

ORIGINAL ARTICLE

The Mutual Reinforcement of Media Selectivity and Effects: Testing the Reinforcing Spirals Framework in the Context of Global Warming

Lauren Feldman¹, Teresa A. Myers², Jay D. Hmielowski³, & Anthony Leiserowitz⁴

1 School of Communication and Information, Rutgers University, New Brunswick, NJ 08901, USA

2 Center for Climate Change Communication, George Mason University, Fairfax, VA, 22030, USA

3 The Edward R. Murrow College of Communication, Washington State University, Pullman, WA, 99164, USA

4 School of Forestry and Environmental Studies, Yale University, New Haven, CT, 06520, USA

This study tests a model of reinforcing spirals in the context of global warming, using a 2-wave, within-subjects panel survey with a representative sample of Americans. Results show that, within waves, conservative media use is negatively related to global warming belief certainty and support for mitigation policies, while nonconservative media use is positively associated with belief certainty and policy support. In addition, the results show that consuming conservative or nonconservative media at Wave 1 makes people more likely to consume those same media at Wave 2, partly as an indirect result of the media's effects on global warming belief certainty and policy preferences. Wave 2 media use, in turn, further strengthens audiences' global warming belief certainty and policy preferences.

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Given the myriad news outlets available to citizens in the modern U.S. news media environment, partisans can easily choose information sources that align with their political predispositions (Mutz & Martin, 2001). Such selective exposure has been a source of consternation for scholars. One worry is that the rise of partisan news—on cable, political talk radio, and the Internet—allows Americans to insulate themselves in “echo chambers” where they are exposed to content that is consistent with their opinions while shielded from dissenting views (Jamieson & Cappella, 2008; Sunstein, 2002). This use of like-minded content has been shown to increase attitude extremity and polarization (Stroud, 2011). As a result, the fragmented U.S. media environment might make it increasingly difficult for policymakers and the public to achieve mutual understanding and compromise on the most pressing issues of the day.

Corresponding author: Lauren Feldman; e-mail: lauren.feldman@rutgers.edu

The above concerns presuppose both that people selectively expose themselves to like-minded media *and* that these media have polarizing effects on audiences. While the existing literature offers evidence for both of these processes independently, we know less about the dynamic relationship between them. In part, this is because prior research on media effects has often been concerned with untangling causal priority: Do the media influence audience beliefs, or are audiences simply drawn to outlets that support their views? Recently, however, some communication scholars have argued that it is important to step beyond the typical research that focuses on identifying causes and effects. Specifically, Slater (2007) proposed the “reinforcing spirals framework” to explain the dynamic, mutually reinforcing processes of media selection and effects. Slater conceptualizes media selection and effects as a “spiral of ongoing influence” (p. 285), whereby the selection of a particular type of media influences beliefs, these changes in beliefs beget future consumption of similar media content, leading to the further maintenance or strengthening of the said beliefs.

This study advances prior research by explicitly applying Slater’s (2007) reinforcing spirals framework to the contemporary partisan media environment in order to better understand the dynamics that shape Americans’ understanding of global warming—an issue which is increasingly politicized in the United States (McCright & Dunlap, 2011). Although Zhao (2009) examined the mutual influence between individuals’ media use and global warming perceptions, his study was based on cross-sectional data and was thus unable to test the full reinforcing spirals model. Our study expands on this work through the use of a two-wave, within-subjects panel survey. Also, unlike previous research, we focus on ideologically oriented media outlets, which allow us to differentiate between media that communicate scientific consensus regarding climate change and those that question the existing evidence. As such, we are able to examine these outlets’ distinct role in the reinforcing process and demonstrate how like-minded media use and directional beliefs are perpetuated over time.

Specifically, we test the direct and indirect relationships between media use (conservative and nonconservative), global warming belief certainty, and support for climate change policy over time. Our results show contemporaneous effects of conservative and nonconservative media use on global warming belief certainty and policy support. In addition, we find that consuming conservative or nonconservative media at Wave 1 makes people more likely to consume those same media at Wave 2, partly as an indirect result of the media’s effects on global warming perceptions and policy preferences. Wave 2 media use, in turn, further strengthens audiences’ global warming perceptions and policy preferences. Thus, this study provides evidence for the mutually reinforcing effects of media exposure and public opinion, with implications for media fragmentation and polarization.

Conservative and nonconservative media effects on global warming beliefs

The contemporary media environment has given rise to distinctly conservative media outlets, including the Fox News cable network and Rush Limbaugh’s talk radio show,

which present coherent conservative messaging that clearly differentiates them from other major broadcast media such as ABC, CBS, NBC, CNN, and MSNBC (Jamieson & Cappella, 2008). According to Jamieson and Cappella (2008), “conservative media create a self-protective enclave hospitable to conservative beliefs” by “portray[ing] themselves as the reliable, trustworthy alternative to mainstream media, while at the same time attacking ‘liberals’ and dismissing or reframing information that undercuts conservative leaders or causes” (p. x). Consistent with this characterization, quantitative content analyses have shown that Fox News and conservative talk radio are more supportive of Republican and conservative interests than other outlets (Aday, 2010; Aday, Livingston, & Hebert, 2005; Project for Excellence in Journalism, 2012). Moreover, in keeping with the conservative movement’s opposition to climate science and policy (Dunlap & McCright, 2010; Jacques, Dunlap, & Freeman, 2008), research has shown that Fox News airs significantly more stories that question the existence of human-caused climate change than stories that accept these scientific claims (Feldman, Maibach, Roser-Renouf, & Leiserowitz, 2012).

This conservative message has become more pronounced as other media outlets have shifted their coverage to emphasize that global warming is happening. Although early mainstream media coverage highlighted the “disagreement” among those who believed global warming was happening and those who questioned the scientific evidence (Zehr, 2000), more recently, news from these sources has been less likely to cover the argument made by climate contrarians (Boykoff, 2007; Feldman *et al.*, 2012, Nisbet, 2011). Instead, liberal-leaning outlets, such as MSNBC, and mainstream outlets, such as CNN and the major broadcast networks, stress that global warming is happening and that it is caused by human activity.

