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Public Problem Characterization, Policy Solution Generation, and Intra-Agenda Connectivity

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While policy agenda studies have extensively examined the interplays of various venues, one under-explored area is the internal dynamics within an agenda venue. In this study, we focus on one of the important venues—news media—and investigate the inherent connections between how a public problem is characterized and how problem solutions are generated in media agenda setting. Drawing on agenda-setting theories, we develop a typology to theorize the relationships between problem characterization and solution advocacy, and use a news dataset on climate change to empirically assess how issue characterization affects issue solution generation. Our logistic regressions demonstrate that the likelihoods of climate change policy solutions being proposed in the news are significantly influenced by how the media stories characterize the issue along four key attribute dimensions: issue image, scope, linkage, and narrative style. Key implications are discussed in the conclusion.

KEY WORDS: agenda setting, problem definition, policy solution, news media, climate change

Over the last several decades, a growing body of agenda-setting literature in political science has extensively examined the dynamics of problem characterization in politics and policy processes (e.g., Baumgartner & Jones, 1993; Chong & Druckman, 2007a, 2007b; Cobb & Elder, 1983; Entman, 1993; Iyengar & Kinder, 1987; Kingdon, 1995; Nelson, Clawson, & Oxley, 1997; Rochefort & Cobb, 1994; Stone, 1997). Two robust research traditions in agenda setting, policy process study and political communication study, have greatly improved our knowledge in this field. While these two traditions are sometimes viewed as distinct schools and may differ in the units of analysis and the terms they use (for a review, see Wolfe, Jones, & Baumgartner, 2013), both lines of research share a common central task. This task is to understand how a public problem is presented, defined, or framed by policy actors in different ways along various attribute dimensions, and how variations in problem characterization affect issue perceptions, alternative formulations, and policy outcomes. In this study, we draw upon the common theme in both lines of agenda research to explore one less-explored area—the connections between public problem characterization and policy solution generation in the news media.

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Problem characterization, also termed problem definition or issue framing, takes place in every policy venue and can be found in various political activities (such as congressional hearings, presidential speeches, public debates, and news media reports and portrayals of public issues). News media, as important policy venues in political communication and critical agenda setters in policy processes, not only possess tremendous power to influence relative salience of a public issue through repeated news coverage over some period of time (e.g., Baumgartner & Jones, 1993; McCombs & Shaw, 1972; Roberts, Wanta, & Dzwo, 2002; Soroka, 2002), but also have the capability to characterize and frame a public issue in various ways (e.g., Dearing & Rogers, 1996; Iyengar, 1990; Iyengar & Kinder, 1987).

Possible sources of framing effects have been explored by social science scholars (Druckman, 2004; Riker, 1986; Simon, 1985; Slovic, 1987; Tversky & Kahneman, 1973). An extensive literature in political communication and policy process studies of agenda setting has examined different ways in which news media characterize and frame public issues (Baumgartner, De Boef, & Boydstun, 2008; Baumgartner & Jones, 1993, 2009; Gilliam & Iyengar, 2000; Iyengar, 1987, 1991; Terkildsen & Schnell, 1997). Most studies in this field have focused mainly on interagenda interplay or intervenue connectivity, demonstrating that issue salience and issue definition in the news media exert significant agenda-setting effects on the general public and/or policymakers (Baumgartner & Jones, 1993; Berinsky & Kinder, 2006; Gilliam & Iyengar, 2000; Iyengar & Kinder, 1987; Liu, Lindquist, & Vedlitz, 2011; McCombs & Shaw, 1972; Nelson et al., 1997). However, one less focused and under-explored yet very important area is the internal dynamics within the news media—i.e., the intra-agenda effect between media problem characterization and media solution generation.

In a democratic society, news media are not only crucial venues where complex public issues are discussed, characterized, and framed, but also important places where various issue solutions are frequently generated and debated. Past research has primarily focused on how media framing of a public problem affects how policy actors in other venues (e.g., the mass public, administrative agencies, or Congress) think about the problem, and many studies have greatly advanced our understanding of how media framing shapes policy options and solutions (Baumgartner et al., 2008; Baumgartner & Jones, 1993; Iyengar, 1987, 1991; Kellstedt, 2000; Rose & Baumgartner, 2013). However, there has been little research on the possible internal connections—connections between problem characterization and issue solution within the media.

Possible connections between problem characterization and solution generation within a policy venue have long been implied in past agenda-setting theories, but the overarching logic and process of how the connections may occur have not been explicitly and systematically examined until recent years. One theoretical perspective in the school of policy process study of agenda setting, developed by Jones and Baumgartner (2005) in their attention theory of policy choice, contends that the pathways connecting problem characterization and issue solution originate from how multiple pieces of information regarding a specific public problem are incorporated, processed, and represented in politics and policy processes. For Jones and Baumgartner (2005,

pp. 33–43, 60–70; see also Baumgartner & Jones, 1993; Jones, 1994, 2001), a public problem is usually multifaceted with many attributes (or dimensions), and which attributes are used and how much weight is assigned to each of these selected attributes in understanding and characterizing a public problem will directly affect how problem solutions are generated. Theoretical perspectives and propositions of attribute–solution dynamics, similar to what Jones and Baumgartner contend here, are also advanced in political communication study of agenda setting, particularly in the scholarly work of issue framing and framing effects (Chong & Druckman, 2007a; Iyengar, 1991; Miller & Riechert, 2001).

Following this common line of thinking in both policy and communication studies of agenda setting, we intend to further theoretically and empirically examine the attribute–solution connections in this study, with a focus on the news media. In what follows, we first briefly review relevant literature with particular attention to the attribute–solution framework proposed by Jones and Baumgartner. We then develop an attribute–solution typology to theorize and specify the possible linkages between problem attributes and solution advocacy, and apply this typology and use news media coverage of climate change as an example to develop testable hypotheses. After that, we discuss our research design, data collection, content analysis methods, news article coding procedures, and dataset construction. Next, we conduct statistical analyses for hypothesis testing. Our statistical analyses and robust tests using logistic regressions demonstrate that climate change solutions generated in the news articles are indeed significantly affected by how climate change and global warming are characterized along several key attribute dimensions, including issue image, issue scope, issue linkage, and narrative style. While we understand that the process does not necessarily follow the order of the chronologically staged heuristic embedded in the Jones and Baumgartner attribute–solution framework, we indeed find strong connections between problem attributes and solution advocacy. Our study contributes directly to both policy process and political communication traditions of agenda-setting research, and the findings have broad implications for the study of media's role in policy processes and policy changes.

Theoretical Foundation: Attribute–Solution Connection

Inherent connections between problem characterization and policy solution are suggested in the literature of both policy process and political communication studies of agenda setting (Baumgartner & Jones, 1993; Cobb & Elder, 1983; Chong & Druckman, 2007a, 2007b; Iyengar & Kinder, 1987; Kingdon, 1995; Rochefort & Cobb, 1994; Wood & Vedlitz, 2007). Among various perspectives, Jones and Baumgartner (2005; see also Jones, 1994, 2001), in their theory of political information processing, propose a conceptual policy choice framework to address how public issues are prioritized, how multifaceted problems are assessed along different attributes/dimensions, and how possible alternatives or solutions are generated and attached to problems by individual and collective policy participants.

For Jones and Baumgartner (2005), the process of policy choice starts with attention allocation and ends with a final policy choice. In the first attention-allocation

stage, many public issues compete for decision makers' attention, and the central question at this stage is "which issue to attend to" (Jones & Baumgartner, 2005, p. 37).[1] The last stage of the process—i.e., the choice stage, typically involves formal decision making, where decision makers make their final choice about "which alternative to select" (Jones & Baumgartner, 2005, p. 37).

