"Chernobyl. Fukushima. Indian Point?" The Impact of Analogy on Attitudes towards Nuclear Power

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Abstract
The Narrative Policy Framework (NPF) asserts that "policy stories" serve as strategic tools to shift public opinion in favor of policy preferences. They do so through the use of common elements including characters, settings, plotlines, and morals of the story. One element that has received little attention thus far is analogy, though analogies frequently appear in policy stories. This research examines the empirical effects of exposure to analogy on public opinion related to nuclear power using data from a national-level survey of 2,544 U.S. adults conducted by the Marist Poll. In a split-sample design, respondents were exposed to narrative prompts that discussed nuclear power generally or with reference to past accidents at Three Mile Island, Chernobyl, and/or Fukushima, and then asked about their views on nuclear energy. The results indicate that the effects of analogizing are limited, as attitudes are not significantly more negative for participants that are exposed to negative analogies for most groups. However, there are interesting interaction effects between analogy exposure and partisanship. Republicans were significantly more likely to profess support for nuclear power and attest to its safety when primed with negative analogies, suggesting the existence of confirmation bias and partisan entrenchment on the issue.

Introduction

On March 11th, 2011, a 9.0 magnitude earthquake struck off the Northwestern coast of Japan, triggering a tsunami that, by some reports, reached wave heights of up to three stories. The resultant devastation knocked out power to the electrical grid servicing the Daiichi and Daini nuclear power plants in Fukushima Prefecture, 150 miles north of Tokyo, causing elevated radioactive emissions and reactor core meltdowns. Within days of the disaster, the world widely acknowledged the nuclear accident as the worst since the meltdown at Chernobyl, Ukraine in 1986.[1] This comparison was not lost on U.S. anti-nuclear activists. In an odd twist of fate, the 25th anniversary of the Chernobyl tragedy came just 6 weeks after the tsunami in Japan, while the country still struggled to get the damaged plants under control. In response, Greenpeace dispatched a marine research vessel to monitor sea radiation, announcing that "Exactly 25 years after the Chernobyl nuclear disaster, the *Rainbow Warrior* is on her way to another disaster that will keep reminding people of the dangers of nuclear power for at least the next 25 years" (Teuling 2011). Similar messages linking Fukushima to dramatic historical events (and, at times, predicting likely future accidents at prominent nuclear sites in the U.S.) were a common element of anti-nuclear advocacy in the immediate aftermath of the disaster.

In many ways, the events of March 11th, 2011, opened a window for anti-nuclear advocates to advance their campaign for a transition away from nuclear power. These activists quickly exploited this opportunity, knowing that framing the nuclear question through the lens of Fukushima would raise both visibility and fear. In the U.S., the anti-nuclear lobby wove a crisis narrative that linked Chernobyl, Fukushima, and several high-profile nuclear plants then operating in the U.S. – including Vermont Yankee, Indian Point

(NY), and San Onofre (CA) – in a way that suggested a chronology of past, present and imminent nuclear disasters. On April 26th, 2011, the 25th anniversary of the Chernobyl accident, travelers at New York City's Grand Central Station were greeted with a Greenpeace banner reading, "Chernobyl. Fukushima. Indian Point?" The impending doom implicit in this message is clearly attention-grabbing, but is it effective as a means to move public opinion? If so, what exactly do those effects look like, and do they operate differently for different populations?

Despite the potential import of this rhetorical strategy, little research has been directed at empirical analyses studying the impact of heuristic devices (such as analogy) on public opinion (Read et. al 1990, p. 126, Shanahan et. al 2011, p. 375). In the case of nuclear power, whether or not anti-nuclear interest groups forge successful issue narratives may have a significant impact on the future of global energy and environmental policy; therefore, it is important to understand their attempts to capitalize on opportunities for policy change. More broadly, this work seeks to build upon the work of policy scholars investigating the role of narratives within policy debates through the Narrative Policy Framework. In particular, this research examines the interaction of partisanship with narrative elements such as analogy.

Analogical Reasoning

Analogies are figures of speech that forge an implied comparison between two or more objects, events or individuals on the basis of a shared characteristic. The implication is that the similarity between the objects extends beyond the identified attribute to include other equivalencies. As Yuen Foon Khong explains, the logic of analogies is as follows:

"event *A* resembles event *B* in having characteristic *X*; *A* also has characteristic *Y*; therefore it is inferred that *B* also has characteristic *Y*" (1992, p. 7). Though rhetorically similar to metaphors, there is an important technical distinction between the two: metaphors assert a direct comparison between two seemingly unrelated objects by stating that one *is* the other (e.g. Romeo's declaration that "Juliet is the sun"), without an explicit explanation of how or why. Analogies construct a more rational argument that highlights the specific ways in which two objects are similar, in order to make the inference that they are likely to agree in other ways as well (Rochefort & DeLeo 2011).