Theoretically, the distinct cues presented by conservative and nonconservative media about global warming should translate into discernible effects on the perceptions and opinions of their respective audiences (see, e.g., Dalton, Beck, & Huckfeldt, 1998; Zaller, 1996). Indeed, both cross-sectional and longitudinal survey analyses have found that Fox News viewers are less likely to accept the scientific view on global warming, whereas use of nonconservative media is associated with greater acceptance of the reality and impacts of global warming (Feldman *et al.*, 2012; Krosnick & MacInnis, 2010; Hmielowski, Feldman, Myers, Leiserowitz, & Maibach, 2013). Experimental research, which is better suited for establishing causality, has found that common practices on conservative media outlets, such as emphasizing scientific controversy about global warming or including interviews with climate skeptics, reduces perceptions of certainty and concern about global warming relative to news stories that do not include this type of coverage (Corbett & Durfee, 2004; Malka, Krosnick, Debell, & Schneider, 2009). At the same time, news reports that provide context for the controversy surrounding climate change—for example, by emphasizing that the balance of research supports the reality of global warming, which is typical of mainstream media reports—increase people’s certainty that global warming is happening (Corbett & Durfee, 2004). Together, these results increase theoretical confidence that attention to conservative and nonconservative outlets influences beliefs about global warming.

Although prior research points to the divergent influence of conservative media and nonconservative media on global warming beliefs, these studies have not accounted for the role of selective exposure and thus leave open the question of whether it is simply that individuals' prior beliefs influence both media exposure and stated opinions about global warming. Our study addresses this limitation by considering the dynamic relationship between media use and public opinion about global warming. Consistent with Slater's (2007) reinforcing spirals model, we propose that media use not only influences individuals' beliefs about global warming, but also that these beliefs, in turn, drive selective exposure to media outlets that are consistent with their views on global warming, which further strengthens or reinforces these views over time.

Selective exposure

Partisan selective exposure refers to the tendency for individuals to actively choose information that echoes their political beliefs. Evidence for partisan selectivity first emerged in early studies of voting behavior during American election campaigns, which found that voters were more likely to read and listen to messages from their preferred candidate or party (e.g., Lazarsfeld, Berelson, & Gaudet, 1948). Contemporary research has shown that conservatives and Republicans prefer right-leaning outlets, such as Fox News, and tend to avoid outlets such as CNN and NPR, with the reverse true for liberals and Democrats (Iyengar & Hahn, 2009; Stroud, 2011). Individuals' attitudes toward particular issues also drive news selection. For example, experimental studies have found that partisans prefer to read stories that confirm their existing beliefs on issues such as gay marriage, social security reform, gun control, and abortion, relative to stories that challenge their opinions (Garrett, 2009a, 2009b; Knobloch-Westerwick & Meng, 2009). In the context of climate change, Kim (2011) found that those who were dismissive of global warming expressed greater interest in reading an article that denied the dangers of global warming, as opposed to an article that described the dangers. Although scholars have advanced several theoretical explanations for selective exposure (see Stroud, 2011, for a review), the most prominent include a desire for cognitive consistency (e.g., Festinger, 1957; Kunda, 1990).

Stroud (2011) argues that selective exposure is motivated by beliefs that are linked to a person's interests or self-concept. This is why people with strong political leanings are especially likely to engage in selective exposure, because their political beliefs are cognitively accessible and personally defining. Over the last decade or so, global warming has become increasingly politicized at both the elite and mass levels, with widening gaps between how Democrats and Republicans perceive the issue (McCright & Dunlap, 2011). Nisbet (2009) has argued that global warming has become one of just several issues that define what it means to be a Democrat or Republican. As such, views on global warming are likely strongly related to one's political identity and, therefore, would serve as a probable basis upon which to choose among media. This idea is also consistent with research on issue publics, or groups of citizens who care deeply about particular issues (Converse, 1964). Issue publics have been shown to be

highly selective information seekers, preferring information on the issues they find personally important (Kim, 2009). Thus, although prior studies of selective exposure to partisan media outlets like Fox News have mostly examined political partisanship (Republican/Democrat) or ideology (conservative/liberal) as predictors (e.g., Iyengar & Hahn, 2009; Stroud, 2011), we argue that issue-specific beliefs—in this case, related to global warming—can also drive the selection of broadly conservative or nonconservative media sources, even after controlling for general political predispositions.

Reinforcing spirals

We have thus far established an argument both for why conservative and nonconservative media use should be expected to influence global warming beliefs and for why global warming beliefs should motivate the selection of conservative or nonconservative media. However, the innovation of the reinforcing spirals framework (Slater, 2007) is that it links these two processes rather than treating them in isolation. According to this model, influence does not merely flow from media use to beliefs (media effects) or from beliefs to media use (selective exposure), but rather from media use to beliefs to more media use, in an ongoing chain of influence. This reinforcing process has been shown for a range of issues of interest to communication scholars. For example, Slater, Henry, Swaim, and Anderson (2003) demonstrated that violent media exposure leads to aggressiveness in adolescents, which in turn leads to increased use of violent media. Eveland, Shah, and Kwak (2003) likewise demonstrated the mutually reinforcing effects of news attention and political knowledge.

Thus, for our study, there are three key implications of the reinforcing spirals framework that move us beyond traditional models of media effects and selective exposure. The first is the expectation that conservative media use spawns more conservative media use over time (as will nonconservative media use to nonconservative media use), due to the intervening effects of global warming beliefs and attitudes. Previous studies have shown robust over-time relationships between media use at Wave 1 and subsequent media use of the same type (Holbert, 2005; Holbert & Benoit, 2009). For example, Holbert and Benoit (2009) found that Fox News use before a presidential debate strongly predicted Fox News use after the debate. Although these studies establish the consistency of people's media use over time, they did not test the mechanism via which this consistency occurs. Our contribution is to propose selective exposure based on issue-related beliefs as the mechanism of influence—in this instance, beliefs concerning the issue of climate change. As a corollary to this, we also expect that conservative media use will be *negatively* related to nonconservative media use over-time (and vice versa). Although selective *avoidance* of opinion-challenging information has been found to be less pervasive than selective exposure to like-minded information (Garrett, 2009a, 2009b), to the extent that ideologically oriented media cultivate a culture of mistrust toward other viewpoints (see Jamieson & Cappella, 2008), selective avoidance becomes more likely (Slater, 2007).

