

John Benjamins Publishing Company



This is a contribution from The Agenda Setting Journal 4:2
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Deepening the concept of 'compelling arguments'

Linking substantive and affective dimensions
of attributes in assessing the effects
of climate change news on public opinion

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This study examines the effects of both the substantive and affective dimensions of issue attributes in the news coverage of climate change on the public's perception of the importance of this environmental issue. Results from our analysis show that the four affective dimensions (e.g., positive and negative emotions, anger, and sadness) of the three attributes (e.g., existence, effects, and solutions) exerted strong influence on public issue priority. This study extends the concept of compelling arguments in agenda setting research by suggesting that compelling arguments effects are not solely dependent on substantive attributes. Their affective dimensions are influential, as well.

Keywords: climate change, agenda setting, compelling arguments, substantive attribute, affective attributes

Since McCombs and Shaw's (1972) seminal Chapel Hill study, scholars have found extensive evidence of agenda setting effects by the news media on the public. Agenda-setting theory has expanded to three levels with each focusing on different aspects of these effects. The first level examines issues or other objects that are the focus of attention. The second level is concerned with the attributes of those objects. The third level investigates these effects from a network perspective (Guo, Vu, & McCombs, 2012; Guo & McCombs, 2015).

This research addresses the second or attribute level, which focuses on aspects of issue objects. Numerous studies have examined the effects of sub-

stantive (e.g., political ideology, perceived qualifications, integrity, or personal biographical information of candidates) or affective (e.g., positive, neutral, or negative aspects of the substantive attributes) attributes (McCombs, Lopez-Escobar, & Llamas, 2000) in news coverage of various objects, such as issues or public figures, on the public attribute agenda for these objects (McCombs, 2013). Studies in this area also have expanded to examine the concept of compelling arguments that looks at cross-level effects between the news media attribute agenda and the public issue agenda (Ghanem, 1997). The concept of compelling arguments asserts that the salience of some attributes (e.g., government actions against drugs, social impact of drug abuse, among others) of an object (e.g., drug issue) on the news media agenda can increase the salience of that object on the public agenda while others cannot (Saldaña, 2017; Saldaña & Ardèvol-Abreu, 2015; Saldaña, Ardèvol-Abreu, Guo, & McCombs, 2014). Compelling arguments studies thus far have focused on substantive attributes. None have taken the affective dimension – the tone of substantive attributes on the news media agenda – into account.

This study acknowledges this gap in the agenda setting research literature and examines the effects of the affective dimension of issue attributes in news media content on the first-level public agenda of issues. We focus on climate change because it is a well-reported issue given the controversy revolving around it. This research analyzes content data from two major U.S. dailies, *The New York Times* and *The Wall Street Journal*, using a computer-assisted approach. For U.S. public opinion it uses survey data collected at 10 different time points between 2010 and 2014.

Theoretically, this study contributes to the literature of agenda setting research by expanding the concept of compelling arguments by testing the effects of the affective dimension as well as the substantive dimension of attributes on the public's issue agenda. We argue that these affective dimensions are important because they exert influence on the public's perception of climate change as an issue. In addition, this study provides practical knowledge of climate change communication by identifying the influence of affective aspects of some issue attributes on public perception of climate change. This research may aid scientists and policymakers outlining strategies to effectively communicate climate change to and engage intended audiences.

Literature Review

Climate change and the news media

We chose the issue of climate change for this study because global warming or climate change has been a controversial topic politically, economically, and religiously since its debut more than three decades ago (McCright & Dunlap, 2011). The representation of climate change in the news media helps the public interpret and make sense of the many complexities of this scientific and environmental phenomenon (Boykoff, 2011). News coverage of climate change in the United States has varied over time despite the climate’s potential to impact human life. For example, discourse on climate change remained sparse until the summer of 1988 when the U.S. experienced high temperatures and a severe drought (Schäfer & Schlichting, 2014). The news coverage of climate change dropped between 1991 and 1996 when the first Iraq War and economic downturn drove news media attention away from the environment (Anderson, 2009). Debates on the issue were elevated in the news during 1997 as the United Nations Framework Convention on Climate Change adopted the Kyoto Protocol. The protocol called for industrialized countries to commit to reducing greenhouse gas emissions (Boykoff & Roberts, 2007), but climate change coverage subsided soon after. The 2000s saw a gradual increase in news coverage of climate change, and the release of Al Gore’s book and film, *An Inconvenient Truth*, helped draw the issue back into the media spotlight (Anderson, 2009).

Empirical research has revealed evidence of the effects of media coverage on public attention to this environmental problem. Brulle, Carmichael, and Jenkins (2012) found an association between public awareness and the attention of news media to climate change. Sampei and Aoyagi-Usi’s (2009) study of Japanese news media discovered similar results with the public’s perception of the importance of climate change increasing when the volume of news on the issue rose. Arlt, Hoppe, and Wolling (2011) found that news media usage influences audiences’ awareness of and behavioral intentions regarding climate change. These studies only focus on the amount of coverage of climate change and its association with public attention to the issue; however, a question still exists about what aspects of climate change being reported in the news would exert effects on the public’s agenda regarding this environmental issue.

