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Abstract

How do we understand political polarization within the U.S. climate change debate? This article unpacks the different components of the debate to determine the source of the political divide that is so noted in the mainstream media and academic literatures. Through analysis of the content of congressional hearings on the issue of climate change, we are able to explain political polarization of the issue more fully. In particular, our results show that, contrary to representations in the mainstream media, there is increasing consensus over the science of the issue. Discussions of the type of policy instrument and the economic implications of regulating carbon dioxide emissions, however, continue to polarize opinion. This article concludes by exploring how these findings help us understand more recent political events around climate change.

Keywords

climate change, U.S. environmental politics, political polarization, discourse network analysis, social network analysis

Although President Obama took office in 2008 with campaign promises to pass a climate change bill through the U.S. Congress and make meaningful progress on the issue, he did not fulfill these promises during his first two years in office. With the Republican

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takeover of the U.S. Congress in 2010, the political environment in Washington, D.C., has become increasingly partisan and the issue of climate change has become one of the most polarizing issues. By summer 2011, in fact, former Massachusetts governor and presidential frontrunner Mitt Romney was attacked by organizations and individuals from multiple components of the conservative base for his position on the issue (for a full discussion, see Rucker & Wallsten, 2011). When he stated during a town hall meeting in New Hampshire that he supported the notion that humans are contributing to climate change, many conservative websites reported that this position on the issue was untenable for a Republican candidate and tantamount to committing “political suicide” (see Sheppard, 2011, for a full review). With the National Academy of Sciences maintaining a consistent position since 2001 that human-induced climate change is occurring and “temperatures are, in fact, rising” (Cicerone & the Committee on the Science of Climate Change, 2001, p. 1), it is surprising to see such political polarization. In particular, why is a presidential candidate’s position that echoes the government’s “independent advisor on scientific matters” so contentious?¹

This article explores how we can understand the political polarization of climate politics in America. Looking at the content of congressional discussions around climate change, this article unpacks the components of the debate to understand the main sources of the polarization. We begin our discussion by reviewing the literature on the ways that scholars have analyzed the polarization of the issue of climate change. Here, we pay particular attention to the work that has focused on discussions within the U.S. Congress. Next, we present an analysis of congressional hearings on climate change over a 4-year period, employing an innovation in network analysis to illustrate what aspect of the issue is drawing the most disagreement. This article concludes with a discussion of how our findings help us understand recent political stalemates over the issue of climate change in the United States.

Understanding Polarization of Climate Change Politics in the United States

The political polarization around the issue of climate change is in stark contrast to the scientific consensus that has emerged over the past 40 years. As early as the 1970s, the majority of scholars working within atmospheric sciences agreed that the climate was changing and that it was, at least in part, anthropogenic (Agrawala, 1998a, 1998b). These foundational ideas were expanded in the work of the Intergovernmental Panel on Climate Change (IPCC), which asserted that the earth is experiencing a measurable change in mean temperatures and that this change is exacerbated—if not directly caused—by human activity (Houghton, Jenkins, & Ephraums, 1991). In 2001, the Committee on the Science of Climate Change of the U.S. National Academy of Sciences published a report that began with a very clear statement: “Greenhouse gases are accumulating in the Earth’s atmosphere as a result of human activity, causing surface air temperatures and subsurface ocean temperatures to rise” (Cicerone & the Committee on the Science of Climate Change, 2001, p. 1; also see National

Research Council, 2011). In the words of the Summary for Policymakers of the IPCC's Fourth Assessment Report, the evidence from climate change research is "sufficient to conclude with high confidence that anthropogenic warming over the last three decades has had a discernible influence on many physical and biological systems" (Parry, Canziani, Palutikof, van der Linden, & Hanson, 2007, p. 8; for a full review, see Oreskes, 2004, and Schneider, 2009).

At the same time, there has been a good deal of research on the politics of climate change in the United States (e.g., Arimura, Burtraw, Krupnick, & Palmer, 2007; Fisher, 2004; Harris, 2000; Jacques, Dunlap, & Freeman, 2008; Lisowski, 2002; McCright & Dunlap, 2000, 2003; Rabe, 2004; Selin & VanDeveer, 2007; Victor & Council on Foreign Relations, 2004). One of the main themes in this research is explaining the American position in international climate change policy making (see particularly Lisowski, 2002; Paterson, 2009). Other studies are more specifically interested in climate change politics inside the United States, focused on understanding why there continues to be no federal policy on climate change and describing how this lack of policy is contributing to emerging subnational efforts (see particularly Arimura et al., 2007; Christiansen, 2003; Jones, 1991; Kraemer & Schreurs, 2007; Krane, 2007; Lutzenhiser, 2001; Rabe, 2004; also see the collection by Selin & VanDeveer, 2009).

A small but substantial body of literature has focused specifically on the ways that the issue of climate change is politically polarized. This research tends to agree with claims by Dunlap and McCright (2008), who state, "Nowhere is the partisan gap on environmental issues more apparent than on climate change" (p. 28). Within this work, research has focused on the media coverage of the issue, the role that conservative think tanks have played in creating a countermovement, and the ways the issue has been discussed within the U.S. Congress. In the pages that follow, each of these themes is addressed in turn.