Between the attention allocation and the final choice stages are the problem characterization and alternative generation stages. These two stages constitute the key components of the attribute–solution framework. For Jones and Baumgartner, once an issue receives enough attention and is recognized as a problem, the process moves to the *problem characterization* stage, in which "attributes underlying the problem are set and weighted by importance" (Jones & Baumgartner, 2005, p. 35).[2] In politics, public problems always have many attributes that can potentially be used for problem evaluation. However, due to the limitation in decision makers' information-processing capacity—particularly in their attention span (Jones, 1994; Simon, 1983), individuals and organizations must first decide to which attributes they will attend. Because of the limited carrying capacity (Hilgartner & Bosk, 1988, 58 f.), decision makers eventually can only choose a limited number of attributes in their evaluation of the problem. For Jones and Baumgartner, which attributes are selected and how they are weighted in the problem characterization stage have direct and important implications for the next stage of the policy choice process—i.e., the *alternative generation* stage.

The selection of a limited number of evaluative attributes and different weight assignments across selected attributes in the problem characterization stage have enormous consequences, as they affect the thinking about how the problem ought to be solved and which solutions to examine (Chong & Druckman, 2007a; Druckman, 2001a, 2001b, 2004; Entman, 1993; Jones & Baumgartner, 2005). For instance, policy considerations about civilian use of nuclear power changed drastically when problem characterization shifted from focusing on the attribute of economic advantages (e.g., low-cost source of energy) to public health and environmental risk concern (Baumgartner & Jones, 1993). Similarly, different solutions to the poverty issue were generated when the issue was reframed and recharacterized from social justice and social costs perspectives (e.g., victim of economic system) to "stingy" dimensions (e.g., dysfunction of welfare program) (see Rose & Baumgartner, 2013). In short, the generation of issue solutions can be greatly affected by how the problem is characterized.

The attribute–solution framework provides some unique insights about agenda setting. First, the attribute–solution framework emphasizes that problem definition plays a critical role in directly affecting how solutions are generated and developed, while the traditional problem definition approach focuses mainly on how problems are strategically characterized or framed so as to increase their salience and gain higher agenda status (Rochefort & Cobb, 1994). Second, the attribute–solution framework contends that agenda-setting processes are far from random, highlighting the inherent connections or causal linkages between problem stream and solution stream.[3] Third, while most extant studies on issue framing primarily focus on the interagenda effects across policy venues—that is, how problem characterization in one policy venue (e.g., the news media) affects solution generation and development

in another venue (e.g., the public or government), the attribute–solution framework also emphasizes the intra-agenda dynamics, contending that alternative solution generation is intrinsic to problem characterization within a policy venue.

News media, like other policy venues, are not only important places where complex public issues are discussed, characterized, and framed, but also crucial arenas for issue solutions to be proposed or generated. More importantly, the attribute–solution framework suggests that issue solutions in the media are not randomly generated; instead, they should be regularly influenced by which attributes are focused on and how much weight was assigned to each of the chosen attributes as a result of the media's problem characterization. Does the incorporation of different attributes in news media problem evaluation significantly affect the likelihood of issue solutions being proposed in the news media? In this study, we take the first steps to address this question and examine the attribute–solution link. In the next section, we develop a typology of policy attributes to theoretically explore the possible connections between problem characterization and solution advocacy. After that, we apply the typology to the news stories on the climate change issue and develop several specific hypotheses.

A Typology of Problem Characterizations

To assist in the theoretical specification and empirical testing of propositions related to the connection between issue attributes and solution advocacy, it is important to understand what issue attributes can be. We propose a typology of issue attributes based on four potential characteristics embedded in public issues, including (i) issue image, (ii) issue scope, (iii) issue linkage, and (iv) issue narrative style. The warrant for including each of these dimensions is their connection to the fundamental elements of the Jones et al.'s problem specification theory—political attention. The dimensions represent ways that attention is warranted (issue image), dispersed across the political system (issue scope), connected to other issues (issue linkage), or presented in a cognitive effort conserving manner (issue narrative style). Each of these issue attributes is briefly discussed below, and more discussions on the attribute dimensions will be presented in the next section within the context of the climate change issue.

Issue Image

Issue image is the overall and fundamental impression of whether an issue involves potential stakes of causing harm or providing assistance (Baumgartner & Jones, 1993, 2009; Jones, 1994). Issue image has proven to powerfully influence the thinking and directions about how the issue ought to be addressed and how much policy effects should be made (Baumgartner & Jones, 1993; Jones & Baumgartner, 2005). In agenda setting, portraying an issue as a severe and harmful problem tends to prompt the thinking about issue solutions (Kingdon, 1995; Rochefort & Cobb,

1994; Stone, 1997). Our assessment of issue image will focus on the harms associated with the policy area.

Issue Scope

Issue scope refers to how an issue may have a broad or narrow range of effect at various levels of the policymaking system (local, state, national, or even supranational) that can ultimately be tied to issue responsibility and policy jurisdiction. Cobb and Elder (1983) describe how the characterization of an issue's scope, intensity, and visibility can affect how that issue is perceived and what policy solutions can be pursued. Rochefort and Cobb (1994) point out that issue scope is really about issue ownership, which affects what institutions and participants are considered legitimate for having jurisdiction over the issue and possible solutions. In a federalized policy system, there are recurring conflicts over the level of government that has primary jurisdiction over policies. Contemporary examples of this conflict are the current debates over health insurance regulation (with some critics of the Affordable Care Act alleging health insurance regulation is policy domain best left to the states) and education (with some critics challenging the idea of developing the federal "common core").

Issue Linkage

Issue linkage is defined as the association of a specific public problem with other public issues. In other words, it is about which policy domain to which a specific issue is attached. While how an issue is linked to other issues and how the linkages affect policy solutions are usually domain specific and varying over time (e.g., Baumgartner & Jones, 1993; Rose & Baumgartner, 2013), issue linkage itself is quite prevalent in agenda setting and frequently used by policy participants. Issue linkage has profound policy implications, as different linkages affect the thinking about how a public problem should be addressed and with what kind of measures. For example, linking smoking to public health rather than to agriculture and economic advantages led to different tobacco policies (Baumgartner & Jones, 1993); associating poverty with personal laziness rather than social and economic costs resulted in the decline of government generosity (Rose & Baumgartner, 2013).

Issue Narrative Style

Issue narrative styles are frequently examined in media framing literature. It is about whether the issue is a portrayed as a thematic concern or an episodic occurrence. Iyengar (1987, 1989, 1991) shows that news media typically reports and frames news stories in episodic or thematic styles. Episodic style depicts a public problem in the form of a single, concrete instance or specific event by offering an example, case study, or seemingly isolated event-oriented report (e.g., by discussing a specific gun death). Thematic style, on the other hand, presents an issue within a broader context and portrays it at a more abstract level in the form of general outcomes (e.g., by

discussing national statistics related to the prevalence of gun deaths—possibly by subgroups). Iyengar's study (1991) demonstrates that episodic framing in news coverage on public problems is more likely to divert attention from societal responsibility and dampen support for governmental actions to address these problems, while thematic framing is more likely to highlight the general connections between problems and encourage the understanding of public problems at a collective level, thereby inspiring the thinking of the causes and solutions to governmental policies and programs.

It is important to note that the four dimensions discussed above are not the exhaustive categories for issue attributes. Conceptually there are potentially indefinite numbers of ways that public issues can be characterized or framed. In fact, past literature has examined various elements and even subelements in issue framing. The typology proposed here considers four important dimensions along which public issues are frequently defined by issue participants. While these four attributes particularly connect to Jones and Baumgartner's attention and problem definition theory, they also connect to a broader literature in psychology and framing effect. For instance, issue image (negative vs. positive) resonates with gain vs. loss framing in the prospect theory (Kahneman & Tversky, 1979); issue linkage can be found in secondary agenda-setting research (e.g., Baumgartner et al., 2008; Nelson et al., 1997); issue scope connects to different levels of policy authority; and narrative style can be derived from similar literature in communications research.