Cognitive psychologists agree that analogies serve an essential mental function in that they allow individuals to make sense of complex and/or novel situations about which there is a significant amount of uncertainty. Theories of analogical reasoning are all grounded in the idea that humans have real limits when it comes to information processing. As Khong describes, "human beings rely on some sort of simplifying mechanism to cope and to process – to code, store, and recall – the massive amount of information they encounter in their daily lives" (1992, p. 25). Analogies are one such coping mechanism. When information about a policy dilemma is lacking, policymakers turn to past events stored in their policy memory to help them make sense of the current challenge. Annika Brandstrom and colleagues describe this phenomena as "govern[ing] by looking back" (2004, p. 191). The process of linking the past to the present is known as "mapping" and it involves drawing connections between a target analog (the current situation) and a source analog (a past event/object/figure) (Holyoak & Thagard 1996, Houghton 2001, Hehir 2006). The two elements are mapped through a set of correspondences, be they surface similarities or parallels in structure and/or purpose (Holyoak & Thagard 1996). Clearly,

the universe of possible source analogs is potentially vast, encompassing all of the "giant database" of human history (Brandstrom et. al 2004, p. 193). However, it is in reality much more limited because a source analog must be easily retrievable from an individual's store of memory and thus capable of being activated for use in analogical reasoning (Tversky & Kahneman 1974). The strength of the influence of analogy depends both on the level of correspondence between the past and present situations (i.e., how similar are they?) and the importance of those similarities (i.e., how meaningful is the point of comparison?) (Rochefort & DeLeo 2011, p. 2).

Once selected, Khong (1992, p. 10) argues that analogies help decision makers answer six key diagnostic questions: 1) What type of situation are we facing?; 2) What is at stake?; 3) What are the possible solutions?; 4) What are the odds of success of various alternatives?; 5) How can we assess the 'moral rightness' of these alternatives?; and 6) Are there any dangers associated with the options? Using analogous situations to fill in these gaps in knowledge is a valuable cognitive tool that can improve decision-making outcomes. Holyoak and Thagard describe these "mental leaps" as an "important cognitive advance" that allow for the creativity that sets humans apart from other animal species (1996, p. 25).

Scholarship on the use of analogies has more often warned of the shortcomings of analogies as decision tools, however (e.g., May 1973, Jervis 1976, Neustadt & May 1986). Thomas Gilovich (1981, p. 807-8) counsels "though there is certainly a great deal of truth to Santayana's maxim that 'those who do not remember the past are condemned to relive it,' one might also be cautioned that those who do not forget the past can be led to misapply it." Perhaps the greatest danger of analogical reasoning lies in the selection of which specific analogy/ies to apply (Schrodt 2002, p. 8). We know that analogies that are

superficially similar and/or more recent in history are more available to policymakers, though they may not necessarily be appropriate comparisons (Tversky & Kahneman 1974). As David Hoogland Noon notes, "All historical analogies are fallible in one sense or another because they emphasize some aspects of the past while suppressing others to achieve the right fit" (2004, p. 340). Moreover, when a lack of fit between scenarios reveals itself, people tend to reject such contradictory information or re-interpret it in ways that maintains preconceived notions (May 1973).

To date, most studies on analogy have focused on the use of the heuristic device by those engaged in foreign policymaking (see, e.g., May 1973, Jervis 1976, Neustadt & May 1986, Khong 1992, Hemmer 1999, Noon 2004, Brandstrom et. al 2004, Hehir 2006). For example, Khong's (1992) work includes an extensive analysis of the role of analogies in the decision-making process of U.S. foreign policymakers regarding Vietnam in 1965. He finds that two analogies (Korea and Munich) dominated thinking during this time, predisposing policymakers towards intervention. Christopher Hemmer (1999) argues that Ronald Reagan's actions during the Iran-Contra affair can be explained in large part by his desire to avoid repeating Carter's mistakes during the Iranian Hostage Crisis. A decade and a half later in the late 1990s, in a drive to prevent another Vietnam or Battle of Mogadishu in Somalia, U.S officials initially resisted intervening in Yugoslavia and Kosovo (Hehir 2006).

Much less research has been directed at the potential impacts of *exposure* to analogies offered up by others. In other words, how does the public respond when analogies are invoked by policymakers? This question relates to an ongoing conversation within the literature debating the true purpose of analogies within policymaking. Do they serve a cognitive function, or a political one? In the first view, analogies perform all the

analytical tasks described above and guide decision-makers through the process of policymaking. In the second, policymakers decide on a path forward for other reasons, and employ analogies strategically after-the-fact to justify their decision to other leaders and/or the public. For example, Noon details George W. Bush's rhetoric surrounding the start of the War on Terror, suggesting that he repeatedly invoked the analogy of WWII as the "good war," in order to imply that the current war was similarly justified (e.g. referring to September 11, 2001 as " 'our' Pearl Harbor") (2004, p. 339). Holyoak and Thagard have also noted the tendency to draw upon the WWII analogy in order to make the case for military intervention (1996, p. 106-7). John K. Fairbank describes this as the tendency for leaders to use history as a "grabbag from which each advocate pulls out a 'lesson' to prove his point" (Khong 1992, footnote 25, p. 8). If this is the case, it is important to understand whether or not such a tactic is an effective one.