The second implication is that selective exposure to conservative or nonconservative media will reinforce and strengthen individuals' beliefs about global warming,

Attitude reinforcement has long been considered a consequence of selective exposure (e.g., Klapper, 1960). While this is often interpreted as evidence for limited media influence (e.g., Bennett & Iyengar, 2008; Klapper, 1960), attitude reinforcement should not be overlooked as an important persuasive effect of like-minded media use, particularly given its role in promoting polarization (Holbert, Garrett, & Gleason, 2010; Slater, 2007). Toward this end, contemporary political communication research has begun to consider the consequences of exposure to like-minded media (e.g., Jamieson & Cappella, 2008; Knobloch-Westerwick, 2012; Knobloch-Westerwick & Meng, 2011; Stroud, 2011). These studies have shown that selective exposure leads to more polarized and accessible attitudes, providing implicit support for reinforcing spirals. Similarly, among issue publics, active selection of information about issues of personal concern has been found to produce greater attitude extremity (Kim, 2009).

The final implication is that the relationships between media selectivity and effects should be cumulative, resulting in an ongoing cycle that perpetuates like-minded media use and reinforces attitudes. One explanation for this process, according to Slater (2007), is that relevant media exposure might heighten the salience of a given social identity and associated attitudes, increasing the likelihood of seeking out more relevant media, which, in turn, strengthens identification with a social group. Along these lines, Knobloch-Westerwick (2012) found that selective exposure to attitude-consistent articles increases the accessibility of issue attitudes, which in turn strengthen one's partisan identity. Given that it is those beliefs that are most closely connected to one's political identity that are likely to drive selective exposure in the first place (Stroud, 2011), this helps to explain how partisan media use and global warming beliefs can be linked together in a process of ongoing influence.

The proposed model

Our proposed model focuses on three sets of variables measured at two time points: conservative and nonconservative media use, global warming belief certainty, and support for government policies aimed at mitigating the effects of global warming. Prior research on media effects in a global warming context has typically focused on cognitive outcomes such as belief in the existence of global warming (e.g., Corbett & Durfee, 2004; Feldman *et al.*, 2012), which is considered foundational to broader concern about global warming (Krosnick, Holbrook, Lowe, & Visser, 2006). Moving beyond belief certainty to also focus on policy support provides a fuller understanding of the process of media effects on public opinion and more closely ties this process to policymaking and developing tangible solutions for global warming. In fact, Ockwell, Whitmarsh, and O'Neill (2009) argue that climate change will only be effectively addressed by building public support for government regulation of greenhouse gases and for other mitigation-focused policies.

Following Slater (2007) and Slater, Henry, Swaim, and Anderson (2003), we model media selectivity and effects over-time within the same analysis. In summary, our model is predicated on several expectations. First, as reviewed earlier, we expect that conservative media use will have a negative predictive relationship with

contemporaneous belief in the certainty of global warming and support for climate change mitigation policies. In contrast, nonconservative media use should have a positive predictive relationship with belief certainty and support for mitigation policies. We also expect that global warming belief certainty will positively predict policy support (see, e.g., Ding, Maibach, Zhao, Roser-Renouf, & Leiserowitz, 2011; Krosnick et al., 2006; Leiserowitz, 2006; Zhao, Leiserowitz, Maibach, & Roser-Renouf, 2011), which will in turn drive subsequent media use through a process of selective exposure. In other words, conservative or nonconservative media use will spawn future media use of the same type due to indirect effects via belief certainty and policy support (e.g., Conservative media use [w1] → Belief certainty [w1] → Policy support [w1] → Conservative media use [w2]). At the same time, increased use of one type of media will decrease future media use of the other type. As described earlier, owing to the increasingly partisan nature of global warming, beliefs about global warming should be an important criterion upon which people base their choice to consume conservative or nonconservative media. Moreover, because reduced government intervention is central to conservative ideology, policy preferences should be particularly likely to drive conservative or nonconservative media use given that most mitigation policies call for government intervention of some kind. The effects of this subsequent media use will be to further reinforce or strengthen beliefs about global warming and related policies. Thus, these beliefs should become more extreme over time as a result of exposure to like-minded media (e.g., Belief certainty [w1] → Policy support [w1] → Conservative media use [w2] → Belief certainty [w2]). As implied by our model, the relationships between media selectivity and effects should be mutually reinforcing and cumulative (see Figure 1).

Method

Data for this study were drawn from a nationally representative, within-subject panel survey that measured respondents' climate change beliefs, risk perceptions, policy preferences, and related behaviors. Participants were members of a nationally representative, online panel in the United States maintained by Knowledge Networks. Knowledge Networks recruits its 50,000-member panel using random digit dialing and address-based sampling. The use of this dual sampling strategy covers both listed and unlisted phone numbers, telephone, nontelephone, and cell-phone-only households. Panelists complete an average of two 5- to 20-minute surveys per month for which they receive small incentives, in the range of \$4 to \$6. Those without a home computer receive a free netbook and Internet service to ensure that segments of the population without computers are represented in the panel. A total of 2,164 respondents participated in the first wave of data collection in the fall of 2008 (completion rate 54%, cumulative response rate 6.6%); of these respondents, all who remained members of Knowledge Network's 2011 general panel ($N = 1,301$) were recontacted in the spring of 2011. Of the individuals contacted, 1,036 participated in a second survey wave (completion rate 80%, cumulative response rate 6.4%).¹ The final sample, which