It is also important to note that the typology of problem characterization does not impose the strong assumption of temporal order linking problem characterization and alternative generation, as is present in the Jones and Baumgartner model. Strong linkages between issue attributes and solution advocacy could either mean a strong causal sequence (as the Jones and Baumgartner model suggests) or a process of co-generation wherein policy advocates emphasize problem characteristics with an eye towards the advocacy of a specific solution (much like the debate over the separation of agenda setting and alternative specific stages in Robinson and Eller [2010]). In the latter, the strategy for advocacy precedes the problem identification stage. In either case, a strong connection between problem characterization and solution advocacy has been suggested, though our research design does not permit the determination of temporal sequence.

The creation of a typology of policy attributes is an important addition to the current attention-based models of the policy process associated with Baumgartner and Jones. The attribute–solution framework is silent on the content of the attributes of a particular policy. The theory emphasizes the existence of separable dimensions but does not draw conclusions from the potential content of these dimensions (Baumgartner & Jones, 2015). In specific cases, the framework relies on the inductive clarification of the content of the relevant dimensions within each policy area. In pesticide policy, the role of health consequences, environmental effects, and scientific uncertainty may be central. In defense policy, this set of dimensions and attributes may be different. We base our typology of issue attributes based on previous research we have conducted on climate change policy. While we believe that these four categories in our typology (i.e., issue image, scope, linkage, and narrative) will have some generality across issue domains and policy venues, we are unable to test

the generality of the typology within the scope of this article. Since the typology emerged empirically and inductively, confidence in the framework will depend on the accumulation of examples over time as we (and hopefully other scholars) investigate the limits and the strengths of the typology over time on other issues. Future research, across varied policy areas, can investigate the exhaustiveness, robustness, and specificity of the typology.

Specification of Climate Change Attribute–Solution Model

Based on the typology developed above, we now turn our discussion to specifying the possible attribute–solution linkages and then we propose several testable hypotheses in the context of news coverage of global warming and climate change.

The issue of global warming and climate change has appeared in the U.S. news media since the late 1960s and steadily gained more and more attention over the last four decades in both regional news media (Liu, Vedlitz, & Alston, 2008) and national news outlets (Liu et al., 2011). Numerous studies have traced the total volume of media coverage of climate change (Mazur & Lee, 1993; Trumbo, 1996; Ungar, 1992), investigated the driving forces of media attention (Liu et al., 2011), and examined various narratives or themes of media climate change discourse (Kirilenko & Stepchenkova, 2012; McComas & Shanahan, 1999). Scholars have also investigated how news media (mis)transmitted the science of climate change (Bell, 1994), how values affected news coverage orientations (Wilkins, 1993), and how journalistic norms (e.g., neutrality or objectivity) caused the failure of journalists to accurately transmit scientific consensus to news stories (Boykoff & Boykoff, 2004). Despite the increasing scholarly interests in news media coverage of climate change, few studies have examined the possible relationships between climate change problem characterization and solution generation in the news media.

News media frequently talk about issue solutions, but the most significant media deliberation on many issues is usually not about how best to address it or what specific steps to take; rather, much of the media discourse centers around whether any solutions need to considered or adopted and whether any policy actions need to be taken. The key difference among climate change news stories is that some articles propose and discuss climate solution(s) while others do not.

Why do some news articles generate solutions while others do not? One key reason, according to the attribute–solution model, is that the likelihood of an issue solution being generated is intrinsic to and affected by how the problem is defined along different attribute dimensions. As discussed earlier, four key attribute dimensions are typically involved in problem characterization. Now, we apply these attributes specifically to climate change.

Issue Image and Climate Change

The first key attribute dimension is the "issue image" of climate change. In the news coverage of climate change, one of the most prominent attribute dimensions is

whether, how, and to what extent global warming/climate change is "harmful" (Liu et al., 2008). Thus, if climate change is portrayed in a news story with a negative image as a dangerous and detrimental problem, it is likely for the news article to make suggestions on how to solve the problem. Likewise, if a news story views climate change as a nonharmful issue, it is unlikely for the article to propose or discuss any solution or actionable item.

Issue Scope and Climate Change

The second key attribute dimension in the news discourse of climate change is "issue scope." To significantly reduce the emission of greenhouse gases, nationwide action in all 50 states is necessary (Goulder & Stavins, 2011), and the federal government is expected to have the primary responsibility in formulating policies to combat climate change (APA, 2011). Framing climate change as a national issue conforms to this expectation and, therefore, enhances thinking about climate solutions. In contrast, characterizing climate change with a narrower scope, portraying it as a local or regional issue, may hurt the chance for solution-oriented ideas to be discussed, because local authorities do not usually possess sufficient resources or strong incentives to deal with this large-scale and trans-boundary environmental issue.

Climate change is also frequently discussed in the news media with a much broader scope at the global level. Stories with this global scope often talk about the worldwide impacts of climate change, attribute other countries as contributing sources of greenhouse effects, and suggest that the problem is a global problem rather than just a U.S. problem. This portrayal may inhibit promoting solution-oriented ideas, because it is likely to serve as a stimulus for thinking the situation a tragedy of the commons or collective action dilemma played out between nation states (Helm, 2008; Soroos, 1997), thereby evoking a "free-rider" prospect and inducing an inaction orientation.

Issue Linkage and Climate Change

The third key attribute dimension is "issue linkage." Climate change, by its nature, is an environmental–ecological problem, but it is often linked to other public issues. While climate change issue could be coupled with a large array of other public issues (Smith, 2005), such as public health, immigration, national security, crime/social order, education, housing, and public land, and water management, Liu et al. (2008) find that the news media most frequently links climate change to the following five issue areas: energy, transportation, science research and development (R&D), international cooperation, and macroeconomics (e.g., economic growth and competitiveness).

Because of the causal connections between fossil fuel consumption and global warming, the news media often links climate change to the energy problem. When this type of linkage is made, it is usually very natural to think about reducing energy consumption and promoting alternative energy sources such as wind and solar

power. Similarly, when climate change is associated with the transportation issue, it often leads to solution-oriented ideas such as promoting highly efficient vehicles, reducing traffic jams, and improving highway systems.

Another issue that the news media frequently link to climate change is international cooperation and U.S. leadership in world affairs. To effectively combat global warming, international cooperation and America's involvement are necessary (Nisbet, 2009). When a news story emphasizes this linkage, it is natural for the story to proceed to talk about the importance of U.S. leadership and involvement and to make policy recommendations for the United States to engage in international climate cooperation and sign on to international treaties.[4]

The news media also make various economic linkages in their climate change coverage. For instance, there are news stories viewing climate change risk as an economic issue because it imposes enormous negative consequences for the U.S. economy. There are also stories focusing on the facts that other countries are greatly advancing clean technology solutions in order to reduce their carbon footprint. For these articles, it is likely that certain policy solutions will be generated, proposed, or recommended, urging America to foster technological innovations and enhance economic competitiveness in light of the global movement in combating climate change and growing a green economy.

While linking climate change to energy, transportation, international cooperation, and the economy may promote solution-oriented thinking, portraying the climate change issue as if it is a science and research problem may inhibit policy ideas and solutions. Scholars note that questioning the scientific validity of anthropogenic climate change and reporting more skeptical views of scientific certainty in the news media not only creates an artificial or false journalistic balance, but also amplifies contrarian views of climate change, serving to arouse the thinking of inaction or doing-nothing (Boykoff & Boykoff, 2004; Demeritt, 2001; Liu, Vedlitz, Stoutenborough, & Robinson, 2015; Nisbet, 2009).