Polarization and the Media

Extensive research has been done to understand the media coverage of climate change (e.g., Mazur, 1998; McComas & Shanahan, 1999; Shanahan & Good, 2000; Trumbo, 1996; Weingart, Engels, & Pansegrau, 2000). Scholars working on this subject tend to agree that the dominant model of balanced news reporting used by the American media today is not well suited to presenting complex and multidimensional scientific findings (see especially Boykoff & Boykoff, 2007; Boykoff & Rajan, 2007; Freudenberg & Muselli, 2010). In his well-known book *Science as a Contact Sport*, Stephen Schneider (2009) states, "There are rarely just two polar-opposite sides, but rather a spectrum of potential outcomes [in scientific research], which are often accompanied by a history of scientific assessment of the relative credibility of each possibility" (p. 203).

Schneider (2009) points out that offering equal time and space to climate deniers has created a perception in laypeople—both those in the general public and those in positions of power—that the science of climate change is no more dependable or

trustworthy than that of climate denial (also see Liu, Lindquist, & Vedlitz, 2009). Comparing the media coverage of climate change to the scientific findings on the issue, Freudenberg and Muselli (2010) conclude that the media tend to underestimate the severity of the climate problem. In their own words, "If reporters wish to discuss 'both sides' of the climate issue, the scientifically legitimate 'other side' is that, if anything, global climate disruption may prove to be significantly *worse* than has been suggested in scientific consensus to date" (p. 483). Thus, the literature on this subject agrees that a fair and balanced reporting of the U.S. climate change debate is not a 50–50 proposition; rather, there are multiple perspectives adopted by multiple actors, all of which inform both the public and political discussions of climate change. However, if the media were to present a truly balanced view of the scientific perspectives on the issues, the news coverage would be much more pessimistic.

Polarization and the Countermovement

At the same time, a handful of studies have specifically explored the countermovement against climate change, building off of the broader social-movements-focused literature on countermovements (e.g., Meyer & Staggenborg, 1996; Mottl, 1980). These scholars draw a link between the media's portrayal of climate science as polarized, uncertain, and premature and what Jacques and colleagues (2008) have called an "anti-environmental counter-movement" (also see McCright & Dunlap, 2003). Moreover, this conservative-driven effort to discredit the science of climate change is seen as constituting the backbone of the countermovement against climate politics, which research has found to be tightly tied to American nationalism. In their own words, "The perceived threat to American values and interests posed by environmentalism helped justify the creation of a sustained anti-environmental countermovement, institutionalised in a network of influential conservative think tanks funded by wealthy conservative foundations and corporations" (Jacques et al., 2008, p. 352).

These conservative organizations and think tanks attack climate change not on ideological grounds but on scientific ones, challenging the very existence of the issue as well as the ethics with which it has been studied. On the other side are those groups that do not challenge the science of the issue. Instead, they argue about the imminence of a changing climate, the dangers of nonaction, and the benefits of possible solutions. Often, each side is speaking a different language and constructing their arguments around different logical frames. Climate change, an issue with great political ramifications, is an ideal example of how each side can talk "past" the other. Given this cross-talk, Hoffman (2011) concludes that one of the most fertile grounds for political land grabbing is in the area of climate change science.

Political Polarization and the U.S. Congress

Just as climate change is an ideal example of a politically polarized debate, so too is Congress the best place to study it (Fisher, Leifeld, & Iwaki, in press; Liu et al., 2009;

Park, Liu, & Vedlitz, 2010; also see McCright & Dunlap, 2003). Park and colleagues (2010), for example, use congressional hearings on climate change to investigate the ways that various issues are framed in political debates. The authors find that hearings on climate change are much more likely to occur in Democrat-controlled congressional sessions and that Democratic Congresses tends to feature testimony from more pro-environment political actors and mainstream scientists (p. 12). When the Republicans hold the majority in Congress, in contrast, testimony about the issue primarily comes from speakers in the business and industrial sectors. Moreover, the contents of the testimonies are more likely to challenge the science of climate change and discuss potential negative impacts of climate change policy on economic growth and foreign relations (Park et al., 2010, pp. 12-13; also see McCright & Dunlap, 2003).

Although the extant literature provides accounts of many ways that the climate issue has been polarized in the United States, research has yet to pull apart exactly what specific component of the debate is driving this political polarization. Accordingly, this article analyzes the content of congressional debates around climate change to understand the polarization of this issue more fully, specifically looking at where the polarization is coming from: the science of the issue or the threat of legislation.

Studying Congressional Hearings

To understand where this political polarization around climate change comes from, this article analyzes data from congressional hearings in the U.S. Congress. Although secondary sources like the news media can help to uncover some of the central topics around climate policy, data on congressional testimonies provide direct accounts of the discourse and debate around climate legislation as well as the issue more broadly. We build on the earlier work by McCright and Dunlap (2003), which studies congressional hearings from 1990 to 1997. In contrast to this work, which analyzes these data to assess the “social construction of non-problematicity” in terms of understanding the emergence of climate skepticism in the United States (McCright & Dunlap, 2000, 2003), we analyze data from congressional hearings to understand what aspect of the issue is yielding the most dissent within the Congress.

Congressional hearings are an important part of the policy-making process in the United States. In the words of the Governmental Printing Office, congressional hearings are the principal way that Congress members “obtain information and opinions on proposed legislation, conduct an investigation, or evaluate/oversee the activities of a government department or the implementation of a Federal law.”² The importance of such hearings as a source of information has been noted within the academic literature as well (see particularly Arnold, 1990; Burstein & Hirsh, 2007; Clifton, 2004; Gormley, 1998).