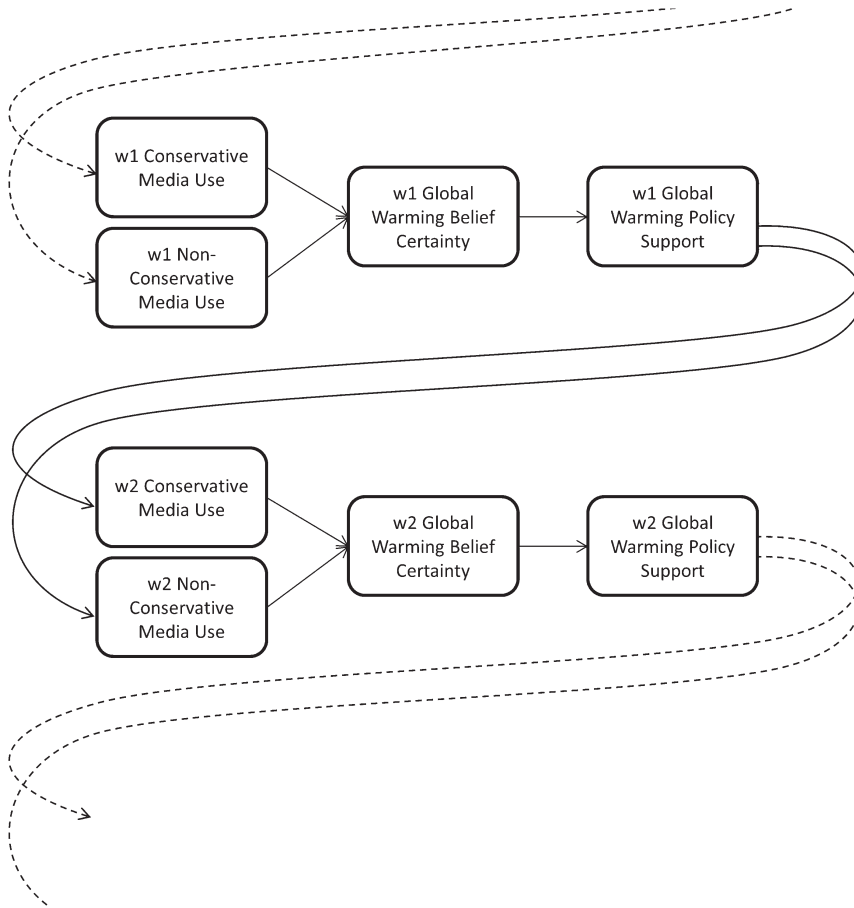


Figure 1 Proposed reinforcing spirals model. *Note.* Although not depicted, direct paths from control variables to all endogenous variables were modeled. Furthermore, paths were estimated between Wave 1 media use, belief certainty, and policy support and all Wave 2 measures. The covariance between conservative media use and nonconservative media use at each time point was also modeled.

was comprised of the 1,036 respondents who participated in both survey waves, was 48% female, 84% White, with a mean age of 49.63 ($SD = 15.63$). Median education was “some college.” Median annual household income was \$50,000 to \$59,999.

Measures

Conservative media use

Conservative media use was measured by averaging two items that asked respondents how often they watch Fox News and listen to Rush Limbaugh (0 = never, 3 = often; $M_{w1} = .83, SD_{w1} = 0.83, r_{w1} = .35, p < .05; M_{w2} = .72, SD_{w2} = 0.83, r_{w2} = .44, p < .05$).

Nonconservative media use

Individuals' use of four news sources known to align more closely with mainstream scientists' views of climate change were used as indicators of nonconservative media use: CNN, MSNBC, National Public Radio, and network TV news. Respondents were asked how often they use each outlet (0 = *never*, 3 = *often*), and these four items were averaged together ($M_{w1} = 1.17$, $SD_{w1} = 0.74$, $\alpha_{w1} = .67$; $M_{w2} = 1.03$, $SD_{w2} = 0.72$, $\alpha_{w2} = .63$).²

Global warming belief certainty

To measure global warming belief certainty, respondents were first asked whether they thought global warming was happening, with options being "yes," "no," or "I don't know." Individuals who answered "yes" or "no" responded to a follow-up question asking how sure they were about their position (0 = *not at all sure*, 3 = *extremely sure*). Responses to these items were combined to create a final belief certainty measure, ranging from 0 (*extremely sure global warming is not happening*) to 8 (*extremely sure global warming is happening*; $M_{w1} = 5.81$, $SD_{w1} = 2.19$; $M_{w2} = 5.09$, $SD_{w2} = 2.43$).

Support for government policies

Individuals were asked how much they support or oppose six policies: (a) regulating carbon dioxide (the primary greenhouse gas) as a pollutant; (b) requiring electric utilities to produce at least 20% of their electricity from wind, solar, or other renewable energy sources; (c) signing an international treaty that requires the United States to cut its emissions of carbon dioxide 90% by the year 2050; (d) funding more research into renewable energy sources, such as solar and wind power; (e) providing tax rebates for people who purchase energy-efficient vehicles or solar panels; and (f) increasing taxes on gasoline by 25 cents per gallon and returning the revenues to taxpayers by reducing the federal income tax. Responses to these six items were averaged, and ranged from 1 (*strongly oppose*) to 4 (*strongly support*; $M_{w1} = 2.92$, $SD_{w1} = 0.64$, $\alpha_{w1} = .80$; $M_{w2} = 2.73$, $SD_{w2} = 0.74$, $\alpha_{w2} = .86$).

Control variables

Three additional media use variables measured on the first survey wave were included as controls. These included local TV news use, online news use, and print news use. *Local TV news use* was measured by asking respondents how often they watch local broadcast news (0 = *never*, 3 = *often*; $M = 2.14$, $SD = 0.99$). *Online news use* ($M = 3.36$, $SD = 2.73$) and *print newspaper use* ($M = 3.15$, $SD = 2.87$) were each measured with one item that asked respondents how often they read the newspaper in each format (0 to 7 days a week).³ *Religiosity* was measured at Wave 1 with one item that asked respondents how often they attend church (0 = *never*, 5 = *more than once a week*; $M = 2.27$, $SD = 1.72$). *Political ideology* was measured at Wave 1 by asking respondents if they see themselves as a liberal or conservative (0 = *very liberal*, 4 = *very conservative*; $M = 2.17$, $SD = 1.00$). Control variables also

included gender, race, income, age, and education, all of which were measured at Wave 1.