Recent research has demonstrated that affect and emotion play an important role in the public’s risk perception and behavior (Weber, 2010). In his study, which examines Americans’ perception of climate change, Leiserowitz (2005) identified 24 categories of affective images (e.g., melting polar ice caps, Antarctica melting, temperatures increasing, upset ecological balance, a hole in the ozone layer,

and world devastation, among others) associated with how the public perceives global warming. In their experimental research, Myers, Nisbet, Maibach, and Leiserowitz (2012) demonstrated that framing climate change as a public health issue can arouse emotions among members of the public. Specifically, the public health frame was likely to generate hopeful feelings among participants, while the national security frame tended to trigger anger. Findings from these studies suggest how important emotional aspects are for the public to engage and take action toward climate change. What remains less clear are which affective elements are included in the news media's climate change messages and more importantly how these affective elements influence public perception of climate change. Identifying which aspects of the news media's portrayal of climate change are related to changes in public perception can be expected to provide a more nuanced understanding of the representation of this major environmental issue.

Theoretical Background

The first level of agenda setting is about the effects of the mass media on the public's focus of attention, specifically "*who and what* people are thinking about" (McCombs, Lopez-Escobar & Llamas, 2000, p.703). But an individual object of attention may have numerous attributes that define how the object is seen. For example, terrorism is an issue that drew extensive news media and public attention after the terrorist attack on September 11, 2001. In examining the news coverage of terrorism, Craft and Wanta (2004) found that some of the attributes of the issue were more salient in the news than others, including the length of the war, future terrorist attacks, effects on the economy, and the Israel-Palestine conflict. Other attributes such as biological threats, air travel safety, war protests, and Afghan civilian deaths did not receive much attention. Their analysis shows that the public's frequency of media use significantly correlates with four (e.g., future terrorist attacks, Israel-Palestine conflict, effects on economy, and war protests) of the eight individual attributes of the 9/11 terrorist attack issue. The findings corroborate attribute or second level effects of the news media on public opinion. These effects and those of numerous other studies are evidence of the thesis that the news media not only tells us *what to think* but can also tell us *how to think* about an object (McCombs, 2013). Second level agenda setting with its focus on the transfer of salience of the attributes of an issue from the news media agenda to the public agenda brought a new theoretical perspective in studying agenda-setting effects (McCombs, 2013 McCombs & Shaw, 1993).

Attribute agenda-setting research examines the salience of two dimensions of these attributes: substantive and affective (Lopez-Escobar, Llamas, McCombs, & Lennon, 1998; Kim & McCombs, 2007). *Substantive attributes* are those dimen-

sions of an object that describe specific characteristics of an issue or other topics on the news media and public attribute agendas. For example, Lee (2010) selected five attributes that are frequently mentioned when news media report on climate change, including ecosystem, floods, industrial business, energy policy, and regional conflict. In his experiment, Lee found a strong correspondence between the respondents’ assessment of the attributes of global warming and the salience of these attributes in the texts participants read.

Affective attributes are the facet of news coverage that provoke emotions. In general, the agenda-setting effects of an attribute can be influenced by how that attribute is presented in the news. An attribute that is portrayed as positive or negative can affect the audience’s perception of it. Wanta, Golan, and Lee (2004) found that salient affective attributes of a country in the news have effects on how the public perceives that foreign nation.

The concept of affect differs from the concept of valence. In the field theory of Lewin (1951), valence is “the subjective worth of an occurrence, item, individual or other being in the life space of the person. An entity which draws the person nearer has positive valence, while one which repels the target has negative valence” (cited in Pam, 2013a, para 1). With valence there is an emphasis on involvement. In regard to compelling arguments, valence arguably would apply to the combined substantive and affective dimensions of an attribute.

Affect or sentiment is only one dimension of an attribute “spanning from distress to extreme joy, from the most minor to the very involved senses involved with feeling” (Pam, 2013b, para 1). Affect is the tone of an attribute and in many cases elicits no involvement. For example, a news story about the consequences of climate change would be perceived by most, if not all, persons as negative. But many people simply will accept this as a fact rather than something to which they feel a need to respond.

Further explicating the concept of valence in the frames of news stories, De Vreese and Boomgaarden (2003, p.362) note: “Entman (1993) suggests that frames promote a ‘moral evaluation’ and Tewksbury, Jones, Peske, Raymond, and Vig (2000:804) argue that ‘frames can imply policy options or implicit answers to questions of what should be done about an issue.’ This goes beyond stressing different aspects of an issue and additionally suggests that frames may have normative implications. The latter studies imply that frames often times have inherent *valence* by suggesting, for example, positive or negative aspects, solutions, or treatments.” More specifically, in their investigation of the valence of the news framing, each story was classified as portraying the *consequences* of the summit as either advantageous or disadvantageous.