Testimonies at hearings are given by a range of experts, including governmental agency officials, interest groups, businesses, think tanks, academic researchers, and members of the U.S. Congress (for a discussion, see Burstein & Hirsh, 2007; DeGregorio, 1998). Congressional hearings provide a forum for different policy actors

to get their perspectives recognized and garner the attention and support of different political constituencies. These testimonies inform decision makers about topics ranging from science and technology to economics and policy. In the words of Burstein and Hirsh (2007), “Members of Congress believe that hearings provide an efficient way to gather information and exert influence. . . . Interest organizations, too, see hearings as important venues for conveying information” (p. 179; also see Laumann & Knoke, 1987).

Congressional hearings, then, represent a field site wherein one can study how science, politics, and economic interests collide in ways that influence climate change policy, or the notable lack thereof. As a result, the perspectives presented during congressional hearings are an ideal data source for understanding polarization around this contentious issue. Building from the literature presented here, this article analyzes the *content* of congressional hearings on climate change policy. In so doing, this work sheds light not just on who has a say in the climate change debate in Congress but also on what they are saying and with whom they are aligning. Before discussing these political and ideological alignments, however, we present the data and method we use in reaching these conclusions.

Data and Method

Data for this project consist of the testimonies from climate change hearings during the 109th and 110th sessions of the U.S. Congress. The 109th (January 3, 2005—January 3, 2007) and 110th (January 3, 2007—January 3, 2009) Congresses were during the second term of George W. Bush’s presidency. During this period, 341 pieces of legislation—such as bills, resolutions, and amendments pertaining to issues about climate change or global warming—were introduced (106 in the 109th Congress,³ 235 in the 110th Congress).⁴ There was a Republican majority in both bodies of the U.S. Congress during the 109th session: Republicans held 55% of the voting share in the Senate and 53% of the voting share in the House of Representatives.⁵ In the 110th Congress, however, Democrats controlled the majority of the House of Representatives, with 54.3% of the voting share. During this congressional session, Democrats held 49 seats in the Senate. However, the 2 Independent members of the Senate both caucused with the Democrats, which resulted in their holding 51% of the voting share during this session.⁶ As is demonstrated by our data below, each Independent senator aligned with the Democratic stance in both sessions of Congress.

Using the Government Printing Office (GPO) as a data collection resource, we conducted a search for all hearings that discussed climate change. The GPO archives transcripts from congressional hearings and makes them available for the public record.⁷ Using the search terms *global warming* and *climate change*, we identified all of the hearings that discussed these issues during the 109th and 110th sessions of the U.S. Congress (2005–2008). Although our primary resource for obtaining transcripts of testimonies is the GPO, the results of these searches were cross-referenced with two other sources to ensure accuracy: THOMAS,⁸ the website and search engine for the

Library of Congress; and the Pew Center on Global Climate Change, a nonprofit that monitors climate change discussions and legislation in the U.S. Congress.⁹ The results of the searches from these three sources were compared to ensure that all of the hearings about climate change were accounted for and included in the data set.

In addition to comparing these findings, the contents of each hearing were reviewed to confirm that the focus of each hearing was, in fact, the topic of climate change. After this review, 8 hearings in the 109th and 3 hearings in the 110th sessions of Congress were excluded from the analyses.¹⁰ In the end, our searches yielded 71 relevant hearings between 2005 and 2008. Consistent with the work of Park and his colleagues (2010), there were more hearings on climate change in the 110th session of Congress, where the Democrats held the majority. We analyzed transcripts from 29 hearings in the 109th Congress, which included a total of 498 testimonies and statements submitted by groups not in attendance.¹¹ From the 110th Congress, there were 42 relevant hearings and 598 total testimonies by members of the Congress. Only formal testimonies and statements were included in the analysis. Comments made during the question-and-answer portion of the hearings were not analyzed.

The testimonies from these congressional hearings composed the data set, which was then analyzed using the Discourse Network Analyzer (DNA) program. DNA is a new computer program that allows for the qualitative coding of articles and statements and prepares the data for network analysis and visualizations so that the relationship between the actors in each “discourse” can be mapped and the strength of these ties can be quantified. The testimonies were organized according to hearing number and speaker. These speakers and organizations were then classified into nine types: congressional Democrats, congressional Republicans, politically independent congress-people, administrative and executive offices, environmental interest groups, businesses, business interest groups and trade associations, scientists and science centers, and “other,” a category that includes actors who do not fall into the other categories, such as religious organizations or state-level elected officials.

The testimonies themselves were coded for eight categories that are particularly relevant to discussions about climate change policy in the United States. Coding involved noting whether the speaker agreed or disagreed with the specific statement. Two of the categories were about the science of climate change, which has been a central theme in the climate change debate in the United States: “climate change is real and anthropogenic” and “climate change is caused by greenhouse gases (GHGs).” The six other categories were about different climate policy issues: “there should be legislation to regulate the emission of pollutants,” “legislation should regulate carbon dioxide (CO₂) emissions,” “legislation that regulates carbon dioxide (CO₂) emissions will not hurt the economy,” “the United States should regulate carbon dioxide (CO₂) regardless of what developing countries do,” “legislation should establish a market for carbon emissions (cap and trade),” and “there should be a carbon tax.” Whenever a statement falling under one of the eight categories was made, the statement was coded appropriately. Sometimes specific testimonies included multiple statements that were coded in the same category. In some cases, statements included mention of both sides of the issue.