Missing data

As is typical in survey data, some people did not respond to one or more questions used in the analyses. To reduce the amount of missing data, we used a hotdeck imputation procedure (Myers, 2011). To impute nonresponses, the rows (i.e., respondents) of the survey data file were randomly permuted within sex and education. Any respondent missing on a given variable was assigned the value of the respondent with the same sex and education level nearest to him or her in this randomly permuted data file. In other words, nonresponses were assigned a response by randomly sampling without replacement from the distribution of the responses to the item with missing data from those individuals with the same sex and education level. Most respondents (90.8%) did not require any imputation, and no variables required imputation on more than 2.5% of cases.

Analysis

We used structural equation modeling in Mplus with robust maximum likelihood (MLR) estimation to test the model proposed in this article (this estimation technique corrects for violations of normality and heteroskedasticity; see Figure 1 for model tested). The model is saturated; therefore, no assessment of model fit is available. However, as we are most interested in testing the pattern of relationships, rather than the model as a whole, this does not pose a major threat to our analysis. Although the full model was tested (see Table 1 for all direct effects), for the sake of parsimony and clarity, our results focus only on selected indirect effects that speak most directly to the theoretical processes of interest (see Table 2).⁴

Results

Contemporaneous effects

Our results show that, within each respective time period, media use was associated with both global warming belief certainty and support for mitigation policies. As shown in Table 1, conservative media use was negatively related to contemporaneous belief certainty at both Waves 1 and 2 ($b_{w1} = -.609, p < .001$; $b_{w2} = -.470, p < .001$). Conversely, nonconservative media use was positively related to contemporaneous belief certainty at both Waves 1 and 2 ($b_{w1} = .524, p < .001$; $b_{w2} = .549, p < .001$).

These relationships were replicated when predicting policy support. Conservative media use was negatively related to contemporaneous policy support at both Waves 1 and 2 ($b_{w1} = -.100, p < .001$; $b_{w2} = -.148, p < .001$) and nonconservative media use was positively related to contemporaneous policy support at both Waves 1 and 2 ($b_{w1} = .115, p < .001$; $b_{w2} = .147, p < .001$). Furthermore, global warming

Table 1 Direct Effects

	Wave 1			Wave 2		
	GW Belief Certainty	Policy Support	Conservative Media Use	Nonconservative Media Use	GW Belief Certainty	Policy Support
Policy Support, Wave 1	—	—	-.082**	.048	.272**	.474***
GW Belief Certainty, Wave 1	—	.099***	-.017*	.017*	.505***	.005
GW Belief Certainty, Wave 2	—	—	—	—	—	.067***
Conservative Media, Wave 1	-.609***	-.100***	.661***	-.011	-.049	-.041
Conservative Media, Wave 2	—	—	—	—	-.470***	-.148***
Nonconservative Media, Wave 1	.524***	.115***	-.080**	.565***	.122	.014
Nonconservative Media, Wave 2	—	—	—	—	.549***	.147***
Ideology (Con. High)	-.528***	-.116***	.068***	-.042*	-.279***	-.023
Education	.121 ⁺	-.036 ⁺	.018	.053**	.049	-.020
White	-.295 ⁺	.014	-.055	-.130**	-.284 ⁺	-.065
Age	.004	.002	.005***	.006***	-.004	-.002
Gender	.203 ⁺	.004	-.094**	-.041	-.017	.073 ⁺
Income	-.005	-.001	.004	.003	-.031 ⁺	-.001
Religiosity	-.112**	-.001	.006	.003	-.041	-.003
Newspaper (Print)	.026	-.005	.001	-.003	.025	-.004
Newspaper (Online)	-.022	.015*	.013*	-.004	-.014	.008
Local TV	.005	-.008	.024	.051**	-.135*	-.016

Note. Model entries are unstandardized coefficients.

* $p < .05$. ** $p < .01$. *** $p < .001$. ⁺ $p < .10$.

belief certainty was positively associated with policy support at both Waves 1 and 2 ($b_{w1} = .099, p < .001$; $b_{w2} = .067, p < .001$).

In addition to these direct effects on policy support, media use was associated with policy support *indirectly* through belief certainty: Media use influenced belief certainty, which then was associated with policy support. Specifically, the contemporaneous indirect effect through belief certainty was negative for conservative media (indirect effect at Wave 1, $-.061, p < .001$; at Wave 2, $-.032, p < .001$), but positive for nonconservative media (at Wave 1, $.052, p < .001$, at Wave 2, $.037, p < .001$; see Table 2 for selected indirect effects).