Narrative Style and Climate Change

The fourth attribute dimension in the news media characterization of climate change is issue narrative style. Episodic coverage of climate change would focus on specific stories and subjects disconnected from a larger policy domain (e.g., covering global warming by presenting a story of a polar bear struggling to survive as the arctic climate changes or a story about the impact of sea level rise caused by climate change on a family fishing business). By contrast, thematic coverage would be more general and discuss climate change as a series of global, interconnected processes. Examples of thematic coverage would include discussions of global sea level rise and its impacts across countries and continents (rather than episodic coverage focusing on specific locations) or the impact of climate change on global crop production and animal migration patterns.

Based on the discussions above, we expect that the likelihood of climate change solution being proposed in the news stories will be affected by the four key attributes

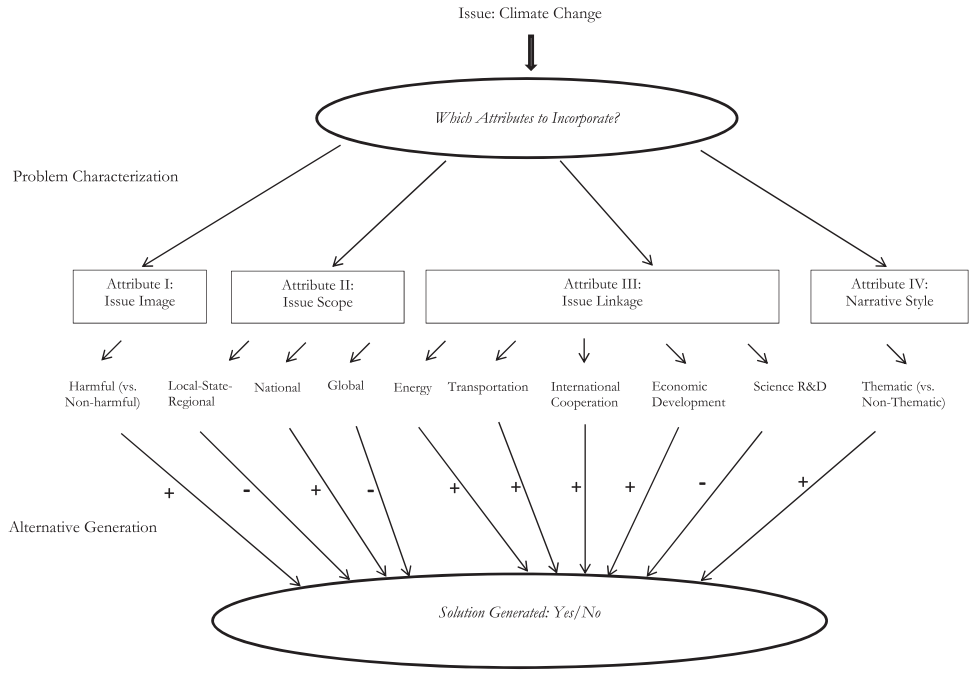

Figure 1. Specification of the Climate Change Attribute–Solution Model.

in climate change problem characterization—i.e., issue image, issue scope, issue linkage, and narrative style. More specifically, we hypothesize the following relationships:

> *Hypothesis 1: Harmful issue image is more likely to increase the chance of climate change solution generation in the news media than nonharmful issue image.*
>
> *Hypothesis 2: The likelihood of climate change solution generation in the news media will increase if the issue scope is portrayed at the national/federal level, but will decrease if the issue scope is depicted at the subnational level and the global level.*
>
> *Hypothesis 3: The likelihood of climate change solution generation in the news media will increase if the issue association is tied to energy, transportation, economic development/competitiveness, and international cooperation, but will decrease if it is linked to science R&D.*
>
> *Hypothesis 4: Thematic narrative style is more likely to enhance the likelihood of climate change solution generation in the news media than nonthematic narrative style.*

Specification of the attribute–solution model (adopted from Jones & Baumgartner, 2005, p. 62) and the hypothesized relationships between climate change attribute characterization and solution generation are summarized in Figure 1.

Analytical Strategy: News Collection, Coding, and Variable

Testing the hypotheses developed above requires systematic collection and analysis of relevant news articles on climate change. Because news articles are basically

texts that are not readily amenable to quantification, content analysis methods and article coding techniques become necessary for dataset construction (Krippendorff, 1980; Neuendorf, 2002; Riffe, Lacy, & Fico, 2005; Weber, 1985).

Our dataset construction began with the collection of relevant newspaper articles on climate change. To systematically collect the articles, two online searchable document archives—Lexis-Nexis and Pro-Quest—were used. We used three key words—"climate change," "global warming," and "greenhouse gas"—to search the two archives for relevant newspaper articles beginning in 1969 (earliest data available in these archives) and ending in December 31, 2005 (the cutting date for our final round of data collection conducted in the summer of 2006 for our larger research project).[5] The rationales for using these three key terms and validity tests were discussed in detail in previous research (Liu et al., 2008, 2011; McComas & Shannahan, 1999).

We retrieved 11,413 articles from four U.S. newspapers archived in either Lexis-Nexis or Pro-Quest: *The New York Times*, *Chicago Tribune*, *Los Angeles Times*, and *Houston Chronicle*. These four newspapers were chosen for two reasons: first, each of these newspapers represented a distinct geographic location in the United States, capturing different interests for different regions; and second, all four newspapers were among the top 10 U.S. newspapers by daily circulations in 2005 (Burrelles-Luce, 2006), representing the top visible and high-influence national newspaper group.

Among all the retrieved news articles, we randomly selected 10 percent samples from each of the four newspaper sources. This yielded 1,140 sampled articles. The research team reviewed these sampled articles and identified "irrelevant" and "invalid/indexing" stories.[6] Excluding these tangential and indexing articles yielded a final news database with 608 valid articles on global warming and climate change from the four newspapers: 101 articles (16.6 percent) from *Chicago Tribune*, 80 articles (13.2 percent) from *Houston Chronicle*, 159 articles (26.1 percent) from *Los Angeles Times*, and 268 (44.1 percent) from *The New York Times*.

Guided by the attribute–solution framework and the issue attribute typology specified in the last section and assisted with pilot-coding and standard content analysis methods, we developed our codebook and coding protocol and constructed a coding platform using Microsoft Access. Two research assistants were trained extensively, and they independently reviewed and coded the news articles assigned to them. One assistant, as the primary coder, completed coding for all 608 articles. The other assistant coded 20 percent randomly selected articles (i.e., 122 articles) from the 608 articles. Based on the results of the 122 articles coded independently by the two assistants, we performed a intercoder reliability test, using the simple measure of "percent agreement" between the two coders over each coded item. The intercoder reliability tests showed high consistency between the two coders—the lowest percent agreement between the two coders among all coded variables was .82,[7] meeting the .80-or-greater standard for adequate concordance in most content analysis practices (Lombard, Snyder-Duch, & Bracken, 2004; Neuendorf, 2002).

The final dataset of all 608 coded articles included basic fact information such as newspaper sources (CT, LAT, HC, and NYC) and article publishing date as well as the following variables.

Solution

If an article clearly discussed any policy idea, suggestion, action item, or recommendation for dealing with the climate change problem (e.g., developing alternative or clean energy; regulating greenhouse gas emissions; working with other counties on climate change research; providing tax incentives for fuel-efficiency vehicles), this article was coded as 1 (solution proposed). Articles without mentioning any ideas or solutions to climate change were coded as 0 (no solution proposed).

Issue Image

The overall view of each article was evaluated to discern whether global warming or climate change was portrayed as harmful or nonharmful. Articles clearly indicating any real or possible negative consequences of climate change were coded as 1 (harmful); articles arguing that global warming may actually benefit human beings (i.e., greater agricultural productivity), suggesting that climate change is not detrimental or dangerous, or articles lacking a clear indication of whether climate change is harmful were coded 0 (nonharmful).[8]

Issue Scope

Each article was coded to identify whether climate change was discussed at one of the following scopes: local/state/regional (1= yes; 0 = no), national/federal (1 = yes; 0 = no), or global (1 = yes; 0 = no). As one article may discuss climate change at several levels, multiple checks on this variable were allowed in our coding. For example, if an article discussed the global warming trend around the world and then discussed possible consequences of sea-level rise for the Houston-Galveston Bay area, we coded the issue scope of this article as both "global" and "local/state/regional."