This article focuses on the results of four of the codes from this analysis. We compare the science statements (“climate change is real and anthropogenic” and “climate change is caused by GHGs”) to two statements focused on policy and the economy (“legislation should regulate CO₂ emissions” and “legislation that regulates CO₂ emissions will not hurt the economy”).

Network Analysis Technique

Each relevant statement of a political actor was coded for four variables: the name of the actor, the classification of the policy actor into one of nine types, the issue addressed by the actor, and a dummy variable indicating either a positive or a negative stance on the issue. For each issue, the statements were transformed into an actor-by-stance affiliation matrix with two columns (one for agreement with the issue and one for disagreement) and with actors occupying the rows of the matrix. The cells of the matrix contain binary information on whether an actor referred to the issue in a certain way.¹²

Each rectangular actor-by-stance affiliation matrix was then converted into a square actor-by-actor co-occurrence matrix where the cell entries reflect the number of shared issue stances between the row actor and the column actor, with diagonal entries (“loops” in the language of social network analysis) left blank. Cell entries of value 0 indicate that there was no shared stance between two actors, cell entries of value 1 indicate that there was one shared stance (either both agreeing with the issue or both disagreeing), and cell entries of value 2 reflect cases where both actors sent mixed signals. Such a co-occurrence matrix can be interpreted as an undirected and weighted network. The network can be visualized as a graph with actors as vertices and the number of shared issue stances as edge weights between these vertices.

It is possible to aggregate such a “discourse network” over many issues (see Leifeld & Haunss, 2012, for an example). In our application to congressional testimony, however, our aim is to compare univariate networks—co-occurrence networks based on a single issue—in terms of their polarization and actor composition. In the network diagrams, the size of each node is proportional to the overall number of statements regarding the current issue that the actor makes during the 109th and 110th Congress. This measure is taken as an indicator of how important the issue is to the actor. The color of the node reflects the actor type.

Any univariate, issue-specific network diagram is composed of two completely connected subgraphs (“components”)—one representing agreement to the issue and the other one disagreement. In some cases, there are actors who send mixed signals and refer to the issue both in a positive and in a negative way. These actors thus connect the two components. We interpret these apparent self-contradictions as moderate positions on the issue because these actors try to align strategically with both camps instead of committing themselves to one position. This interpretation alleviates the potential oversimplification of employing binary agreement patterns, which was imposed in the first place because the reliability and validity of making more

fine-grained judgments about agreement or disagreement would be too low. Conveniently, these moderate actors occupy the center of the network. The discourse network diagrams are thus a good way to operationalize and visualize the polarization of the actor space over one or more issues.

Findings

In the pages that follow, we present the results of our analyses of climate change hearings in the 109th and 110th sessions of the U.S. Congress. We start by looking at the frequencies of these statements and the descriptive statistics of participants in these hearings. Next, we present network diagrams for each of the four statements. By analyzing the patterns within these diagrams, we highlight the ideological and political polarization present in each session of Congress.

Frequencies of Statements

We begin our analysis by looking at the overall frequency of these statements. Figure 1 shows the overall statement frequencies in each Congress for the four statements. According to the figure on the left, negative statements about whether climate change is anthropogenic and about the role of greenhouse gases were in the minority of statements in the 109th Congress (22 and 12 statements, respectively) and decreased somewhat by the 110th Congress (to 19 and 4 statements, respectively). Positive responses for each statement, on the other hand, essentially doubled from the 109th Congress to the 110th (from 52 to 106 statements for the greenhouse gas question, and from 76 to 150 statements in the anthropogenesis question). Given these results, we can conclude that the transition from the 109th to the 110th Congress saw increased consensus on these issues; although a vocal minority testified that climate change was not anthropogenic and not linked to greenhouse gases, the vast majority of speakers agreed that greenhouse gases and human activity were causing climate change.

In the analysis of the two political codes—"legislation should regulate carbon dioxide (CO₂) emissions" and "legislation that regulates carbon dioxide (CO₂) emissions will not hurt the economy"—there is much greater polarization, as illustrated on the right side of Figure 1. Statements asserting that the legislation of carbon dioxide emissions would hurt the economy decreased from 52 to 36 between the 109th and 110th Congresses. Speakers who stated that the government should not regulate emissions also decreased between the 109th and 110th sessions of the Congress, from 22 to 11 statements. At the same time, statements supporting legislation and those that asserted its harmlessness to the economy increased between these two sessions of Congress. A total of 29 speakers stated that regulation would not hurt the economy in the 109th Congress; this number almost doubled to 50 in the 110th Congress. Furthermore, 45 speakers asserted that the federal government should regulate emissions through legislation in the 109th Congress; this number increased to 58 in the 110th Congress. The figures illustrate that, for these statements, the transition from the 109th to the 110th