Narrative Policy Framework

The links between a single rhetorical device – analogy – and consequent impacts on policy attitudes may be best illuminated through application of the Narrative Policy Framework. The primary foundation of the NPF is that narrative matters for public policy. Recognizing that humans are a story-telling species, the NPF posits that narratives are both a natural component of and consequential for policy debates, and thus merit the same theoretical attention as resources, institutions, rules and coalitional politics (Shanahan et. al 2013). To make sense of policy problems and decide which policy alternative to pursue, people tell stories about them: how bad is the problem? Who is to blame for it? Who is it likely to affect (and how deserving or undeserving are those populations)? How certain is

the science on the issue? How likely is it that a given policy solution will work? What will happen if we do nothing? Of course, these questions are rarely if ever able to be answered objectively, and therefore the narratives that individuals and groups weave do much to reveal their ideological and political perspectives. Narratives simplify some issue characteristics while emphasizing others in accordance with policy actors' world views. Thus, a key tenet of the Narrative Policy Framework is a post-positivist one: reality is subjectively determined, and the best way to uncover that reality is through analysis of relevant public narratives, which can be connected to both belief structures and political strategies (McBeth et. al 2005, McBeth et. al 2007). In the words of Jones et. al (2014, p. 4), "what the world *means* varies tremendously… if you want to understand that meaning, you need to understand the policy narratives relevant players use to make sense of their policy reality."

The NPF identifies several elements common to narratives. First, narratives take place within a specific *setting*, which may include geographical location, legal context, political balance of power, and demographic backdrop, among other factors. They also have *characters* (heroes, villains and victims) that may be human or non-human (e.g. the environment, animals), and who take part in the *plotline*. This plot progresses through a beginning, middle and end that gives the audience a sense for the trajectory of the policy issue (indicating, for example, that things have steadily worsened, or that the entrance of a policy hero has improved the situation) (Stone 2002). Finally, narratives may include a *moral of the story*, which suggests a policy solution. In addition to these elements, narratives may make use of other literary devices, such as symbols.

Emotion plays a critical role in narratives. In fact, the NPF contends that affect, in the form of stimuli perceived as positive or negative, precedes reason in cognitive processing (Jones et. al 2014). This may be especially important in the case of nuclear power, which is widely acknowledged as a "dreaded technology" about which emotions are unusually strong (Sjöberg 2000). Studies have shown that the public consistently assesses the risks of nuclear power at much higher levels than do scientists (Slovic 1987). When "hot cognitions" – based upon emotional assessments of a situation – take over, more rational, analytical "cold cognitions" are overridden (Khong 1992, p. 225-6). Narratives that draw upon such emotions are therefore likely to be especially impactful.

It's important to understand that policy narratives are constructed for strategic outcomes; they are intended to influence public opinion in the direction of a specific policy goal (Shanahan et. al 2011). They do this through the use of *policy narrative strategies*, which may include efforts to determine the scope of participation on an issue (Shanahan et. al 2011). For example, McBeth et. al 2007 found that "losing" policy coalitions were more likely to emphasize diffuse costs and concentrated policy benefits as a way of attracting new participants into the policy debate and shifting the balance of power, whereas those on the winning side did just the opposite in the hopes of maintaining the status quo. Similarly, losing coalitions have been shown to make greater use of the "devil shift," a story element in which the storyteller attributes sinister motives to their policy opponent and presents them as exceedingly powerful, effectively demonizing them (Shanahan et. al 2013). Winning coalitions, on the hand, have a tendency towards employing the "angel shift," portraying themselves as heroes that have come to solve the problem.

There is also a place for analogies within such narrative devices. In many ways, they fulfill the "flashback and foreshadowing" role described by Shanahan et. al (2013) and send important messages about the import, likely outcomes and/or possible solutions to a problem by referencing past events. We can see this illustrated in the narrative surrounding the first Persian Gulf War, in which leaders drew an explicit analogy to WWII that compared Saddam Hussein to Adolf Hitler. The analogy unfolded like a "story figuring a villain, Hitler; misguided appeasers, such as Neville Chamberlain; and clear-sighted heroes, such as Winston Churchill and Franklin Delano Roosevelt" (Holyoak & Thagard 1996, p. 102). The intention here, and with all analogies, is to tell audiences how the story *should* end. Analogizing to a glorified past event implies that taking similar action now will also result in policy success; referencing past failure warns that we must change course or risk suffering the same losses again.

Importantly, the NPF asserts that these narratives, which reflect subjective assessments of the world, can be objectively – and empirically – studied (Jones et. al 2014). Through the use of the scientific method and utilizing data obtained through experiments, interviews, focus groups, and/or opinion surveys, researchers can study individual-level narrative construction and effects.