In short, valence implies some degree of involvement with a topic or response to a topic that De Vreese and Boomgaarden (2003, p.362) note “goes beyond

stressing different aspects of an issue.” The focus of this study is on those descriptive attributes, in particular the tone or affect of attributes that function as compelling arguments. Put another way, valence is more appropriate to framing while the more narrowly focused concept of affect is appropriate to attribute agenda setting.

Compelling arguments refers to the link between the salience of individual attributes at the second level with object salience at the first level (Ghanem, 1997; McCombs, 2013). This concept notes that the salience of an issue or other object in the public agenda results from more than the salience of the issue or object in the news agenda. The idea of compelling arguments takes notice of the fact that the salience of an issue also results from the salience of the attributes of the issue, and the various attributes of an issue presented in the news media attribute agenda do not resonate equally with the public. Drawing upon George Orwell’s fictional *Animal Farm*, McCombs (2013, p. 51) notes:

Some attributes are more equal than other attributes. Some are more likely than others to be regularly included in media messages, and some are more likely than others to be noticed and remembered. In the interpretation of a message some attributes will also be considered more pertinent than others. Certain characteristics of an object may resonate with the public in such a way that they become especially compelling arguments for the salience of the issue, person, or topic.

Consequently, a few attributes of an issue may drive its salience among the public as much as, or even more than, the overall salience of the issue on the news agenda. This relationship links the first and second levels of agenda setting and is illustrated in Figure 1 by the diagonal arrow.

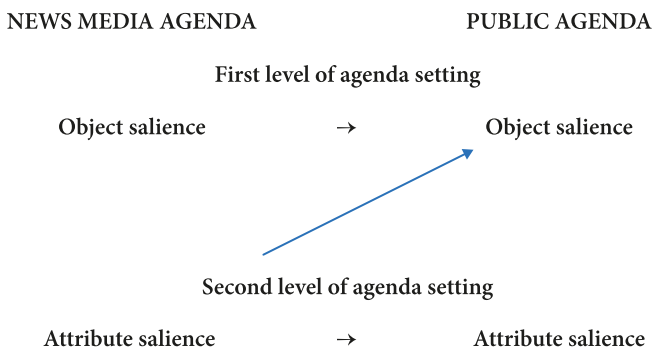


Figure 1. Explaining the concept of compelling arguments

Evidence of compelling arguments effects were first discovered in Ghanem’s research on the issue of crime in Texas in the early 1990s. Ghanem (1997) found that the salience of the issue for crime in the news corresponds positively with

the Texas public citing crime as the most important problem of the day (+0.70). Ghanem also found that two attributes of the crime issue in the news coverage, how threatening crimes were to the public as well as the geographical distance between where crimes happened and the audience in Texas, had equal or stronger influence on the public than did the total coverage. The correlations were +0.78 for the level of the threat and +0.73 for the geographical distance, and crime events that happened in Texas had stronger effects than those taking place elsewhere. Each of the two attributes in the news media coverage have equal or stronger predictive power on the salience of the crime issue among the public than the total coverage – confirming the compelling arguments gateway for the transfer of salience from the news media to the public agenda.

Theoretically, the concept of compelling arguments captures a psychological aspect of the process in which agenda-setting effects occur. Human minds tend to selectively record only a limited number of aspects of an object simply because they cannot pay attention to everything. But these few aspects help make the object accessible in audiences' memories. Whether the attribute images stored in people's minds would lead to further consequences on public perception requires deeper examination.

Since Ghanem's seminal study on compelling arguments, agenda setting scholars have found more evidence supporting this theoretical concept. For example, Jaspersen, Shah, Watts, Faber, and Fan (1998) identified compelling arguments effects with regards to the issue of the federal budget deficit, Ardevol, Saldaña, and McCombs (2013) for the issue of oil shortages, Saldaña, Ardèvol-Abreu, Guo, & McCombs (2013) for the drug issue, and Saldaña (2017) for unemployment. These various studies identify a diverse variety of attributes that are compelling arguments for the salience of issues, but they do have one thing in common. All of them involve only the substantive dimension of these attributes or divergent pairs of affective attributes (e.g., positive vs. negative) of the overall news coverage. This study will be the first one to investigate the compelling arguments effects of the affective dimensions of substantive attributes of climate change on the public perception of this environmental issue. This research will build on previous studies (Vu, 2015; Liu, Lindquist, & Vedlitz, 2011) that identified existence, effects, and solutions as the dominant substantive attributes in the news coverage of climate change during the time period studied here.