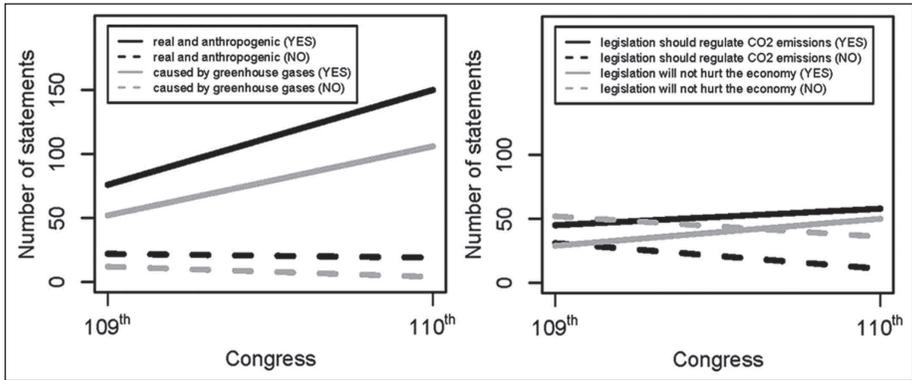


Figure 1. Statement frequency over time, science questions, and questions about legislation

session of Congress was much less consensual than it was for the science statements; speaker opinions may have shifted as political control of Congress shifted, but the majority–minority divide illustrated in the science questions is not present here. With only two sessions of Congress in our data set, it is difficult to isolate the effect of party politics on agenda setting. The evidence does highlight, however, that an array of different actors and interests were involved in the discussion of climate change policy. Moreover, consistent with the work of Park and his colleagues (2010), our findings suggest that the party in power plays a role in the way the issue is discussed within congressional hearings.

Participation in Congressional Hearings on Climate Change

Next, building off of the work by Burstein and Hirsh (2007), Gormley (1998), and McCright and Dunlap (2003), we analyze the types of actors who made statements during the climate change hearings in our sample. Table 1 presents these results. Contrary to what one might expect, given the scientific aspect of hearings about climate change, scientists presented only a small portion of the statements in these hearings (about 8% in the 109th and 11% in the 110th Congress). These findings are significantly lower than those in McCright and Dunlap’s (2003, p. 362) analysis of congressional hearings from 1990 to 1997, which found that 27.9% of testimonies were given by scientists. These differences are likely the result of the ways that the issue of climate change has evolved in the United States since the early 1990s.

Even with these differences, our findings are consistent with the study by McCright and Dunlap (2003, p. 362) as well as with Burstein and Hirsh’s (2007, p. 186) article on policy innovation in the U.S. Congress (also see DeGregorio, 1998). Specifically, the majority of the speakers in both sessions of the Congress came from different branches of the U.S. government (Burstein & Hirsh, 2007). Although the hearings in

Table 1. Organizational Affiliations of Witnesses at Congressional Hearings on Climate Change (2005–2008)

	109th Congress (2005–2006)		110th Congress (2007–2008)	
	<i>n</i>	%	<i>n</i>	%
Business	48	11.7	36	9.2
Business association/ trade group	37	9.0	19	4.9
Democrat	100	24.3	79	20.2
Environmental group	36	8.7	58	14.8
Government agency	41	10.0	87	22.3
Independent	5	1.2	0	0.0
Republican	99	24.0	19	4.9
Scientist	34	8.3	42	10.7
Other	12	2.9	51	13.0
Total groups	412		391	

both sessions of the Congress were dominated by government actors, there are a number of differences between these two sessions that are worth noting. First, there are striking differences between the government actors participating in the climate change hearings in these different sessions of the Congress. Even though the rules of the U.S. Congress stipulate that the minority party is given the opportunity to call witnesses at congressional hearings,¹³ participation in these hearings was very different in the two sessions of Congress. In the 109th Congress, which had a Republican majority, 24% of the statements were provided by Republican members of the Congress. During the 110th session of the Congress, which had a Democratic majority, in contrast, only 5% of the people making statements were Republican. Although the level of Republican participation changed significantly during these two congressional sessions, Democratic participation remained relatively stable (24% and 20%, respectively). At the same time, participation by the Bush administration increased significantly between the 109th and 110th sessions (10% and 22%, respectively). This finding is consistent with the work of DeGregorio (1998), who finds executive participation in Congress to be very high “when presidential autonomy is at stake” (p. 146).

There are also noteworthy differences among participation by nongovernmental actors. Participation by representatives of businesses and business or trade associations decreased between the 109th and 110th sessions of Congress (in aggregate, 20% to 14%). However, environmental group participation went up between these two sessions of Congress (from 9% to almost 15%). It is interesting to note that the level of participation by business and environmental actors is relatively consistent with the findings from earlier research on climate change hearings, where 20.9% of all testimonies were given by business actors and 8.4% of all testimonies were given

by environmental actors (McCright & Dunlap, 2003, pp. 362-363). Moreover, these findings are consistent with those of Park and his colleagues (2010) in their study of connections among congressional committees, congressional hearings, and the witnesses at these hearings, which finds that there are significant differences in witness selection based on the party that held the majority.

Mapping Ideological Networks

Although these descriptive statistics show some interesting patterns of participation during the two sessions of the U.S. Congress, they do not tell us anything about the *content* of the hearings. Accordingly, we now look at how the different policy actors' testimonies were related. In particular, this analysis presents the network diagrams for each of the statements separately. These diagrams represent organizational positions for and against each category. In each diagram, the left-hand side of the figure represents those actors who are against each category. Those who agree with the categories are placed on the right-hand side of the diagram.