Nuclear Power

The trajectory of attitudes towards nuclear power has been far from constant. Polls show that initial public enthusiasm towards the energy technology in the early 1970s was followed by a cooling in support following the incident at Three Mile Island in 1979 (Rosa & Dunlap 1994, p. 297). It was not until the early 1980s, however, that opinion turned

decidedly against nuclear power, with Americans asserting greater certainty in their

preferences and a clear majority opposing new nuclear installations (Rosa & Dunlap 1994,

p. 297-8). By May of 1986, only 34% of Americans supported the idea of building more

nuclear power plants in the U.S., down from 69% in 1977 (CBS News 2008). Notably, the

effect of the Chernobyl disaster in 1986 on opinion was small in comparison to Three Mile

Island, largely because opposition had already grown dramatically in the years prior (Rosa

& Dunlap 1994, p. 299-300). By the early 1990s, Eugene Rosa and Riley E. Dunlap

concluded, "Clearly, the American public no longer supports the construction of additional

nuclear power plants" (1994, p. 298).

This attitude was not to last, however. Throughout the late 1990s and early 2000s,

public opposition towards nuclear power softened. Favorability of nuclear once again

crossed the 50% threshold in 2001, reaching 56% in 2006 (Bolsen & Cook 2006). Opinion

polls showed that support for nuclear power gained in relation to other energy sources

most especially when the energy source was framed as a way to reduce the use of fossil

fuels (Greenberg 2009, p. 3243). Prior to the disaster at Fukushima, talk of a nuclear

renaissance was common in energy circles. President Obama's 2011 proposed budget

included $36 billion in federal loan guarantees to the nuclear industry, paving the way for

the construction of the first new plants ordered since 1978. Obama described this support

as "only the beginning" (Associated Press 2010), signaling a presumed jumpstart to an

industry long considered dead in the water. (In one now-unfortunately chosen turn of

phrase, a 2010 article detailing the rush for new reactor licenses from the Nuclear

Regulatory Commission called it an "application tsunami"[2]).

There is little doubt that public support for nuclear energy at this time was not enthusiastic – one set of researchers referred to it as "reluctant acceptance" (Butler, Parkhill & Pidgeon 2011, p. 7) – and there were a number of other cost and regulatory obstacles that were already hampering new nuclear build-ups (Duffy 2007, Cooper 2011). More recently, the low cost of natural gas has stalled investment in the nuclear industry, causing several companies to withdraw their applications for new reactor licensing (Economist 2013).

One international survey conducted by WIN-Gallup International found that, following the Fukushima disaster, public support for nuclear power declined in 40 of the 42 countries surveyed; unsurprisingly, the most dramatic decline was seen in Japan (Kim, Kim & Kim 2013). A study conducted in Switzerland showed that not only did acceptance of nuclear energy as a power source decline, but so did trust in nuclear scientists, operators, and the government in terms of their ability to safely regulate the technology (Visschers & Siegrist 2013, p. 341). In the U.S., the percentage of Americans opposed to the use of nuclear power grew to 52% immediately following the disaster (up from 41% in February 2010) (Pew Research Center 2011).

Throughout these periods of waxing and waning support for nuclear power, a persistent difference has remained between different partisan groups, with Republicans consistently the most supportive of nuclear power, followed by Independents, then Democrats. In a recent Pew Research poll, 60% of Republicans and Independents who lean Republican state that they favor building more nuclear plants, comparted to only 35% of Democrats and Democrat-leaning Independents (Pew Research Center 2015). The report asserts that this partisanship gap mirrors the broader trend of political sorting into

"ideological silos" (Pew Research Center 2015). As we will see, party affiliation is an important mediating factor in the relationship between analogical narratives and public opinion on nuclear power.

Data & Methods

It is important to note at the outset that the rhetorical treatments used in this research are not full policy narratives as defined by the NPF. This study employs survey questions that include long-form preliminary prompts that provide contextual information, but do not contain characters or a "moral of the story" – the minimum criteria needed to meet the definition of a policy narrative (Jones & McBeth 2010). Rather, this research tests for the isolated effects of one narrative element – analogy – on public opinion. Though these analogies are not contained within an official policy narrative, I fully expect that the results explained here will also apply to analogies included in the types of narratives explored through the NPF. In short, this research tests the *likely* impacts of analogies within policy narratives by exploring their effects on public opinion when delivered through another medium – traditional survey research questions.

The data were collected by the Marist Poll in August and December 2015, during which 2,544 adults were surveyed on their views related to nuclear power. A table displaying the demographic breakdown of the sample follows.