Traditional agenda setting research has usually used aggregate data for the public agenda, with results compiled from responses to the Gallup poll's MIP (Most important problem facing your country) question (McCombs, 2013). Recently, a few studies have examined the influence of individual factors on public issue priority (Vu, Jiang, Chacón, Riedl, Tran, & Bobkowski, 2018). With regards to climate change, research on public perception of this environmental issue

shows that individual factors (e.g., political ideology, education level), although varying from country to country, are associated with public perception of risks related to global warming and climate change (Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015).

Research Questions & Hypotheses

We begin with assessing the influence of individual factors including age, education, gender, household income, and political ideology on public opinion regarding climate change. Our first research question asks:

RQ1: Which demographic variables predict the salience of climate change among the public?

To replicate the compelling arguments effects of substantive attributes on the issue of climate change, we ask:

RQ2: Of the three dominant substantive attributes in the news media coverage of climate change (existence, effects, and solutions), which predict the salience of issue salience on the public agenda?

The primary focus of the investigation reported here is to explicitly link affective dimensions to the substantive attributes of climate change on the news media agenda and gauge the effects toward issue salience among the public, and we pose this exploratory research question:

RQ3: Which affective dimensions of these three dominant substantive attributes in the news media agenda (existence, effects, and solutions), predict the salience of climate change on the public agenda?

When each of these substantive attributes is stratified to create new variables that link the substantive attribute with one of the affective dimensions of the climate change coverage in the news, which of these new variables predict the salience of climate change among the public? The identity of these affective dimensions is presented in the methods section.

Methods

Data Sources

The data sources for this research are two-fold. For public opinion on climate change we employ secondary data from a series of nation-wide representative surveys conducted by the Yale University Project on Climate Change Communication. For the analysis we include 10 waves of surveys completed online from November 2009 to March 2015 with roughly two being launched each year. The 10 surveys were conducted among Americans 18 years or older representing the country’s population. The high quality of these surveys is indicated by their completion rates, ranging between 47.1% and 60.9%. The cumulative response rates were between 4.2% and 7.1%.¹ The average number of respondents in each survey is 1,134. Details are presented in Table 1.

Table 1. Number of news articles and number of survey respondents in each wave

Wave	Content data (No. of articles)	Survey data
1	11	1001
2	7	1024
3	9	1010
4	7	1000
5	8	1008
6	8	1061
7	6	1045
8	9	1657
9	7	1275
10	9	1263

For the news content we chose *The New York Times* and *The Wall Street Journal*, two major publications in the United States, whose agenda-setting role has been extensively documented (McCombs, 2013). The timeframe is one month before each survey was launched, a time period within the decay of issue salience memory (Watt, Mazza, & Snyder, 1993). Search terms include “climate change,” and/or “global warming,” and/or “greenhouse gas” in headlines or leads to locate

1. Cumulative response rate = recruitment rate × profile rate (those who completed questions about their demographic profile/those who initiated their answer with or without completing questions about their demographic profile) × completion rate (DiSogra & Callegaro, 2009).

relevant news articles in LexisNexis. Duplicate articles, letters to the editor, movie or book reviews, corrections, and blog posts were excluded. Articles that did not focus on climate change were also screened out. We then generated a random sample of the news articles by including every other article in our database. Each of the 10 waves has a monthly span. (See Table 1 for more details).

The codebook is adapted from a previous attribute agenda setting study on climate change by Liu, Lindquist, and Vedlitz (2011) that content analyzed newspaper articles on climate change from 1992 to 2005. We focus on three popular attributes in news coverage of global warming/climate change: (1) climate change existence, (2) effects of climate change, and (3) solutions to mitigate climate change (Boykoff & Boykoff, 2004; Liu, Vedlitz, & Alston, 2008). Each time a substantive attribute is mentioned in the text, it is counted once. Two graduate students in journalism, who were not among the authors, were recruited to perform the coding. After training, coders checked articles (13%) for inter-coder reliability, which was found satisfactory with Cohen's Kappa values ranging from 0.80 to 0.84.

Measurement

The salience of the attributes of climate change was assessed by summing the number of times each attribute was mentioned in each of the articles for the one month before each survey was conducted. Sentences and paragraphs that contain those attributes were selected for input in a computer program for affective salience identification.

Independent Variables

For the salience of substantive attributes, we manually identified the number of paragraphs in each article that focused on the three major attributes: (1) existence of climate change,² (2) effect of climate change,³ and (3) solution to climate

2. Includes mentions of the following: global warming/climate change does exist, and/or human activity causes global warming/climate change; a person approves of/supports/believes in climate change, that the person thinks global warming/climate change exists; and scientific evidence of global warming/climate change; global warming does not exist, and human activity does not cause global warming/climate change; a person disapproves of/disbelieves in climate change, that the person thinks global warming/climate change does not exist (e.g., human activity makes no effects on temperature increase; there are not enough facts about climate change; climate change is made up by a liberal conspiracy; global warming is a hoax, a scam; global warming is in doubt, etc.)