Issue Linkage

In our coding of the news articles, we examined how the climate change issue was associated by the news media with five other issues, including energy (1 = yes; 0 = no), transportation (1 = yes; 0 = no), international cooperation (1 = yes; 0 = no), economic development (1 = yes; 0 = no), and science R&D (1 = yes; 0 = no). Since one article could associate climate change with several issues, multiple checks were allowed in coding issue linkage.

Narrative Style

Each news article was assessed under the rule of whether the story predominately used a thematic narrative style and coded into the dataset as either 1 = thematic or 0 = nonthematic. In our coding, it was rare to encounter a news story

that was either exclusively thematic or episodic. For example, a news story on the 1997 Kyoto Protocol—an international treaty that sets binding obligations on industrialized countries to reduce emissions of greenhouse gases, might begin with lead-in remarks by the reporter about the potential large-scale impacts of climate change on the entire planet and for all human beings, and then offering a look at how global warming affected a fisherman in a small town in the Gulf of Mexico. On the other hand, an overall account of the politics and policy debates over the Kyoto Protocol might include a brief description of how a West Virginia coal miner's job and his family might be affected by the treaty. Nonetheless, in our original coding, thematic frame or episodic frame clearly predominated in most stories when we applied a two-thirds rule to determine the predominant focus of the story—that is, if a story was judged to be two-thirds or more thematic, it was coded as thematic; if it was two-thirds or more episodic, it was coded as episodic. In addition, there were 45 stories (7.5 percent) judged to be split roughly even between thematic and episodic frames and originally coded as "mixed." To simplify the analysis, we grouped "episodic" and "mixed" into the "nonthematic" category in this study to make the narrative style a binary variable (i.e., 1 = thematic and 0 = nonthematic).

The coding results of these variables are summarized in the Appendix.

Data Analysis and Results

The unit of analysis is individual newspaper articles on climate change. Our dependent variable y_i for each article i is *Solution_Proposed*, which is binary,

$$y_i = \begin{cases} 1 \ \textit{solution proposed} \\ 0 \ \textit{otherwise} \end{cases}$$

Independent variables include the four attributes described above: issue image (*Harmful_Image*), issue scope (*Local_State_Regional*, *National_Federal*, and *Global*), issue linkage (*Energy*, *Transportation*, *Economic_Development*, *International_Cooperation*, and *Science R&D*), and narrative style (*Thematic_Narrative_Style*). All these independent variables x_i are also binary, where

$$x_i = \begin{cases} 1 \ \textit{yes} \\ 0 \ \textit{otherwise} \end{cases}$$

We first conducted baseline tests for each of the hypotheses, running each independent variable along one of the four issue attributes against the dependent variable without controlling other variables. We then placed all independent variables into one binary logistic model to test the attribute–solution connections in a more comprehensive and robust manner; we also checked whether there is any newspaper-fixed effect (see further explanation below). In addition, we analyzed the marginal effects and discrete changes of each of the independent variables on the dependent variable.

Table 1. Baseline Logit Regression Models

	Model 1 Issue Image	Model 2 Issue Scope	Model 3 Issue Linkage	Model 4 Narrative Style
(*Constant*)	−1.653*** (0.290)	−.552+ (0.322)	−.870** (0.292)	−.710** (0.253)
Overall Attention (Control)				
Annual_Attention	0.010* (0.005)	0.011* (0.005)	0.004 (0.005)	0.013** (0.005)
Issue Image				
Harmful_Image	2.037*** (0.234)			
Issue Scope				
Local_State_Regional		−0.142 (0.210)		
National_Federal		1.148*** (0.203)		
Global		−0.497* (0.209)		
Issue Linkage				
Energy			1.402*** (0.210)	
Transportation			1.109*** (0.261)	
Economic_Development			0.815** (0.262)	
International_Cooperation			0.974*** (0.219)	
Science R&D			−0.978*** (0.202)	
Narrative Style				
Thematic_Narrative_Style				0.730*** (0.189)
AIC	729.550	783.353	631.510	805.356
BIC	742.780	805.404	662.382	818.587
Log-likelihood	−361.775	−386.676	−308.755	−399.678
p	0.0000	0.0000	0.0000	0.0000
Pseudo R^2	0.120	0.059	0.249	0.028
N	608	608	608	608

$^{+}p = 0.1$, $^{*}p = 0.05$, $^{**}p = 0.01$, $^{***}p = 0.001$.

In all these models, we controlled for the overall annual news attention to climate change, as one may argue that the likelihood of climate change solutions generated in news stories may be correlated with the ups and downs of the overall annual volume of news attention to climate change. Previous literature, particularly the issue-attention cycle argument of Downs (1972), suggests that as an issue matures over time and more attention is directed to it, policy actors think more about policy solutions to address the issue. Thus, the chance of solution generation may be positively affected by increased attention. To control this possible effect, we created a new variable—*Annual_Attention*—measuring the total number of articles published in a particular year and assigned that number to each article published in the same year. We also conducted another estimation, i.e., year-fixed-effect, to examine the possible effect of attention variations in different years (more discussion later).

Baseline Models and Individual Hypothesis Testing

To conduct the individual tests for each of the hypotheses, we ran four baseline models with logit regressions. Table 1 summarizes the parameter estimates and *z* statistics for all baseline models.

Each of the four models affirms the importance of a single dimension (considered individually) in the proposal of solutions in policy dialogue (controlling for overall annual attention levels). The first model reveals that there is a strong positive association between the use of the harmful image frame and the proposal of solutions (Hypothesis 1). This is the most obvious connection and the results are not surprising. The baseline prediction (including a constant term and overall issue attention) correctly predicts the outcome 59.2 percent of the time. Model 1 adds issue image and improves the predictive quality of the model to 71.1 percent. This is a 29 percent reduction in classification error and illustrates the power of issue image as a predictor of solution proposal. Model 2 focuses on issue scope (Hypothesis 2). The results for Model 2 reveal that discussion of federal scope is positively related with solution proposal while discussion of global scope suppresses the likelihood of a proposed solution. The latter suggests the power of the collective action problem and its demobilizing effect in the global frame. The effect of the local-state-regional scope is not statistically significant, but the sign (negative) is as expected. Model 2 correctly predicts the outcome in 65.1 percent of cases, representing a 14 percent reduction in classification error. The effect of issue scope is substantively important but not as strong as issue image.

Model 3 focuses on specific issue linkages across policy domains (Hypothesis 3). The results suggest that ties to specific, actionable policy domains are related to the proposal of solutions. Framing an argument in terms of energy, transportation, international cooperation, or economic development is all positively associated with proposing solutions. This suggests that once debates reach a point of intersection with these policy areas, the subject of the debate likely turns to specific action. As expected, linkage to debates of scientific uncertainty has the opposite effect. This linkage reduces the probability of solution proposal—an effect that may well be present in other debates ranging from gun control to education reform. Model 3 improves predictive accuracy to 76.3 percent with a reduction of classification error by 42 percent. This is the largest of the improvements by any of the issue dimension models. Clearly, the substantive impact of issue linkage is quite strong.

Finally, Model 4 focuses on the effect of narrative style (Hypothesis 4). Having a thematic narrative style is positively associated with the proposal of a solution. The interconnectedness inherent in a thematic frame creates an association similar to the intersection with other policy domains in Model 3; interconnected themes are associated with solution proposal. This effect is modest compared to the other models, however. Model 4 improves predictive accuracy to 61 percent, representing only a 4 percent improvement in classification error. While statistically significant, this dimension has the smallest substantive association of solution proposal.