Table 1. Demographic Characteristics of Sample

Age		Education		Gender		Party ID	
18-29	21.9	Non-College Graduate	59.4%	Male	49%	Democrat	35.8%
30-44	25.5	College Graduate	40.6%	Female	51%	Republican	28.6%
45-59	26.7					Independent	35.6%
60 or older	25.9						

The survey made use of a split-sample design with four different sub-groups. The first sub-group served as a control group. This group was asked questions about their opinion on nuclear power without any accompanying narrative (e.g. "Do you support or oppose the use of nuclear power as a source of energy?", "Overall, would you describe the use of nuclear power as an energy source as safe or not safe?", etc.). In the second sub-group, participants were first read a brief prompt that detailed the disaster at Fukushima, Japan in 2011 and provided contrasting viewpoints about the appropriate role of nuclear power ("Some people say this disaster illustrates the dangers of nuclear power. Others say nuclear power is still a reliable, domestic source of energy…"), and then proceeded to the same series of questions. A third sub-group heard the same prompt discussing Fukushima, but this text also included reference to Chernobyl ("Some people say this disaster, *like the one at Chernobyl*, illustrates the dangers…"). The fourth sub-group was read a similar prompt that included an analogy to Three Mile Island instead of Chernobyl.

Expectations

There is reason to believe that the use of analogies in political rhetoric would have an impact audiences being exposed to them. Earlier research found that when exposed to another heuristic device – metaphors – at the beginning of an oral passage, participants in the study exhibited better memory recall for statements in that passage (Read et. al 1990, p. 133). They also perceived the messages included in the passage as being more logical, comprehensible and easier to visualize when a metaphor was included (Read et. al 1990, p. 135-6). Metaphors also serve a framing function, highlighting certain aspects of an issue/event and thus bringing select arguments to the fore, which might lead to shifts in public opinion (Read et. al 1990, p. 139). Moreover, Gilovich (1981) found that when associations are made available through the use of analogies, people will incorporate that information into their decision-making process. For example, when undergraduate students were presented with a hypothetical foreign policy scenario in which an unnamed totalitarian nation was threatening a small, democratic country, their preferred response differed according to whether or not the scenario included an analogy to WWII or Vietnam, with those receiving the WWII reference selecting intervention at significantly higher rates than those receiving the Vietnam analogy (Gilovich 1981). Similarly, when the connection between carbon dioxide accumulation in the atmosphere and climate change was analogized to the process of filling a bathtub with water, a greater proportion of participants reported support for acting now to address climate change (Guy et. al 2013).

Therefore, I expect that analogies would also influence public support for nuclear power in the wake of the Fukushima crisis. This research suggests that including analogies to prior nuclear disasters might alter public opinion by sending the message that nuclear

power is dangerous. If the disaster that occurred in Fukushima does not stand alone, but rather harkens back to previous accidents, then the danger lies in the technology itself, not any given situation related to specific reactor designs, site appropriateness, personnel training or emergency plans. Overall, then, I anticipate that narratives that discuss the future of nuclear power by analogizing the Fukushima accident to earlier disasters – Three Mile Island or Chernobyl – will result in a decrease in support for nuclear power as an energy source in the U.S.

> *H1a*: Treatments referencing Three Mile Island or Chernobyl analogies will be associated with higher levels of respondents reporting that nuclear power is unsafe.
>
> *H1b*: Treatments referencing Three Mile Island or Chernobyl analogies will be associated with lower levels of support for nuclear power as an energy source in the U.S.

I expect that both the relevant analogies (Three Mile Island and Chernobyl) will influence attitudes towards nuclear power; however, I don't expect that they will be equal in their effects. Eugene A. Rosa and Riley E. Dunlap (1994) tracked three decades of public opinion related to nuclear energy and found that while support for building new nuclear plants declined after both the Three Mile Island and Chernobyl accidents, the drop was more dramatic after TMI[3]. Though the environmental and public health effects of Chernobyl far exceeded the dangers posed by Three Mile Island[4], the fact that the events at TMI occurred on domestic soil might increase fear regarding nuclear power to a greater extent than an event in far-off Eastern Europe. There is an informal journalistic equation that gets at the impact of proximity on the mental impact of crises; Edwin Diamond describes it thusly: "Ten thousand deaths in Nepal equals a hundred deaths in Wales equals ten deaths in West Virginia equals one death next door" (Smith 2002, p. 74). The "near-

miss" at TMI might therefore have a stronger negative influence on nuclear acceptance than a much more consequential accident across the globe. Therefore, I expect that individuals that are exposed to analogies linking the disaster at Fukushima to Three Mile Island will exhibit lower levels of support for the energy source than those hearing analogies to Chernobyl.

> *H2*: Treatments referencing Three Mile Island will be associated with lower levels of support for nuclear power than those referencing Chernobyl.

There is also reason to believe that the presence of analogies will interact with political views in their effects on nuclear attitudes. Given that support for nuclear power has long been closely linked to partisanship, I expect that Democrats, Republicans and Independents will react differently when exposed to analogies. In particular, Democrats are consistently less supportive of nuclear power, and more likely to perceive it as an unsafe energy technology than Independents, or, especially, Republicans. Because public opinion with the Democratic group is already decidedly negative, I expect that the effects of exposure to analogies to be more muted for this group. Conversely, I expect that the effect of referencing nuclear disasters will have a stronger effect on the attitudes of Independents and Republicans, who have more room to decrease their levels of support.

