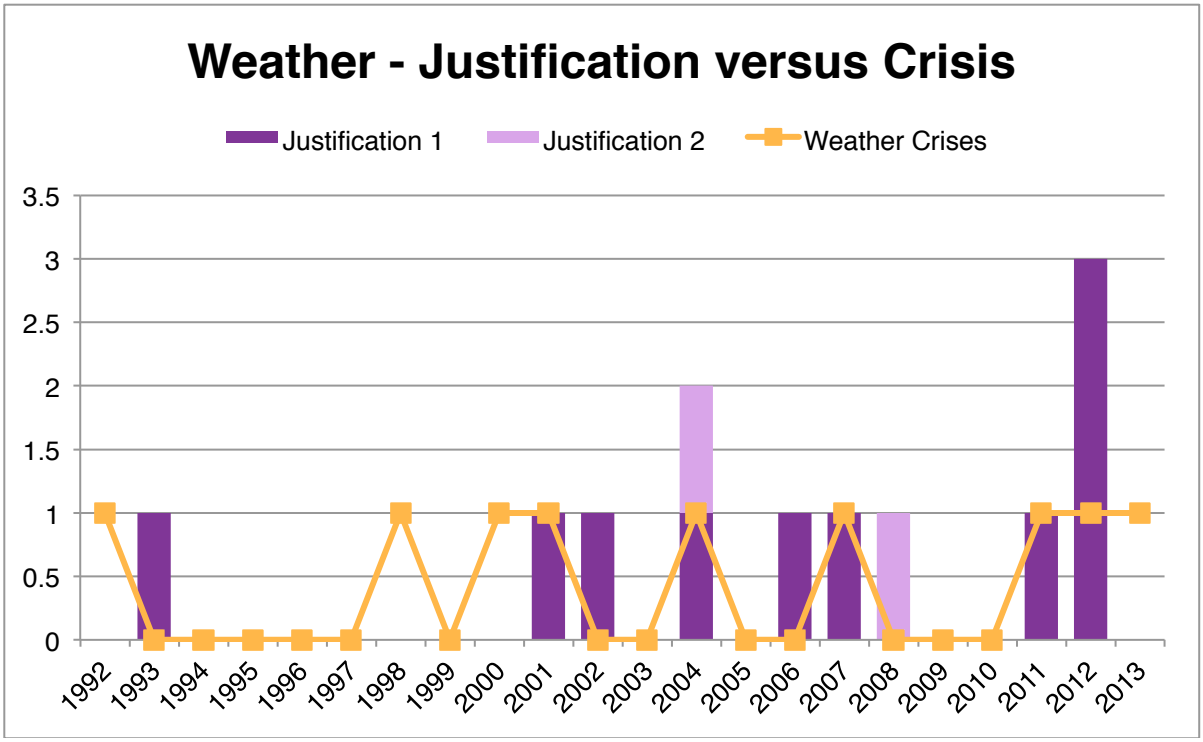

Figure 14

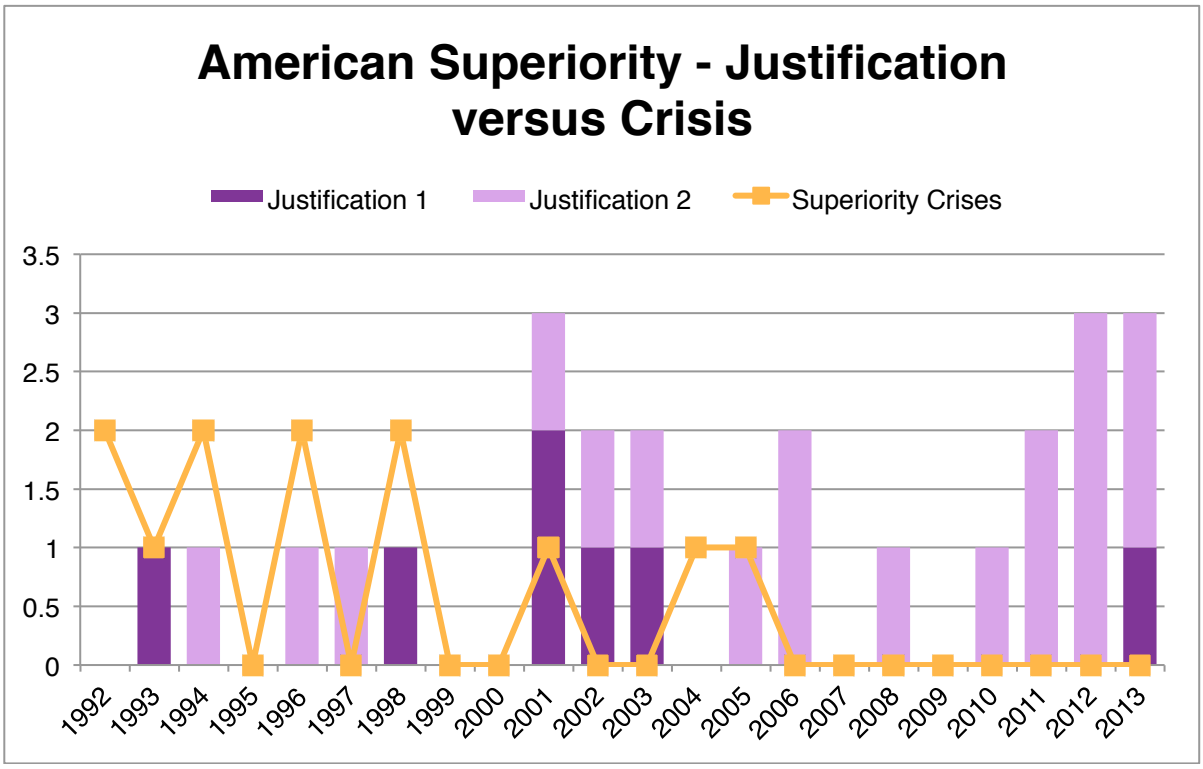

Figure 15

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