3. Includes mention of the following: consequences of global warming/climate change (e.g., 'environmental disaster,' 'health risk,' 'loss of life,' 'threat to infrastructure,' 'land degradation,'

change,⁴ respectively. We then ran correlation tests between the two newspapers for each of the three substantive attributes. Test results show statistically significant correlations between the two newspapers for all three attributes: existence of climate change: $r=0.738$, $p<0.05$; effect of climate change: $r=0.676$, $p<0.05$; and solution to climate change: $r=0.638$, $p<0.05$. We then added the numbers for each of the substantive attributes from the two publications together. The unit of the news media data was wave of media content.

For the affective salience of these attributes we used Linguistic Inquiry and Word Count (LIWC), a dictionary-based text analysis application, to run the sentiment scores for the paragraphs we identified in the first step. LIWC counts words in psychologically meaningful categories and compares the input text with a dictionary of more than 2,000 words. The program assesses the presence of a host of linguistic and psychological constructs, such as emotional, cognitive, and social processes. The program has been used widely to content analyze documents and news stories in the field of linguistics and mass communication among others (Coppersmith, Harman, & Dredze, 2014; Kahn, Tobin, Massey, & Anderson, 2007; Pennebaker, Slatcher, & Chung, 2005; Stieglitz & Dang-Xuan, 2012). We identified four affective dimensions for this study: *positive emotions* (e.g., love, nice, sweet, etc.), *negative emotions* (e.g., hurt, ugly, nasty, etc.), *anger* (e.g., hate, kill, annoyed, etc.), and, *sadness* (e.g., crying, sad, grief, etc.). We validated these words based on

'greater severity and frequency of tropical storms,' 'drought,' 'extreme weather,' 'snow storm,' 'glacier melting,' 'polar bear extinction,' 'rising sea level,' 'influencing water resources,' etc.), or that climate change does no harm; Denying all possible effects that are often associated with global warming/climate change; good effects brought about by global warming/climate change, ('climate change is not a threat to the earth or human kind,' 'global warming helps agriculture,' 'we need global warming in cold areas,' etc.)

4. Includes mentions of the following: solutions to mitigate, prevent or adapt to global warming/climate change (e.g., 'cutting greenhouse gases,' 'adapting to climate change by growing forests,' 'using alternative energy like solar, wind to avoid warming the earth,' 'new policy to curb emission,' etc.); countries need to work together to fight climate change; ('UN conferences on climate change; the U.S. should make stronger commitments to international climate change initiatives'; 'climate change treaty will engage more countries in the world'; 'India and China promised to cut greenhouse gases,' etc.); No solution is needed or is helpful in climate change mitigation, prevention, or adaptation. Adopting other solutions will be more helpful than investing in mitigating global warming, (e.g., 'there is nothing humans can do about climate change,' 'solar energy cannot replace coal to cut greenhouse gas,' 'investing in clean energy is expensive,' 'cutting greenhouse gases will slow down the economy,' 'no country is doing anything to cut greenhouse gases,' etc.); No cooperation is effective or needed for climate change, (e.g., countries in the world are withdrawing from the climate change treaty; no countries are doing anything to mitigate climate change; international conferences discussing global warming/climate change do not reach their goals, etc.)

the ratings by experts for psychometric information (Pennebaker, Booth, Boyd, & Francis, 2015; Tausczik & Pennebaker, 2010). The LIWC dictionary was arranged hierarchically so one word may belong to several sub dictionaries. For example, the word cried is indexed in *sadness*, *negative emotions*, *overall affect*, *verbs*, and *past focus*. Words that represent *anger* and *sadness* are therefore also included in the negative emotion category (Pennebaker et al., 2015).

Stratifying each of the substantive attributes (existence, effects, and solutions) by these four affective dimensions creates 12 compelling arguments for analysis:

Existence/positive emotions, *existence/negative emotions*, *existence/anger* and *existence/sadness*;

Effects/positive emotions, *effects/negative emotions*, *effects/anger* and *effects/sadness*;

Solutions/positive emotions, *solutions/negative emotions*, *solutions/anger* and *solutions/sadness*.

Dependent Variable

The dependent variable is the public salience of climate change measured by answers to this single question in the surveys:

Here are some issues now being discussed in Washington, D.C. [Global warming was one of the issues asked about] Do you think each of these issues should be a low, medium, high, or very high priority for the next president and Congress?" (1 = low; 4 = very high).

Analysis

We ran a linear regression analysis with robust standard errors to capture the relationships between substantive attributes, their affective dimensions, and public opinion. Before running the regression analysis, we conducted skewness and kurtosis tests to check whether the non-normality is acceptable. The results showed that the coefficients of both positive and negative as well as sum and net affect fell within the acceptable range (less than 3) (Chambers, Mallows, & Stuck, 1976).