Nested and Robust Models

After testing each individual hypothesis using the four baseline models, we conducted logit regressions that include all the independent variables.

Table 2. Nested Models and Newspaper Fixed Effects

	Logit, Default SE	Logit, Robust SE	Fixed Effects, Logit, Robust SE
(Constant)	−1.935*** (0.460)	−1.935*** (0.477)	−2.089*** (0.494)
Overall Attention (Control)			
Annual_Attention	0.002 (0.006)	0.002 (0.006)	0.003 (0.006)
Issue Image			
Harmful_Image	1.489*** (0.276)	1.489*** (0.290)	1.515*** (0.293)
Issue Scope			
Local_State_Regional	−.156 (0.259)	−.156 (0.260)	−.191 (0.262)
National_Federal	0.505* (0.253)	0.505* (0.251)	0.490* (0.255)
Global	−1.001*** (0.284)	−1.001*** (0.308)	−1.001*** (0.312)
Issue Linkage			
Energy	1.130*** (0.225)	1.130*** (0.225)	1.195*** (0.229)
Transportation	0.916*** (0.280)	0.916*** (0.286)	0.883** (0.286)
Economic_Development	0.653* (0.277)	0.653* (0.292)	0.690** (0.295)
International_Cooperation	1.161*** (0.259)	1.161*** (0.271)	1.155*** (0.271)
Science R&D	−.843*** (0.225)	−.843*** (0.225)	−.840*** (0.225)
Narrative Style			
Thematic_Narrative_Style	0.608* (0.250)	0.608* (0.266)	0.608* (0.269)
Newspaper Fixed Effect			No
AIC	584.205	584.205	588.059
BIC	637.127	637.127	654.212
Log-(pseudo)likelihood	−280.103	−280.103	−279.030
p	0.0000	0.0000	0.0000
Pseudo R^2	0.319	0.319	0.321
N	608	608	608

*$p = 0.05$, **$p = 0.01$, ***$p = 0.001$.

The nested model tests whether the various hypothesized relationships overlap or compete with each other. Specifically, this model illustrates whether the dimensions of issue attribution converge to such an extent that their effects cannot be separated statistically. If the sign or significance of variables changes in the nested model, multicollinearity is likely present, and those attribute dimensions affected would be inseparable. The nested tests also include a more robust series of statistical analyses. Table 2 shows the results.

In the first column (logit, default SE), we run a standard logit. The second column (logit, robust SE) shows an alternative estimation with robust standard errors to address heteroskedasticity.[9] The last model, in the third column, adds the newspaper sources to test if there are any newspaper-fixed effects. The test for newspaper-fixed effect examines whether the pattern of attribute–solution connections holds across different newspapers. Previous studies indicate that news stories are not just a product guided by professional journalism standards of fairness and neutrality, they are also driven by individual journalists' perceptions (Hiles & Hinnant, 2014) and news organizations' political values and norms (Bennett, 1996; Patterson & Donsbach, 1996) as well as market incentives and economic concerns of managers and owners for business efficiency and profitability (McManus, 1995). Political orientations, partisan bias, economic norms, and other prior conditions and characteristics vary across individual news organizations, and the coverage of climate change in different newspapers may be affected by "motivated reasoning" and other information-processing biases (Lodge & Taber, 2005; Taber & Lodge, 2006; see also Chong & Druckman, 2007a, 2007b; Druckman 2001a, 2001b, 2004; Druckman & Bolsen, 2011; Jones &

Song, 2014). All these factors raise a possibility that the pattern of attribute–solution connections may differ from one newspaper to another.

The first logit model with default SE and the second logit model with robust SE yield nearly identical results. The third model adds newspaper-fixed effect, and the results are similar to those of the first and second models. The third model also indicates there is no significant newspaper-fixed effect, suggesting that the differences in probability of solution generation are not an artifact of mean probability differences across the newspapers. All three models have very large chi-square values, indicating that they fit the data very well ($p < 0.0001$). As expected, all attribute variables, except Subnational Scope are statistically significant at the .05 level, strongly supporting the theory of attribute–solution connection and the independence of the attribute dimensions. Annual_Attention shows no effect on the likelihood of solution generation, suggesting that the first level agenda setting (i.e., issue attention or issue salience) may be not as important as the second level agenda setting (i.e., problem characterization or issue definition) with respect to solution proposal.[10] In other words, variation in issue attention does not necessarily enhance the chance of solution generation, while attribute dynamics exert significant influence on issue solution (at least for the climate change issue). This finding, at first glance, appears to be incompatible with what Downs's issue-attention cycle theory would predict—more issue attention leads to more policy discussion. However, it is important to note that the climate change issue in the United States has not evolved to its maturity. In fact, there has been no breakthrough of national legislation regarding global climate change (Dolšak & Houston, 2013). This finding of no effect of attention volume on solution generation does not mean that Downs was wrong (or correct). It could be that the climate change issue is still developing in the United States and has not evolved to the "alarmed discovery" stage (in Downs's terms) where solution-oriented thinking is likely evoked along with increasingly heightened attention.[11]

The most important conclusion from the nested models is the independence of the issue dimensions. Strong relationships between the issue dimensions (e.g., if harmful images were always used in relation to federal scope) would interfere with the identification of the individual coefficients. Instead, what Table 2 reports is that the effects of the dimensions are sufficiently independent as to retain the core characteristics in the presence of all other dimensions. The nested test also serves as a hard test of the individual significance of each dimension. Interestingly, the nested model also renders the annual attention levels statistically ignorable. This supports the interpretation from before that issue dimensions are having a stronger effect on the proposal of solutions. Here, the effect of annual attention is not distinguishable from zero whereas the issue dimensions each include statistically significant components.

The fixed effect model with robust standard errors performs well overall. It improves the predictive accuracy of the model to 80.3 percent (a 52 percent reduction in error). The model is a substantial improvement over the baseline prediction and leaves only 20 percent of the variation in solution proposal to explain. The consistency of the individual effects and the performance of the models lead us to conclude that there is strong evidence of an association between issue dimensionality and solution proposal.[12]

Table 3. Marginal Effects and Discrete Changes

Variable	dy/dx	SE	z	$p>\|z\|$	X
Issue Image					
*Harmful_Image**	0.276	0.057	4.80	0.000	0
Issue Scope					
*National_Federal**	0.071	0.037	1.98	0.054	0
*Global**	−.082	.034	−2.27	0.015	0
Issue Linkage					
*Energy**	0.192	0.059	3.05	0.001	0
*Transportation**	0.147	0.066	2.12	0.027	0
*Economic_Development**	0.097	0.055	1.62	0.079	0
*International_Cooperation**	0.199	0.069	2.75	0.004	0
*Science R&D**	−0.073	0.028	−2.39	0.008	0
Narrative Style					
*Thematic_Narrative_Style**	0.089	0.045	1.85	0.049	0

(*) dy/dx is for discrete change of binary variable from 0 to 1; mean (41.582 articles/year) is used for *Annual_Attention*.

Substantive Influence: Analysis of Marginal Effect and Discrete Change

We further evaluate the substantive influence of problem characterization on solution generation by conducting analysis of marginal effect and discrete change. The marginal effect of a continuous independent variable (i.e., Annual_Attention, in our model) is the partial derivative with respect to that variable. The discrete change of a binary independent variable, x_a, is the difference in predicted probabilities of $x_a = 1$ and $x_a = 0$, holding other independent variables constant at their reference points.