> *H3*: The effect of analogy exposure on nuclear attitudes will be stronger for Republicans and Independents than for Democrats.

Moreover, the impact of analogies is likely to be greater on those individuals that personally experienced the source analog event. Annika Brandstrom and colleagues hypothesize that when policymakers have personal experience with events referred to in historical analogies, they are more likely to rely on them to guide their policy decisions

(2004, p. 208). Different generational cohorts find different analogies "attractive," and this preference is based in large part on whether or not the group lived through the event, allowing it to make a strong impression on them (Schuman & Rieger 1992). The impact is likely to be particularly strong if the event occurred during an individual's early adulthood, if it was particularly attention-worthy, and if it was interpreted in a consensual way (e.g. the "success" of WWII vs. the "failure" of Vietnam) (Schuman & Rieger 1992). Though there are clear limits to the coherence of in-generation interpretation of the same lived event (Lang et. al 1993, p. 213), there are nonetheless significant "cohort effects" in terms of the impact of analogy on different generations (Schuman & Rieger 1992). These nuclear disasters, in particular, are likely to operate especially strongly on the generations that experienced them because they are acknowledged as part of the collective historical memory (Perko et. al 2012, p. 293). Chernobyl, in particular, has taken on the status of a mythical specter for those who live in its wake (Alves 2015). As such, we should expect that references to the accidents at Three Mile Island and Chernobyl are likely to inspire greater negative associations for older generations that lived through them than for younger generations for whom these incidents are simply part of the historical record.

> *H3*: Analogies to Three Mile Island and Chernobyl will be associated with greater negative nuclear attitudes in older generations than younger generations.

Finally, the impact of these analogies are likely to operate differently depending upon one's geographical location. In particular, I expect that attitudes towards nuclear power – and the effect of analogies on them – will be influenced by one's proximity to an existing nuclear power plant. Research on the "proximity effect" in regards to nuclear power has come to contradictory conclusions. Some have found that willingness to accept

the construction of a new nuclear plant decreases as the nearness of the site to one's residence increases, presumably in response to heightened perceptions of risk (Jenkins-Smith et. al 2009, p. 9-10). At the same time, proximity can increase support, particularly when residents perceive economic benefits from the siting of a nuclear facility, such as the addition of jobs or tax revenue (Jenkins-Smith et. al 2009, p. 10). Support for new nuclear power build has been found to be strongest among communities that are already home to a plant (Venables et. al 2012). This may be because the benefits mentioned above are already being enjoyed by the community. Nuclear plants can serve as a defining feature of a community's "sense of place," contributing to the area's distinctiveness and/or sense of pride and efficacy, also leading to higher levels of support (Venables et. al 2012). Additionally, initial feelings of fear and mistrust might be eased over time as accident-free operation builds confidence (Greenberg 2009). The key factor, then, in the impact of the proximity effect appears to be whether or not the nuclear plant being proposed would be an entirely new facility to a community unfamiliar with nuclear power, or additional capacity in an established facility. In the latter case, nuclear power is more often greeted with enthusiasm. Therefore, I expect that the effect of analogies that reference past nuclear disasters will be mediated by whether or not individuals live in a "nuclear community." Specifically, lower levels of concern and higher levels of risk acceptance that often exist in these communities will dampen the potential effects of analogizing Fukushima to Three Mile Island or Chernobyl.

> *H5*: For residents of communities that are located in close proximity to a nuclear power facility, the use of analogies will have a lesser impact on support for nuclear power than those living farther away.

Data Analysis and Discussion

First, it is interesting to note that the inclusion of analogies in the question prompts served to reduce participant uncertainty about nuclear issues. Though very few respondents answered questions related to nuclear power with an answer of "unsure" (approximately 6-9% of the sample), exposure to any of the analogies included in the survey significantly reduced this slim minority even further. Specifically, when respondents heard any analogy – to Fukushima, Chernobyl and/or Three Mile Island – they were less likely to report being unsure about whether or not nuclear power is safe (p= .026); our use of it should be increased, decreased or remain about the same (p= .007); or whether they support or oppose the technology (p= .025).

Contrary to my expectations in H1a and H1b, however, chi-square analysis reveals that, absent any control variables, references to previous nuclear disasters did *not* have an effect on participants' perceptions of the safety of nuclear power nor their support for the technology. Respondents were no more likely to report that nuclear power is unsafe after hearing prompts that discussed Fukushima, Chernobyl and/or Three Mile Island. The inclusion of these analogies also did not increase respondents' likelihood of opposing nuclear power. I hypothesized that analogies to Three Mile Island would correlate with the lowest levels of support for nuclear power (H2). However, in line with the results for H1a and H1b described above, this particular treatment did not produce any significant differences in the level of support or opposition to nuclear energy.