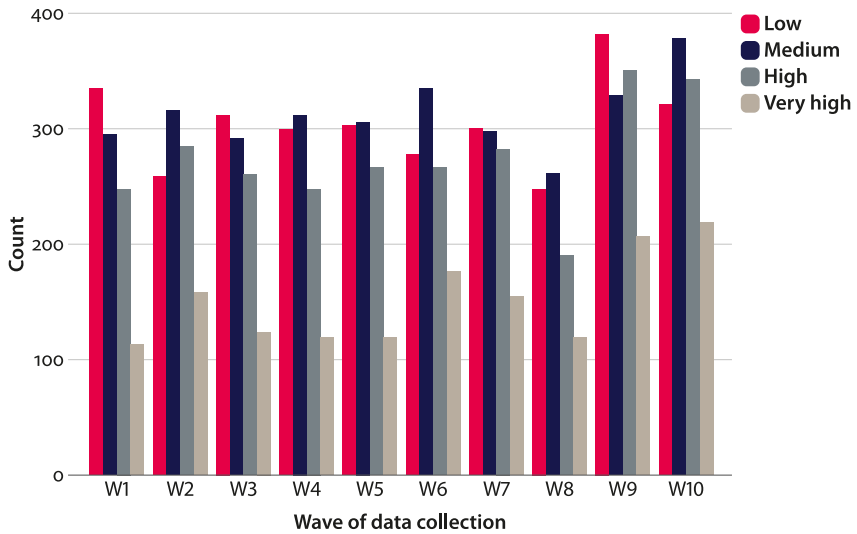


Figure 2. Public Issue Priority Across 10 Waves

Results

Demographics

Of the 11,344 participants 49.7% were male and 50.3% were female. Respondents’ education was measured by four categories: *Less than high school* (8.3%); *High school* (30.4%); *Some college* (29.4%), and; *Bachelor’s degree or higher* (31.8%). The household median income for all waves was between \$ 60,000 and \$ 74,000. Participants’ ages were assessed with four categories: 18–29 (15.3%), 30–44 (23.7%), 45–59 (31%), and 60 or older (30%). Political ideology was measured on a 5-point scale ranging from 1=very liberal to 5=very conservative (*Mean* across 10 waves = 3.17, *SD* = 1.05).

News Media Data

Climate change existence was mentioned on an average of 21.74 times in each wave (*SD* = 8.73). Climate change effects had an average of 40.1 mentions (*SD* = 10). Climate change solutions were referred to 35.01 times (*SD* = 8.19).

For the four affective dimensions of these three substantive attributes *positive emotions* had the largest numbers of mentions with *M* = 22.96 for *existence*, *M* = 29.39; for *effects*, and *M* = 38.92 for *solutions*. *Negative emotions* were the second most prevalent with *M* = 14.31 for *existence*, *M* = 26.44 for *effects*, and *M* = 21.04 for *solutions*. *Anger* had a much smaller average number of mentions for each

Table 2. Regression results on relationships between the media’s existence, effects, and solutions attributes and their affective dimensions and public issue priority

Predictors	<i>b</i>	Robust standard error	95% Confidence interval	
Existence				
<i>Intercept</i>	89.28	1.83 ^{***}	85.68	92.87
<i>Age</i>	0.545	0.267 [*]	0.021	1.068
<i>Gender</i>	0.211	0.557 (<i>ns</i>)	-0.881	1.304
<i>Education</i>	0.368	0.318 (<i>ns</i>)	-0.256	0.992
<i>Household income</i>	-0.023	0.070 (<i>ns</i>)	-0.160	0.114
<i>Political ideology</i>	0.199	0.018 ^{***}	0.164	0.235
<i>Existence (substantive)</i>	-1.827	0.061 ^{***}	-1.947	-1.707
<i>Positive emotions</i>	2.155	0.054 ^{***}	2.049	2.260
<i>Negative emotions</i>	2.692	0.086 ^{***}	2.524	2.861
<i>Anger</i>	-12.654	0.230 ^{***}	-13.106	-12.203
<i>Sadness</i>	1.591	0.324 ^{***}	0.955	2.226
<i>F</i> (10, 11333) = 805.63, <i>p</i> < 0.001. <i>N</i> = 11,344. <i>R</i>² = 0.413				
Effects				
<i>Intercept</i>	12.33	1.684 ^{***}	9.031	15.633
<i>Age</i>	-0.132	0.206 (<i>ns</i>)	-0.536	0.271
<i>Gender</i>	0.440	0.429 (<i>ns</i>)	-0.402	1.282
<i>Education</i>	-0.225	0.245 (<i>ns</i>)	-0.706	0.256
<i>Household income</i>	0.031	0.054 (<i>ns</i>)	-0.075	0.136
<i>Political ideology</i>	0.192	0.014 ^{***}	0.165	0.219
<i>Effects (substantive)</i>	2.174	0.025 ^{***}	2.124	2.224
<i>Positive emotions</i>	-1.681	0.039 ^{***}	-1.757	-1.604
<i>Negative emotions</i>	1.746	0.041 ^{***}	1.665	1.827
<i>Anger</i>	-6.149	0.098 ^{***}	-6.342	-5.957
<i>Sadness</i>	-13.672	0.187 ^{***}	-14.039	-13.307
<i>F</i> (10, 11333) = 2,138.83, <i>p</i> < 0.001. <i>N</i> = 11,344 <i>R</i>² = 0.651				
Solutions				
<i>Intercept</i>	-9.57	2.309 ^{***}	-14.096	-5.045
<i>Age</i>	0.751	0.239 ^{**}	0.283	1.220
<i>Gender</i>	0.517	0.499 (<i>ns</i>)	-0.461	1.496
<i>Education</i>	-0.373	-0.285 (<i>ns</i>)	-0.932	0.186
<i>Household income</i>	0.113	0.063 (<i>ns</i>)	-0.010	0.236
<i>Political ideology</i>	0.215	0.016 ^{***}	0.183	0.247