Organizational affiliation is depicted by the color of the node: blue indicates Democrats in Congress, red indicates Republicans in Congress, aqua indicates Independents in Congress, pink indicates representatives from the executive branch of the government, green indicates environmental groups, purple indicates businesses, orange indicates business and trade associations, yellow indicates scientists, and gray indicates policy actors who fall into the "other" category. Node size is dependent on the number of times the actors talked about the same category. For clarity, nodes are labeled in these maps only if the actor made two or more statements.¹⁴ The connections between the nodes are either red, to indicate disagreement with the statement, or blue, to indicate agreement with the statement. Those actors listed in the middle of the diagrams spoke on both sides of the issue; we interpret these speakers as presenting moderate positions on the issue because they try to align strategically with both camps instead of committing to one position. In the sections below, each map is discussed in turn.

Climate change is real and anthropogenic. During the 109th Congress, 54 people made statements about this issue (see Figure 2). About 23% of all of the statements were in disagreement with the claim that climate change is real and anthropogenic. Two actors took a moderate position, speaking on both sides of the issue. In this session of Congress, those who spoke in disagreement included political actors from business and science and governmental representatives from the administration and four Republicans in Congress. It is worth noting that the science centers that provided testimony against this statement included Colorado State University, the University of Virginia, and James Cook University, all of which were known at the time to house noted climate change skeptics. In support of the statement were scientists, environmental groups, businesses and business associations, and representatives from administrative offices and Republicans, Democrats, and Independents from the U.S. Congress. Moderate actors included the head of the National Academy of Sciences, Ralph Cicerone, and a scientist at the University of Oklahoma.

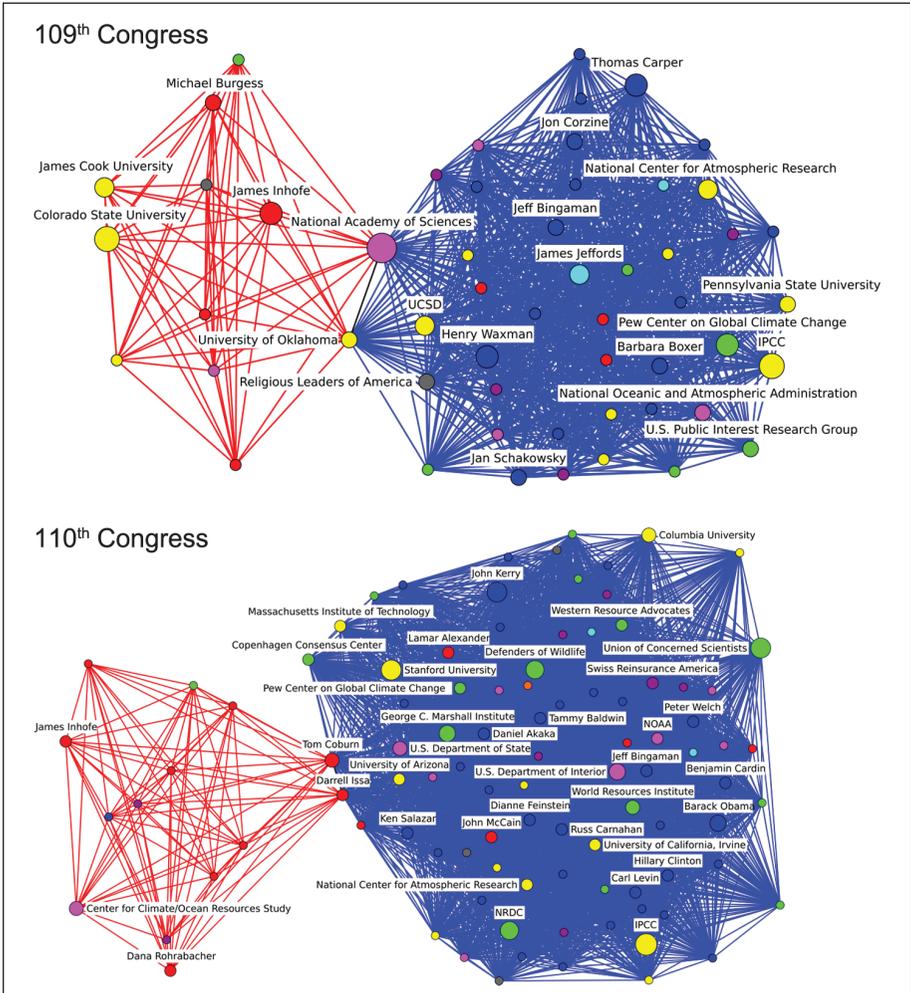


Figure 2. Network diagrams for the statement “climate change is real and anthropogenic” Blue indicates Democrats in Congress, red indicates Republicans in Congress, aqua indicates Independents in Congress, pink indicates representatives from the executive branch of the government, green indicates environmental groups, purple indicates businesses, orange indicates business and trade organizations, yellow indicates scientists, and gray indicates policy actors who fall into the “other” category. Node size is dependent on the number of times the actors talked about the same category. Red lines indicate opposition to the statement. Blue lines indicate agreement.

By the 110th Congress, the number of times this issue came up increased to 97. Of those statements, about 11% were in disagreement with this issue. Those who disagreed include congressional Republicans, a House Democrat, businesses, and representatives from two environmental groups known to promote climate skepticism.