We start with a baseline analysis, where for the continuous variable Annual_Attention, the mean (41.582 articles/year) is used as its reference point; for all other binary (dummy) independent variables, 0 is used as their reference point. The marginal effect calculations are based on the final model from Table 2—the logit regression with robust standard errors and fixed effects for newspapers. Table 3 summarizes the results with the independent variables showing significant influences.[13]

The baseline probability for proposing a solution if none of the issue dimensions are present and issue attention is at its mean is 13.7 percent. The baseline is actually a rare event in that most news stories include at least one of the issue dimensions in the models. Yet, it does serve as a useful baseline for comparison of effect sizes. The use of an issue image including the harms of climate change is related with a 27.6 percent increase in the probability of proposing a solution (holding the overall attention at mean and all other values at 0). This is a large effect size; effectively tripling the probability of a proposed solution. This effect size is substantially larger than the impact of moving from no issue scope to a national scope (increasing the probability of a proposed solution by 7.1 percent) or a global scope (reducing the probability by 8.2 percent). The most individually influential issue dimension was issue linkage. In individual terms, issue linkages have different effects ranging from a 7.3 percent reduction in solution proposal with linkages to scientific uncertainty to a 19.2 percent increase in solution proposal if the statement included linkages to energy policy. The

Table 4. Marginal Effects at the Means (MEMS Model)

Variable	dy/dx	SE	z	$p>\|z\|$	X
Issue Image					
*Harmful_Image**	0.355	0.065	5.51	0.000	0.787
Issue Scope					
*National_Federal**	0.121	0.061	1.98	0.048	0.760
*Global**	−0.216	0.059	−3.63	0.000	0.729
Issue Linkage					
*Energy**	0.263	0.051	5.20	0.000	0.564
*Transportation**	0.200	0.056	3.55	0.000	0.281
*Economic_Development**	0.146	0.061	2.40	0.016	0.270
*International_Cooperation**	0.259	0.056	4.61	0.000	0.405
*Science R&D**	−0.195	0.050	−3.89	0.000	0.498
Narrative Style					
*Thematic_Narrative_Style**	0.146	0.065	2.26	0.024	0.738

(*) dy/dx is for discrete change of binary variable from 0 to 1. Means are used for all dependent variables.

narrative style effect was comparatively modest with a thematic frame increasing solution proposal by 8.9 percent. While all of these effects are substantially important (the smallest representing a 50 percent increase in the base probability of solution proposal), it is clear that issue image and elements of issue linkage have the strongest associations with the solution proposal process.

We also conduct analysis of marginal effects at the means (MEMS), where the means of all the variables are used as reference point. In the MEMS model, the predicted probability of a solution proposal is 62.55 percent when all variables are held at their means. Table 4 reports the MEMS calculations with the independent variables showing significant influences.[14] Consistent to the results in Table 3, Table 4 shows significant effects of each attribute dimension on solution generation and confirms the results produced by the baseline marginal effect calculations.

Conclusion and Discussion

The proliferation of policy and communication studies of agenda setting in political science has greatly improved our understanding of how problem characterization affects policy solutions. However, most extant studies focus on interagenda interplays across various venues and investigate how issue dynamics in one venue (e.g., the news media or the general public) affect the alternative generation and policy choice in another venue (e.g., Congress). Drawing insights from Jones and Baumgartner's conceptual framework and other media agenda and framing literature, we theoretically explored one less-focused-on area in extant agenda literature—the intra-agenda dynamics between problem characterization and solution advocacy. Using quantitative data, we further empirically examined the attribute–solution connections in the context of news media agenda setting of climate change.

Our study makes several contributions. First, our study directly communicates with both policy process and media communication traditions of agenda research. Recent studies point out some distinct features between these two research approaches, and call for an integrated effort with an emphasis on studying media's

role in highlighting/underweighting attributes and how that attribute dynamics links to policy choice and policy change (e.g., Wolfe et al., 2013). Some scholars have begun to employ both perspectives to study media–policy connections and produced new and insightful findings (e.g., see Fowler, Gollust, Dempsey, Lantz, & Ubel, 2013, on competitive framing and policy implications for the HPV vaccine issue), but more scholarly attention should be paid to marrying the two rich but somewhat parallel traditions. In this study, we demonstrated that an integrated approach was not only feasible but also could potentially lead to a better understanding of agenda setting. Second, building on Jones and Baumgartner's policy process framework and drawing insights from media agenda and framing literature, we constructed a typology of four key issue attributes potentially embedded in most policy issues and theorized their possible relationships with policy proposals. Third, we applied this typology to one important policy venue in politics and policymaking—the news media. We believe this typology of intra-agenda dynamics of attribute dimensions and our modeling of their relationships to policy solution proposal can be extended to other venues (e.g., legislature) and other policy issues. Fourth, we developed testable hypotheses by using the climate change issue as an example and used content analysis techniques to construct a dataset. The coding techniques and strategies can be applied to other public issues. Fifth, our statistical analysis robustly demonstrated that problem attributes or dimensions indeed influenced issue solutions. Our findings, based on a relatively large number of cases (i.e., news articles), show that selection and utilization of various attributes are not just to characterize an issue and make sense of it, they are also touting or dampening ideas about solutions. Attributes are powerful organizing devices that can be highlighted or downplayed to enhance or reduce the likelihood of solution proposals. While the evidence presented in this study is based on the climate change issue and from within the news media, we think that it is likely that the same or similar logic, processes, and relationships exist within other policy venues and across issue domains.

The study of policy—particularly scholarship that has emphasized a staged approach to the policy process—has suggested a connection between issue definition and the process of alternative selection. One does not have to accept a strong version of the stages model (with specific gated stages, preset sequences, etc.) to admit the likelihood of such a connection. This connection, though, has not been subject to as much attention and theorization as the processes of issue definition and alternative specification themselves. These results reveal how fruitful it can be to study the connection between dimensions of issue definition and solution proposal processes.

The most important conclusion is that there are connections between issue dimensions evoked in news stories and the probability that news stories will also propose solutions to the problem. The paper proposed a typology of issue dimensions to make this approach portable to various policy areas. In this study, issue image, scope, linkage, and narrative style were each related to the probability of solution proposal—tested independently and then modeled simultaneously. This opens the field to further investigation into the dynamics linking issue definition and alternative specification.

The results suggest a variety of interesting avenues to elaborate on the typology of issue dimensions, but this research design has limitations as well. The first limitation is the impossibility of causal inference from this approach. One cannot tell whether a focus on the harms dimension encouraged proposal of a solution or if the anticipation of proposing a solution encouraged the choice of the harm frame. The causal direction of the relationship is less important for us than it would be to a strict version of the policy process theory (where it is vital that one phase precede another). Our primary interest is in the connection between these processes rather than the causal direction of effects. The statistics are convincing of the relationship itself. That being said, one should hesitate to declare that the choice of the issue dimension or frame unilaterally causes proposals. More broadly, we should note that news stories about public issues do not just act as a cause of policy; they are also a product of complex social and political interactions involving many actors: policy-makers, elite journalists, news organization managers, interest groups, and other stakeholders. How these actors influence the attention and content of news media is traditionally a question in the news production literature (e.g., McManus, 1995; Patterson & Donsbach, 1996). While this question is simply beyond the scope of this study, future agenda research should pay closer attention to the relationships among these actors, their interests, attribute-weighting dynamics, and policy solutions embedded in the news media. Furthermore, while our study focused on the intra-agenda dynamics between problem characterization and solution generation within the news media, future research should further examine how the media dynamics interact with similar attribute–solution links in other policy venues (e.g., government).

The second limitation is the focus on climate change debate. Like much policy process research, this study focuses on a single policy area. This limits the validation of a general typology of problem attribution. While climate change is an area worthy of investigation in its own right, it is likely that the manifestation of issue dimensions will vary across policy domains. Whereas climate policy included linkages to energy and transportation policy, for example, other policies may see linkages with public health, environment, or security policy domains. Debates over scientific uncertainty are present in a variety of policy issues and may have similar suppressive associations. While there is reason to be optimistic of the generality of the typology of issue dimensions and some of the specific elements (like scientific uncertainty and issue scope), there are other elements that require specification in different specific domains. We are most interested in seeing the typology of issue dimension employed in different policy domains—like social welfare or education. It would be interesting to see how much the types of issue dimension and their relative importance vary across policy domains.