When the bivariate relationship is complicated by the addition of control variables related to political views, the results become much more interesting. Take, for example, the following question: "Overall, would you consider the use of nuclear power as an energy

source as safe or not safe?" Question prompts that referenced Fukushima, Chernobyl

and/or Three Mile Island did not have a significant effect on either Democrats or

Independents. However, there is a significant relationship for Republicans, but in the

opposite direction than expected. In other words, Republicans that heard analogies to these

nuclear accidents were *more* likely to perceive nuclear power as safe, by roughly 10% (See

Table 2).

Table 2. Nuclear Safety by Exposure to Analogy and Party ID

Party Identification	Overall, would you consider the use of nuclear power as safe or not safe?	Did the Participant Hear an Analogy?		
		Yes	No	Pearson's Correlation Coefficient (p-value)
Democrat	Safe	43.4%	46.5%	.447 (p= .504)
	Not Safe	56.6%	53.5%	
Republican	Safe	75.1%	64.5%	5.32 (**p= .021**)
	Not Safe	24.9%	35.5%	
Independent	Safe	65.1%	63.6%	.125 (p= .723)
	Not Safe	34.9%	36.4%	

The same is true for participants' level of support for nuclear energy. Republicans that

heard question prompts referencing prior disasters expressed *higher* levels of support for nuclear

power than those that were not exposed to analogies. Notably, as shown in Table 3 below,

Republicans that heard analogies were more than 14 points more likely to "strongly support"

nuclear power as an energy source than those that didn't hear analogies (they were also more

likely to "not so strongly support" the technology). Again, the relationship for Democrats and

Independents was insignificant.

Table 3. Support for Nuclear Power by Exposure to Analogy and Party ID

Party Identification	Overall, would you consider the use of nuclear power as safe or not safe?	Did the Participant Hear an Analogy?		
		Yes	No	Pearson's Correlation Coefficient (p-value)
Democrat	Strongly Support	23.8%	31.4%	4.034 (p= .258)
	Not So Strongly Support	23.2%	20.3%	
	Not So Strongly Oppose	18.1%	14.4%	
	Strongly Oppose	35.0%	34.0%	
Republican	Strongly Support	49.1%	34.7%	16.265 (**p= .001**)
	Not So Strongly Support	24.3%	30.5%	
	Not So Strongly Oppose	10.7%	22.9%	
	Strongly Oppose	15.9%	11.9%	
Independent	Strongly Support	37.9%	30.8%	4.179 (p= .243)
	Not So Strongly Support	28.0%	27.7%	
	Not So Strongly Oppose	9.8%	13.8%	
	Oppose	24.3%	27.7%	

What might explain these counter-intuitive results? Molly Walker Wilson (2014) has written about the phenomenon of elite partisan entrenchment as it relates to perception of risk. As she observes, "because lawmakers as a group must argue strongly for the positions they advocate, they often consciously or unconsciously become closed off to alternative views, and even to facts that might lead to a different conclusion" (Wilson 2014, p. 118). Non-elites are also subject to the influence of partisan attachment when weighing policy preferences. Bolsen, Druckman and Cook refer to this as *partisan motivated reasoning*. They find that "individuals weigh information consistent with their existing beliefs or social identities more heavily than contradictory information" (2014, p. 236).

Research looking at the effect of risk perception on support for nuclear power pre- and post-Fukushima similarly found that conservatives' perceptions of the risk of nuclear energy significantly *decreased* following the disaster in Japan (in comparison to a dramatic

increase for liberals and slight increase for moderates) (Yeo et. al 2014, p. 732). These researchers focused on the interaction of partisanship with media use, and they found that the differences in risk perception before and after Fukushima were much larger for those groups that had high levels of exposure to media coverage of the disaster, leading them to posit that liberals and conservatives seek out media outlets that confirm their preexisting ideological leanings (Yeo et. al 2014, p. 734). Further, even those individuals accessing the same media sources are likely to interpret the information presented in line with their predispositions, attending more to some aspects of coverage than others (Yeo et. al 2014, p. 735).

This is perhaps less surprising when one considers that research has shown that attitudes towards nuclear energy have remained steadily deadlocked in highly polarized positions (Mandel 2005, p. 129). One study found that 75%-85% of survey respondents selected a "non-moderate" position when asked their opinion about nuclear power, a proportion that revealed a higher level of polarization than any other technology study (Mandel 2005, p. 129). This division is so pronounced that it inhibits peoples' acceptance of compromise positions (Mandel 2005). These deep-seated opinions on nuclear power might therefore not be easily influenced by rhetorical devices, and may in fact inspire defensive reactions.