Supporters of this issue included scientists, environmental groups, businesses and a business association, representatives from administrative offices, and Republicans, Democrats, and Independents. As with the 109th, this session of Congress also had two speakers discuss both sides of the issue: two House Republicans.

The map for the 109th Congress shows that there was a substantial contrary minority, representing almost a quarter of all speakers. Two years later, in the 110th Congress, there was significantly less disagreement about this issue. We also note in the transition to the 110th Congress that the types of actors who spoke out against climate change shifted; Republicans led the charge in both Congresses. In the 109th Congress, their allies were typically climate change skeptics within the scientific community. However, the 110th Congress saw the Republicans joining forces with business and environmental groups that supported skepticism.

Climate change is caused by greenhouse gases. Although some level of consensus around the notion that climate change is real and anthropogenic can be seen during the hearings of these two sessions of Congress, analysis of the content of testimonies that discuss whether greenhouse gases cause climate change had even stronger results (see Figure 3).

In the 109th Congress, 39 speakers spoke about this issue, with almost 19% of their statements disagreeing with the notion that climate change is caused by greenhouse gases. Like the previous subject in the 109th Congress, there were four scientific centers that also spoke in opposition. It should again be noted that these scientific centers housed prominent climate change skeptics, who were themselves in the minority in their disciplines. The other dissenting speakers include Senate Republicans and a business interest group. In support of this statement were environmental groups, scientists, businesses and business associations, administrative offices, Democrats in the House and Senate, and one House Republican. There were no moderate speakers on this subject in this session of Congress.

Consensus is nowhere more plainly illustrated in our analysis than this statement in the 110th Congress. During this session of Congress, 72 actors spoke about this issue, and only 2 of them stated that climate change was not caused by greenhouse gases (about 4% of all statements). The 2 dissenters were the CEO of Murray Energy Corporation and a Republican member of the House of Representatives. Those who spoke in agreement included numerous administrative offices, scientists, environmental groups, businesses and business associations, and Republicans and Democrats from both the House and Senate.

It is clear from Figure 3 that the question of whether or not greenhouse gases are causing climate change became substantially more consensual in the years between the 109th and 110th Congresses. Although the same small but significant cadre of skeptical scientists and Republican congresspeople spoke against this statement in the 109th Congress, nearly everyone—from scientists to businesses, from the administration to the lobby floor, and on both sides of the aisle—agreed in the 110th Congress that greenhouse gases were causing climate change. In sum, by 2007, the science of climate change was not a politically polarizing issue in the U.S. Congress.

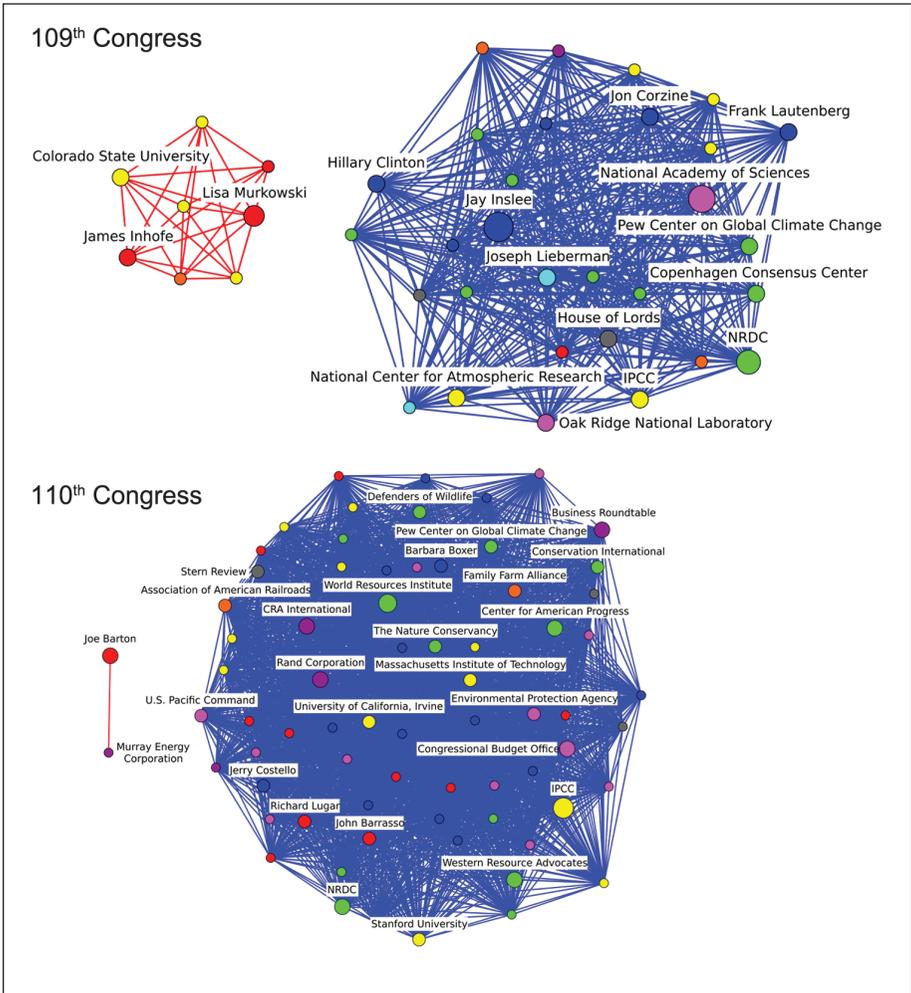


Figure 3. Network diagrams for the statement “climate change is caused by greenhouse gases (GHGs)”
 See note to Figure 2.