Table 2 Selected Indirect Effects

	Indirect Effect
<i>Contemporaneous indirect effects of media use on policy support</i>	
Conservative Media → Belief Certainty → Policy Support	
Wave 1	-.061 ^{***}
Wave 2	-.032 ^{***}
Nonconservative Media → Belief Certainty → Policy Support	
Wave 2	.052 ^{***}
Wave 2	.037 ^{***}
<i>Media to media indirect effects through belief certainty and policy support</i>	
Conservative Media _{w1} → Conservative Media _{w2}	.024 ^{***}
Conservative Media _{w1} → GW Belief Certainty → Conservative Media _{w2}	.011 ⁺
Conservative Media _{w1} → Policy Support → Conservative Media _{w2}	.008 [*]
Conservative Media _{w1} → GW Belief Certainty → Policy Support → Conservative Media _{w2}	.005 [*]
Nonconservative Media _{w1} → Nonconservative Media _{w2}	.017 ^{**}
Nonconservative Media _{w1} → GW Belief Certainty → Nonconservative Media _{w2}	.009 ⁺
Nonconservative Media _{w1} → Policy Support → Nonconservative Media _{w2}	.005
Nonconservative Media _{w1} → GW Belief Certainty → Policy Support → Nonconservative Media _{w2}	.002
Conservative Media _{w1} → Nonconservative Media _{w2}	-.018 ^{**}
Nonconservative Media _{w1} → Conservative Media _{w2}	-.023 ^{***}
<i>Reinforcing indirect effect of beliefs on beliefs through media use</i>	
GW Belief Certainty _{w1} → GW Belief Certainty _{w2}	.051 ^{***}
GW Belief Certainty _{w1} → Conservative Media → GW Belief Certainty _{w2}	.008 ⁺
GW Belief Certainty _{w1} → Policy Support → Conservative Media → GW Belief Certainty _{w2}	.004 [*]
GW Belief Certainty _{w1} → Nonconservative Media → GW Belief Certainty _{w2}	.009 ⁺
GW Belief Certainty _{w1} → Policy Support → Nonconservative Media → GW Belief Certainty _{w2}	.003
GW Belief Certainty _{w1} → Policy Support → GW Belief Certainty _{w2}	.027 ^{**}
Policy Support _{w1} → Policy Support _{w2}	.042 ^{***}
Policy Support _{w1} → Conservative Media → Policy Support _{w2}	.012 [*]
Policy Support _{w1} → Conservative Media → GW Belief Certainty → Policy Support _{w2}	.003 [*]
Policy Support _{w1} → Nonconservative Media → Policy Support _{w2}	.007
Policy Support _{w1} → Nonconservative Media → GW Belief Certainty → Policy Support _{w2}	.002
Policy Support _{w1} → GW Belief Certainty → Policy Support _{w2}	.018 ^{**}

Note. Values in roman are total indirect effects through all paths modeled. Values in italics are specific indirect effects.

* $p < .05$. ** $p < .01$. *** $p < .001$. + $p < .10$.

Over-time effects

Predicting Wave 2 media use

We first examined the direct relationships between Wave 1 global warming belief certainty and policy support, respectively, and Wave 2 media use. Looking at columns 3 and 4 of Table 1, there is a negative relationship between Wave 1 belief certainty and Wave 2 conservative media use ($b = -.017, p < .05$) and a positive relationship between Wave 1 belief certainty and Wave 2 nonconservative media use ($b = .017, p < .05$). Policy support at Wave 1 was negatively related to conservative media use at Wave 2 ($b = -.082, p < .001$), but *not* to nonconservative media use at Wave 2 ($b = .048, p = .109$).

We also found that media use at Wave 1 was directly related to media use at Wave 2. That is, Wave 1 conservative media use was a strong positive predictor of Wave 2 conservative media use ($b = .661, p < .001$), and nonconservative media use at Wave 1 was likewise a strong predictor of nonconservative media use at Wave 2 ($b = .565, p < .001$). However, in addition to these direct effects, media use at Wave 1 *indirectly* influenced subsequent media use through Wave 1 belief certainty and policy support. We estimated the total indirect effects, which are the sum of the indirect effects of Wave 1 media use on Wave 2 media use through belief certainty, through policy support, and through both belief certainty and policy support. The indirect effects were small, relative to the direct effects, but statistically significant. As shown in Table 2, the total indirect effect of Wave 1 on Wave 2 conservative media use was $.024, p < .001$; the total indirect effect for Wave 1 nonconservative media use on Wave 2 nonconservative media use was $.017, p < .01$.

Finally, we examined the over-time relationship between divergent types of media use. Here, we found that nonconservative media use at Wave 1 had a negative direct effect on conservative media use at Wave 2 ($b = -.080, p < .01$). Nonconservative media use at Wave 1 also indirectly influenced conservative media use at Wave 2 via belief certainty and policy support (*total indirect effect* = $-.018, p < .01$). On the other hand, conservative media use at Wave 1 was not directly related to Wave 2 nonconservative media use ($b = -.011, p = .631$); however, the total indirect effect through belief certainty and policy support was significant and negative (*total indirect effect* = $-.023, p < .001$).⁵

Predicting Wave 2 belief certainty and policy support

Wave 1 belief certainty and policy support had both direct and indirect effects on their Wave 2 counterparts. Looking to the last two columns in Table 1, Wave 1 belief certainty was directly related to Wave 2 belief certainty ($b = .505, p < .001$), and Wave 1 policy support was directly related to Wave 2 policy support ($b = .474, p < .001$). In addition, both belief certainty and policy support at Wave 1 indirectly influenced their Wave 2 counterparts through media use, though, again, these indirect effects were relatively small. As shown in Table 2, the total indirect effect (i.e., the sum of all component paths) of Wave 1 belief certainty on Wave 2 belief certainty through Wave 1 policy support and Wave 2 media use was $.051, p < .001$.

The total indirect effect of Wave 1 policy support on Wave 2 policy support via Wave 2 media use and belief certainty was .042, $p < .001$. Thus, beliefs and policy support at Wave 2 were not only influenced directly by their prior levels, but also indirectly via media use (although the strength of these specific indirect effects varies; see Table 2).

Discussion

The results of our study offer broad support for the proposed model. We find that conservative media use is associated with lower levels of both global warming belief certainty and support for global warming mitigation policies. On the other hand, nonconservative media use is associated with higher levels of both belief certainty and support mitigation policies. In addition, we find that global warming belief certainty is positively associated with support for global warming mitigation policies, contributing to an indirect effect of media use on policy support through belief certainty. Moreover, our over-time analyses demonstrate an ongoing, reinforcing cycle in which media use influences beliefs, and these beliefs then affect subsequent media use, which, in turn, reinforces beliefs. Specifically, our results show that conservative and nonconservative media use at Wave 1 increased Wave 2 conservative media use and nonconservative media use, respectively, as a result of indirect effects via global warming belief certainty and policy support. Conservative and nonconservative media use at Wave 1 also decreased media use of the divergent type at Wave 2, again due to the indirect effects of belief certainty and policy support. Finally, belief certainty and policy support at Wave 1 were strengthened at Wave 2 due to indirect effects via conservative and nonconservative media use. These results are consistent with the reinforcing spirals framework and help to validate its assumptions of mutual reinforcement between audience selectivity and media effects.