To conclude, the results demonstrate a strong connection between the issue dimensions raised in the news media and the likelihood that solutions are proposed. While the evidence presented in this study is focused on climate change and news media, the theoretical expectation is that the intravenue linkage between activities traditionally associated with agenda setting and those associated with alternative specification should be applicable to other public issues and policy venues, given the differences across issues and unique features of various venues (e.g., different party

controls in Congress). Moreover, how issue characterization and solution generation in one venue (e.g., news media) affect the dynamics of problem definition and solution proposal in another venue (e.g., Congress) are also important research questions that warrant more scholarly attention. Are issue debates in Congress influenced by news media's problem definition? Are policy developments in Congress affected by solutions or proposals generated in the news media? What are the relationships between intravenue agenda setting and intervenue agenda setting? While we do not have answers to these questions, our hope is that this study will encourage additional research into the connections between issue dimensionality and the policy process across multiple issue domains and policy venues.

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Notes

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1. This stage is also termed as issue competition/prioritization or attention allocation dynamics in policy process (Baumgartner & Jones, 1993; Jones, 1994, 2001) or first-level agenda setting in communication research (McCombs & Shaw, 1972).
2. This problem characterization stage is also termed as issue/problem definition in policy process (e.g., Baumgartner & Jones, 1993; Cobb & Elder, 1983; Rochefort & Cobb, 1994; Wood & Vedlitz, 2007), issue framing in experimental psychology (e.g., Gilliam & Iyengar, 2000; Iyengar, 1987, 1991; Kahneman & Tversky, 1979), or second-level agenda setting in communication research (Kiousis, 2004; McCombs & Shaw, 1972).
3. The attribute-solution framework does not exclude the possibility that policy alternatives or solutions are sometimes developed independently out of the problem stream (for the argument of separated streams of problem and policy solution, see Kingdon, 1995; see also Zahariadis, 1995, 2003).
4. It is important to point out the difference between linking climate change to "international cooperation" and portraying climate change as a "global scope" problem (as discussed earlier in the three levels of issue scope). News stories with a "global scope" perspective primarily depict climate change as a global problem rather than just a U.S. problem. These stories often suggest that the problem is caused by many other countries around the world and tend to evoke a scenario of classic collective action dilemma. We expect that this emphasis on the global scope and portrayal of climate change as a much wider issue beyond the U.S. control inhibits solution-oriented thinking. In the news, there are some stories linking climate change to "international cooperation," and these articles emphasize that

international collaborations and worldwide actions, including the U.S. role and leadership in worldwide climate mitigation efforts are much needed to address the issue. We expect these articles that link climate change to "international cooperation" to prompt policy-oriented thinking. In short, portraying climate change as a "global scope" issue implies "the tragedy of the common," while linking climate change to "international cooperation" considers how to overcome the "free-rider" problem.

5. We collected articles dated through the end of 2005 because the data used in this study were from a larger research project, which completed its final round data collection in 2006. The earliest dates of news articles available for the four newspapers were different (1969 for *The New York Times*, 1985 for *Chicago Tribune* and *Los Angeles Times*, and 1991 for *Houston Chronicle*). Because the unit of our data analysis in this research is individual news articles, we pooled all the articles from the four newspapers into a single dataset.
6. We excluded all "irrelevant articles" and "invalid/indexing articles." "Irrelevant articles" are those in which "climate change," "global warming," or "greenhouse gas" were only occasionally or offhandedly mentioned and the main content of the story was not really about global warming or climate change. "Invalid/indexing articles" are the news stories that are simply reporting or following new government policies, initiatives, bills, or public officials' arguments and positions on the climate change issue, and these articles are not really generated by news media, as they are mostly just "indexing" what is going on with the government (see the indexing theory, Bennett 1990; see also, Wolfe et al., 2013).
7. Percent agreement on factual information such as Newspaper Source and Article Publication Date is 1.00. Percent agreement for each of the other coded variables is as follows: Harmful Image = 0.91; Local/State/Regional Scope = 0.95; National Scope = 0.96; Global Scope = 0.89; Linkage to Energy = 0.96; Linkage to Transportation = 0.96; Linkage to Economic Development = 0.92; Linkage to International Cooperation = 0.94; Linkage to Science R&D = 0.82; Thematic Narrative Style = 0.97; and Solution Proposed = 0.90.
8. There were 18 articles (3 percent of all 608 articles) arguing that climate change is not harmful or beneficial. There were 112 articles (18 percent) lacking a clear indication of whether climate change is harmful (i.e., presenting a neutral view or presenting both negative and positive views on the effects of climate change). These 112 articles were first coded as "mixed/neutral/undetermined" and then recoded as 0 (nonharmful), because they primarily presented a nonharmful issue image.
9. In addition to heteroskedasticity consistent standard errors, we clustered on the year of the observation to provide additional protections against nonindependence of the errors.
10. In addition to the three alternative models presented here, we conducted another estimation to examine the possible effect of attention variations across different years. Instead of using Annual_Attention, we included a dummy variable Year and found no year-fixed effects.
11. It is noteworthy that some recent studies indicate that levels of attention are not always positively associated with policy generations or policy programs (see Baumgartner & Jones, 2009, particularly Chapter 5 on two issue-policy expansion models; see also Jones & Wolfe, 2010), suggesting that not all the public issues are subject to Downs's issue attention cycle theory.
12. The length of the time series raises questions about the comparability of the data across time. To test for the stability of the results across time, we conducted a robustness test in which data from pre-1997 were compared to the data post-1997. This year was chosen to indicate the transition to more serious attention to and politicization of climate change research associated with the mid-1990s Republican control of Congress and the 1997 Kyoto Protocols. We run the same nested model of logit regression with robust SE and newspaper-fixed effect for each of the two eras. Across the two eras, the results on harmful image, energy issue linkage, and international cooperation are stable (in terms of sign and significance). For global scope, transportation linkage, scientific uncertainty, and thematic frame the results are not significant in the earlier era but similar to our aggregate results for the more recent era. The variables only significant in the later era—particularly global scope, scientific uncertainty, and thematic frame—roughly correspond to those we would expect to be affected by politicization in Congress. While these results suggest that more careful attention to the changing issue definitions is warranted, the overall finding is generally consistent to that of our aggregated data modeling—i.e., there is a strong association between problem attribute and solution proposal.
13. Annual_Attention and Subnational Scope (Local-State-Regional) do not show statistically significant effects on the probability of solution proposal (this is consistent with the findings in earlier tests) and are excluded from Table 3.

14. Again, Annual_Attention and Subnational Scope (Local-State-Regional) are excluded from Table 4 as they do not show statistically significant effects.

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Appendix: Summary of Variables and Coding Results

Variable and Coding		N	Marginal Percentage
Solution Proposed?	No	248	40.8%
	Yes	360	59.2%
Harmful Image?	No	130	21.4%
	Yes	478	78.6%
Local/State/Regional Scope?	No	454	74.7%
	Yes	154	25.3%
National/Federal Scope?	No	146	24.0%
	Yes	462	76.0%
Global Scope?	No	165	27.1%
	Yes	443	72.9%
Linkage to Energy?	No	265	43.6%
	Yes	343	56.4%
Linkage to Transportation?	No	437	71.9%
	Yes	171	28.1%
Linkage to Economic Development?	No	444	73.0%
	Yes	164	27.0%
Linkage to International Cooperation?	No	362	59.5%
	Yes	246	40.5%
Linkage to Science R&D?	No	305	50.2%
	Yes	303	49.8%
Thematic Narrative Style?	No	159	26.2%
	Yes	449	73.8%
Total		608	