Predictors	<i>b</i>	Robust standard error	95% Confidence interval	
<i>Solutions (substantive)</i>	-0.601	0.033 ***	-0.665	-0.537
<i>Positive emotions</i>	-0.554	0.032 ***	-0.617	-0.491
<i>Negative emotions</i>	3.665	0.040 ***	3.587	3.742
<i>Anger</i>	-2.331	0.132 ***	-2.590	-2.072
<i>Sadness</i>	<i>omitted because of collinearity</i>			
$F(10, 11343) = 1,428.44, p < 0.001. N = 11,344. R^2 = 0.529$				

Notes.

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

wave with $M = 3.50$ for *existence*, $M = 5.44$ for *effects*, and $M = 2.88$ for *solutions*. *Sadness* was the least present of all with $M = 1.40$ for *existence*, $M = 3.18$ for *effects*, and $M = 2.88$ for *solutions*.

RQ1 asked about the influence of demographic factors on participants’ priority for the issue of climate change. Across the regression results for the three replications of news media attribute salience and issue priority displayed in Table 2, only political ideology was a consistent predictor of the priority of climate change among the public ($b = 0.161, p < .001$ for *existence*, $b = 0.192, p < .001$ for *effects*, and $b = 0.215, p < .001$ for *solutions*). This means that conservatives are more likely to say that global warming or climate change should be discussed at the policy-making level. Age was a significant predictor in two of the three replications, specifically *existence* ($b = 0.545, p < .01$) and *solutions* ($b = 0.751, p < .01$). This demonstrates that older people are more likely to see global warming or climate change as an issue of priority. Gender, education, and income were non-significant in all three replications.

To answer RQ2, which inquired about the associations between the three substantive attributes in the news coverage and the salience of climate change on the public agenda, the regression tests in Table 2 controlled for participants’ demographics and the stratified substantive/affective attributes. The test results in the three replications reported in Table 2 indicated that the salience of the *substantive effects attribute* in the news had the strongest effect on the public agenda ($b = 2.174, p < .001$), followed by the *substantive existence attribute* ($b = -1.827, p < .001$), and *substantive solutions attribute* ($b = -0.601, p < .001$). This indicates that the more the news media mention effects of global warming/climate change, the higher the issue is in the public agenda; however, the more they refer to the existence and solutions to global warming/climate change the less likely the public believes in the importance of global warming/climate change.

The core research question for this study is RQ3, which asked about the effects of the three substantive attributes stratified by their affective dimensions on the

public's issue priority for climate change. The regression results in Table 2 indicate that 11 of the 12 substantive attributes stratified by their affective dimensions were statistically significant predictors of the public's climate change issue priority. The twelfth variable, *solutions/sadness* could not be tested because of collinearity.

Comparing the strength of the four affective dimensions within each replication, anger had the strongest impact on the salience of climate change among the public: *existence/anger* ($b = -12.554, p < .001$), *effects/anger* ($b = -6.148, p < .001$), and *solutions/anger* ($b = -2.331, p < .001$). This shows that the use of anger as an affective attribute negatively influences the public's perception of global warming climate change. Specifically, the more the news media use words that show *anger* in reporting on global warming/climate change the less likely the public will believe in its importance.