Our study adds to the extant literature in two key ways. First, it extends the previous research on the reinforcing spirals process within the context of global warming, which relied on cross-sectional analysis (Zhao, 2009), through the use of within-subject, multiwave survey data. Our use of over-time data provides more compelling evidence for the mutually reinforcing, cumulative effects of media use and public opinion about global warming.

A second contribution of our study is that we test the reinforcing spirals process in the context of global warming beliefs and *partisan* media use. Previous studies that have tested the reinforcing spirals framework have focused on violent media use and aggressive behavior (Slater et al., 2003), music television viewing and smoking (Slater & Hayes, 2010), and public affairs news attention and political knowledge (Eveland et al., 2003). However, the conservative media “echo chamber” (Jamieson & Cappella, 2008) provides a particularly ripe environment for reinforcing spirals. Although prior studies have provided implicit evidence for reinforcing spirals in the context of conservative and nonconservative media use (e.g., Jamieson & Cappella, 2008; Stroud, 2011), these studies do not link media use and beliefs together in a process of ongoing

influence. Our results illustrate a cyclical process that perpetuates like-minded media use and reinforces attitudes. As such, the findings point to the mechanism through which partisan media outlets, like Fox News, maintain their audiences: They provide consistent political messaging, which influences political beliefs, and these beliefs in turn drive people back to the media which support these beliefs and away from media that do not, in a repeating cycle.

These results thus speak to the current debate among communication scholars as to whether people do indeed wall themselves off from information that challenges their existing beliefs or whether people seek out information from a wide variety of sources. Some have argued that the increasingly fragmented media landscape is creating a situation in which people can simply consume information that supports their beliefs (Bennett & Iyengar, 2008). Others have shown that people consume a range of opinions from a variety of media outlets (e.g., Holbert *et al.*, 2012; Webster, 2007) and, therefore, are not “weaving an ideological media cocoon” in which they ignore media outlets that contain opinion-challenging information (Holbert *et al.*, 2012, p. 208). However, our results indicate that when examining these relations over time and when accounting for the intervening effects of issue-relevant beliefs, use of like-minded media outlets increases subsequent use of those same outlets, while reducing exposure to cross-cutting outlets. Identifying exogenous events or internal states that serve as impetuses for broadening media selection to include ideologically dissimilar outlets could serve to reconcile these divergent findings in the literature and to further explicate conditions for media selection.

Beyond these broad contributions, several specific findings merit mention and have important implications for our understanding of reinforcing spirals. First, in a departure from previous studies of selective exposure and its effects, we argued that individuals’ issue-specific beliefs, in this case related to global warming, drive their exposure to broadly conservative or nonconservative media outlets, which, in turn, strengthens their initial beliefs. Prior research has examined either general partisan beliefs as a predictor of conservative or nonconservative media use, or issue-related beliefs as a predictor of issue-specific content. By showing that issue-specific beliefs can serve as a basis upon which people select generally conservative or nonconservative media, this study expands the field’s understanding of the parameters within which media selectivity—and by extension, reinforcing spirals—occur. We’ve argued that beliefs about global warming and support for government intervention to mitigate global warming are closely tied to individuals’ partisan identity, making these beliefs a salient factor upon which to base media preferences. A fruitful avenue for future research is to generalize these findings to issues that are both more and less partisan in nature, as well as isolate the association between issue beliefs and partisan identity as a mechanism of influence for reinforcing spirals. A potential alternative explanation to consider is that as individuals’ beliefs about a particular issue strengthen, those individuals become more likely to identify themselves as members of an issue public (Converse, 1964) who are highly selective in their information seeking (Kim, 2009).

Also, rather than simply examining the reinforcing effects of media use and global warming belief certainty, we extend the model by including support for tangible policies as an additional variable in this process. By testing this more complex model, we are able to demonstrate the implications of reinforcing spirals for policymaking about global warming. We know from prior research that policy is often made in response to public opinion (Page & Shapiro, 1983). Thus, by demonstrating that media use not only reinforces certainty or uncertainty in global warming but also, in turn, reinforces support or opposition for policies to mitigate global warming, our results point to the important role of the media in advancing—or hindering—policymaking related to global warming. Specifically, our results suggest that governmental inaction on climate change can partially be attributed to the echo chamber created by conservative media on the issue. We encourage future research on reinforcing spirals and other communication mediation models (e.g., cognitive mediation model; Eveland, 2001) to also include relevant indicators of policy support in order to better highlight the practical implications of media and communication processes.

Finally, it is notable that in testing the direct effects among media use, belief certainty, and policy support, the association between Wave 1 policy support and Wave 2 nonconservative media use was not significant, while this relationship was significant for conservative media use. As a result, the mutual reinforcement of media effects and selectivity, as measured by the specific indirect effects in Table 2, was stronger when they involved conservative media use than when they involved nonconservative media use. This is consistent with Slater's (2007) argument that spiral effects are particularly pronounced in groups that motivate closure to outside, or ideologically inconsistent, influences. According to Slater, closure can be encouraged by creating "a culture of suspicion to outside influences such as mainstream media" and "use of group-specific media . . . that consistently reiterate a consistent and distinctive worldview" (p. 292). Conservative media's coherent messaging on political issues and events, and their efforts to insulate their conservative audience from Democratic and liberal views—in part, via an indictment of the mainstream media (Jamieson & Cappella, 2008)—fit neatly into Slater's depiction of a relatively closed communication subculture. On other hand, nonconservative media, particularly as conceptualized in this study, are more diffuse and thus may be less likely to yield reinforcing effects.