To test H4, I controlled for the age of the respondent. This hypothesis explores whether or not the impact of analogies on public opinion is influenced by whether one lived through the analogous event when it took place. The incidents at Three Mile Island and Chernobyl occurred in 1979 and 1986, respectively. Prior research suggests that an event is most likely to be impactful if an individual experiences it during early adulthood.

Given that the data for age were recorded into four categories, I was somewhat limited in the selection of an exact age cut-off. Therefore, I combined categories to test for a difference in opinion between those under the age of 45 and those 45 years or older. The youngest participant in this age group would have been 8 years of age when the accident at TMI occurred and 15 when Chernobyl happened. Contrary to my expectations, age did not have any impact on the effect of analogies on nuclear attitudes.

Finally, these results reveal that proximity to a nuclear power station does mediate the effect of exposure to analogies on nuclear power views. In contrast to my expectations in H5, however, the effect of analogies was greater for those living closer to nuclear installations. For participants that live less than 50 miles from a plant, hearing a prompt that referenced a previous nuclear accident made respondents significantly less likely to say that our use of nuclear power should be increased (28.2% for those that heard an analogy vs. 34.4% for those that didn't), and more likely to say that levels should remain about the same (29.3% for analogy group and 17.2% of non-analogy group) (p = .026). The effect of analogies on those living 50 or more miles from a nuclear plant was insignificant.

Conclusion

Overall, the results of this research suggest that the effects of utilizing narrative tools such as analogy as a way to move public opinion are more limited than much of the existing literature might suggest. Hearing analogies *did* make respondents that live in close proximity to a nuclear power plant (<50 miles) less likely say that we should increase our use of nuclear power. But in general, the inclusion of nuclear disaster analogies within survey question prompts did not significantly decrease support for the energy source, nor

did it increase perceptions of it as a dangerous technology. These results did not change based upon the specific analogy (Fukushima, Chernobyl, or Three Mile Island) included, either. Interestingly, analogies did have an impact on one particular partisan group: Republicans. Rather than decreasing enthusiasm for nuclear power, however, hearing references to past nuclear accidents *increased* support for the technology among Republicans.

This outcome hints at the possible existence of partisan motivated reasoning related to this issue. Charles Taber and Milton Lodge (2006) define motivated reasoning as the tendency to evaluate arguments that are congruent with prior attitudes as stronger and more reliable than opposing arguments, to spend greater effort discrediting opposing arguments, and to seek out information that falls in line with pre-existing beliefs over disconfirming evidence. In this case, partisanship appears to drive those pre-existing beliefs. Future research might test such a possibility through the use of positive nuclear narratives, to test for a hardening of opinion among Democrats in terms of their opposition to nuclear. Do they similarly double-down on their stance, even in the face of narratives that include analogies to positive nuclear developments? Such a study could also see whether Independents are moved by such positive analogies, as they did not respond significantly to negative analogies.

These findings have implications for political polarization regarding nuclear power, as it would suggest that compromise is less likely on the issue. The partisan nature of attitudes on nuclear power is especially interesting when one considers the relationship between nuclear power and climate change. The lack of greenhouse gas emissions associated with the operation of nuclear power has led some to push for a reconsideration

of nuclear as a "green" technology and possible tool in the fight against climate change. Liberal Democrats are the most likely to believe that climate change is occurring due to human activity, and the gap between political groups has grown over time (Pew Research Center 2015). As we see here, however, Democrats are also the least likely to accept the expansion of nuclear power. If Democrats and Republicans continue to move apart on this issue, and indeed to harden those positions, middle ground seems more and more elusive.

There is one key limitation to this research that bears discussion. The necessarily concise nature of a survey question format did not allow for the inclusion of full policy narratives as defined under the Narrative Policy Framework. It may very well be that the effect of analogies on attitudes is stronger when those analogies are more fully developed through longer-form narratives. Future research might compare these findings with those where opinions are measured through an alternative data collection measure that allows for exposure to narratives in their fleshed-out form.

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Notes

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[1] On April 12, 2011, the Japanese government announced that it had raised their assessment of the Fukushima disaster to a score of 7, the highest possible rating on the International Atomic Energy Association's International Nuclear and Radiological Event Scale (qualifying it as a "major accident"). The only other accident to receive a score of 7 was the disaster in Chernobyl in 1986.

[2] Pasternak, Judy (January 24th, 2010). "Nuclear Regulatory Commission Faces an Application 'Tsunami'." Accessed on August 11th, 2011 at: http://investigativereportingworkshop.org/investigations/nuclear-energy-lobbying-push/story/nuclear-regulatory-commission-faces-tsunami-apppli/.

[3] It is important to note that support for nuclear dropped immediately after the incident at Three Mile Island, but shortly thereafter began to rebound. By the summer months of 1979, acceptance of nuclear power had returned to pre-TMI levels. The sustained increase in opposition to nuclear did not appear until a few years later in 1982-3 (Smith 2002, p. 74).

[4] See http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html for a summary of the accident at Three Mile Island and details on the differences between this accident and the one at Chernobyl.