Positive emotions show the least impact: *existence/positive emotions* ($b = 2.155, p < .001$), *effects/positive emotions* ($b = -1.684, p < .001$), and *solutions/positive emotions* ($b = -0.554, p < .001$). This demonstrates that the more positive emotions are included in portraying the existence of global warming/climate change, the more likely the public would see it an issue of high priority. On the contrary, when words about positive emotions are incorporated in the news coverage of the effects of and solutions to global warming/climate change, public issue priority regarding this environmental phenomenon decreases. Negative emotions were another consistent predictor of public issue priority: *existence/negative emotions* ($b = 2.692, p < .001$), *effects/negative emotions* ($b = 1.746, p < .001$), *solutions/negative emotions* ($b = 3.665, p < .001$). This means that public issue priority increases when the news media include more words that show negative emotions. Sadness shows mixed results across the three replications.

Comparing the strength of each substantive attribute as compelling arguments in the three regressions with the four substantive/affective compelling arguments for the same attribute we see that seven of the 11 comparisons show stronger weights for the substantive/affective arguments.

For existence, *existence/positive emotions*, *existence/negative emotions* and *existence/anger* have stronger weights than existence (substantive). For effects, *effects/anger* and *effects/sadness* have stronger weights. For solutions, *solutions/negative emotions* and *solutions/anger* have stronger weights. (Recall that *solutions/sadness* could not be tested due to multicollinearity.

In sum, when comparisons are made among the four affective dimensions within each replication, anger plays the strongest role in influencing the public agenda. As words representing anger increases in the news, public issue priority decreases. And the effects of anger on the public agenda are strongest when the affective compelling arguments are compared with the substantive attribute alone.

Overall, the relationships found here are strong. When the analysis includes demographics, a substantive attribute and four versions of the substantive attribute stratified by its affective dimensions, Table 2 shows that for existence, $R^2 = 0.413$, for effects $R^2 = 0.651$, and for solutions $R^2 = 0.529$.

These findings are especially strong in comparison to the first-level relationship, total number of news articles and the priority of climate change among the public, a very weak $R^2 = 0.003$.

Discussion & Conclusions

The present study investigates the compelling arguments effects of three substantive attributes of the climate change issue in the news as well as their four affective dimensions on public opinion regarding this important environmental phenomenon. All three substantive attributes, *existence*, *effects*, and *solutions*, exert strong compelling arguments effects on the public perception of climate change, which was measured by *issue priority*. Findings of this study offer empirical evidence of compelling arguments effects, echoing previous agenda setting research on the cross-over influence between the news media attribute agenda to the public's object agenda (Saldaña, et al., 2014).

Most importantly, this study adds to agenda setting theory through its examination of the compelling arguments effects of four affective dimensions (*positive emotions*, *negative emotions*, *anger*, and *sadness*) of the three substantive attributes (*existence*, *effects*, and *solutions*). Specifically,

- Eleven of the 12 substantive attributes stratified by their affective dimensions were statistically significant predictors of the public's climate change issue priority; Their predictive directions are mixed with five positively influencing public issue priority while six negatively impact the public agenda.
- Comparing the strength of the four affective dimensions within the analysis of each substantive attribute, anger has the strongest impact on the salience of climate change among the public. The incorporation of anger negatively influenced public priority with regards to global warming/climate change as the more words that show anger are used the less important the public thinks issues of global warming/climate change are.
- Comparing the strength of each substantive attribute as a compelling argument in the three regressions with the four substantive/affective compelling arguments for the same attribute, seven of the 11 comparisons show stronger weights in influencing the public's agenda on global warming/climate change for the substantive/affective arguments than just the substantive arguments

alone. Theoretically, this finding suggests that in examining compelling arguments including affective attributes may provide more accurate results about the relationship between the news media's and the public's agendas.

This research also investigated the influence of individuals' demographic factors. Of the five demographic variables, only political ideology showed consistent and strong effects on the public's perceptions of climate change. This confirms what was found in previous research that demonstrated that climate change has been politicized in the U.S. The public's views of it are highly divided along the political ideology line (Dunlap, McCright, & Yarosh, 2016; McCright & Dunlap, 2011). Other individual variables exerted little to no influence on the public salience of climate change. However, findings of this research emphasize that the news media play an important role in shaping public views on climate change. Climate change attributes in the news showed strong effects on public perception of this environmental phenomenon.

From a theoretical perspective this study validates and extends the compelling arguments concept in agenda setting research. Specifically, this study argues that compelling arguments effects are not solely dependent on substantive attributes. Their affective dimensions are influential too. It also suggests that some affective aspects are more powerful than others.

A few limitations of this study suggest further inquiry. First, although this study made an attempt to include news media from both sides of the spectrum of media ideology, its reliance on newspapers may make the news media agenda less diverse. Future research should include more news media outlets for the analysis of the news agenda. Second, this project assessed only the three dominant attributes of the climate change issue. Subsequent studies can extend the number of attributes to be examined to provide a larger picture of climate change in the news.

Acknowledgements

The authors would like to thank Dr. Edward Maibach, Dr. Anthony Leiserowitz, and Dr. Connie Roser-Renouf for sharing their survey data.

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