The relatively stronger reinforcing effects for conservative media may help to explain why the overwhelming evidence among climate scientists that global warming is happening and is caused by humans has failed to gain traction among conservatives, or at least among users of conservative media, in the United States (Feldman *et al.*, 2012; Krosnick & MacInnis, 2010). In essence, conservative media audiences are consuming messages that challenge the reality of global warming and warn that any contrary information from scientists or the mainstream media should be questioned or dismissed. This perpetuates further use of conservative media and allows audiences to reinforce their current beliefs about global warming and ignore disconfirming evidence from the scientific community. Our conclusions, however,

are tentative in this regard, as they are based on divergence across conservative and nonconservative media on only one direct path in the overall model. Although this path has implications for the reinforcing process, the total indirect effects of Wave 1 media use on Wave 2 media use, for example, were still significant for both conservative and nonconservative media outlets. Thus, future research will want to further validate this proposition, as well as test it across multiple issues and media outlets, including explicitly liberal media.

Despite this study's contributions, there are limitations that should be addressed. First, some of our measures were conceptually narrow. In particular, our measure of conservative media use was comprised only of Fox News and Rush Limbaugh, which does not fully capture the range of conservative media available to audiences today. The study was also limited by the use of several single-item scales. Given the well-known psychometric limitations of such scales, as well as their lack of conceptual detail, it will be essential for future work in this area to employ multi-item scales. Second, due to the use of panel data, there was inevitable attrition, resulting in a final sample that underrepresented minority groups. Although we therefore should be cautious in generalizing the results of our study to the U.S. population, generalizability may be less of a concern given our focus on testing theoretically driven communication processes (see Hayes, 2005). It is also important to note that Wave 1 of our data was collected in 2008, about a decade after global warming first became a partisan issue (McCright & Dunlap, 2011). Thus, our analysis likely represents the middle to end of the spiraling process for this issue. Moreover, the time lag of 3 years between waves of data collection is not ideal. Although we control for exogenous variables, events occurred during the course of the 3 years that may have accounted for or strengthened the observed relationships between media use and beliefs—such as the fall 2008 election of Barack Obama as U.S. president, the 2009 Copenhagen Climate Change Conference, and the 2009 “Climategate” scandal involving leaked e-mails from leading climate scientists allegedly revealing that they had manipulated climate data. Further, the use of two waves of data does not allow us to fully establish the ongoing, cumulative nature of reinforcing spirals. Preferably, we would have used three or more waves of data collection, had they been available to us. In addition, our model is not fully comprehensive. Factors not explicitly accounted for in our model, such as elite rhetoric, industry lobbying, and interpersonal communication, are also likely to influence media choice and public opinion about global warming. At the same time, global warming is just one of many issues that might drive spiraling effects. Nonetheless, our results advance previous research looking at the reinforcing spirals model in the contexts of global warming and the partisan media environment. Finally, it is important to point out that our decision to designate media use as the starting point for testing the reinforcing spirals process was an arbitrary one. Given the conceptualization of our model as a spiral of ongoing influence, we easily could have used beliefs as our starting point, which likely would have yielded a similar pattern of results. In fact, the observed direct and indirect effects of beliefs on subsequent

beliefs via media use suggest as much. In essence, we assert that where the model starts does not do much to change the nature of the observed relationships.

In summary, we demonstrate that issue-related beliefs not only result *from* ideologically specific media use, but influence subsequent media selection—and that these processes operate in mutual reinforcement rather than in isolation. Our findings are not optimistic for those climate communicators who are working toward a public consensus that mirrors the climate science communities' conclusions about global warming—or for democratic theorists who advocate for increased ideological diversity in interpersonal and mass political communication. Indeed, it seems that people may become more and more isolated on their own ideological islands in which certain facts are accepted while others are questioned and discarded, thereby hampering much-needed progress toward policy solutions to important problems such as global warming. The way forward may require the development of strategic communication campaigns that are targeted to particularized media outlets and audiences, such as current efforts by the Energy and Enterprise Initiative (<http://energyandenterprise.com/>) to align solutions to climate change and energy insecurity with the conservative ideals of limited government. We hope that future research will continue to not only clarify the effects of the contemporary media environment on public opinion and policymaking relative to controversial issues like climate change but also develop and study strategies to overcome the increasing fragmentation and polarization of U.S. media audiences.

Notes

- 1 For more information about response rates for online panels see Callegaro and DiSogra (2008).
- 2 We recognize that nonconservative media are conceptualized relatively broadly to include both liberal-leaning (e.g., MSNBC) and moderately mainstream (e.g., network news, CNN) outlets. These outlets were grouped together based on the nature of their global warming coverage, which tends to emphasize the scientific view on global warming and thus stands in contrast to coverage on the conservative media we study here (i.e., Fox News and Rush Limbaugh). For example, Feldman et al. (2012) found that CNN and MSNBC provide similar coverage of global warming. Still, this broader conceptualization may account for the relatively low reliability of this measure at Wave 2 and may also make a comparison of the effects of nonconservative and conservative media more difficult, given that the latter is represented by more ideologically cohesive outlets.
- 3 These items were not included in the nonconservative media use variable for specific reasons. First, there is little research examining local news coverage of global warming. Second, with the available measures of online news and print newspaper use, there was no way to know whether the content of the website or newspaper came from mainstream (e.g., *The New York Times* or Politico.com) or conservative outlets (e.g., *The Washington Times* or redstate.com).
- 4 Estimates of all indirect effects are available upon request.
- 5 Of note, the association between conservative and nonconservative media use *within* both waves was positive and significant ($\phi_1 = .05, p < .05$; $\phi_2 = .06, p < .001$). This is consistent

with past cross-sectional research which shows that, at a given point in time, people who tune into media outlets of one ideological perspective often also turn to media outlets of the opposing perspective (e.g., Coe et al., 2008; Holbert, Hmielowski, & Weeks, 2012). However, our over-time results suggest that increased consumption of news of a particular ideological orientation tends to drive people away from disparate outlets, due, in this case, to the intervening effects of global warming beliefs.

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