Legislation should regulate CO₂ emissions. In contrast to the consensus we see regarding the science of climate change, we turn now to issues related to what policy instrument is appropriate for regulating carbon dioxide, and what consequences could be expected from these instruments (see Figure 4). First, we consider the question of whether legislation should regulate carbon dioxide emissions. In the 109th Congress, there were 37 actors who spoke about carbon dioxide regulation. Of all the statements made on the issue, about 41% were against regulation. Those who opposed included

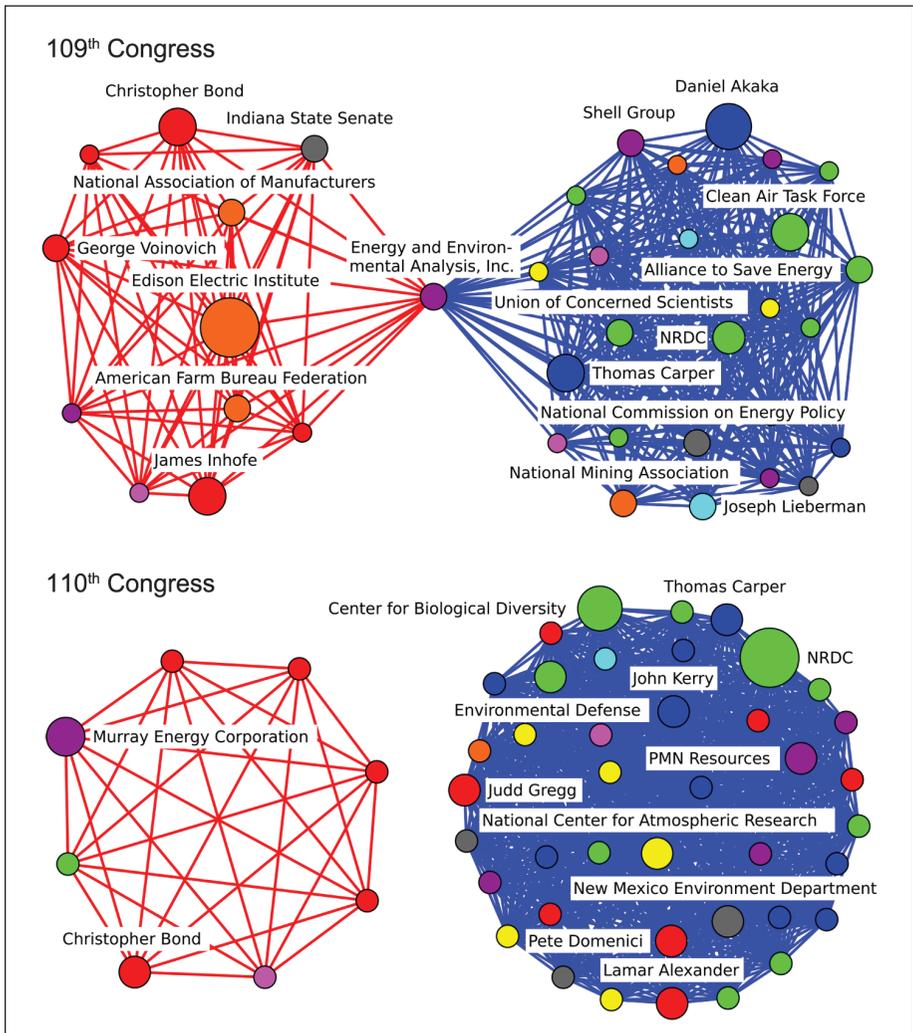


Figure 4. Network diagrams for the statement “legislation should regulate CO₂ emissions” See note to Figure 2.

Senate Republicans, business and business associations, and one administrative office. Speaking in support of legislating carbon dioxide were representatives of environmental groups, businesses and business associations, scientists, administrative offices, and Senate Democrats and Independents. All of the environmental interests that spoke on this issue in this Congress spoke in support of regulating emissions. Only one political actor—a business—spoke moderately on this issue. Although the majority still spoke in agreement with this statement, there was much less consensus here compared to the science questions described in the previous two sections.

Political polarization is also present in the 110th Congress, but at a reduced level. Here, 48 speakers mentioned the issue. Of those, about 16% spoke against the regulation of carbon dioxide emissions. Speakers against the issue included Republicans, an environmental organization that promotes climate skepticism, an administrative office, and a business. Those who supported legislation included environmental groups, scientists, businesses and business associations, administrative offices, and Democrats and Republicans from both houses of the Congress. In the 110th Congress, there were no moderate voices speaking on this issue. Though the polarization in the 110th is less than that in the 109th Congress, these network diagrams do illustrate an important point: polarization in these congressional hearings is not limited to polarization along party lines. During this period, climate change also polarized science against industry, industry against industry, and environmental interests against business interests.

Legislation that regulates CO₂ emissions will not hurt the economy. Consistent with the political polarization around the question of whether or not legislation should regulate carbon dioxide emissions, there were many speakers offering diverse opinions on the economic impact of such a regulation (see Figure 5). In fact, this issue was the most polarized within these sessions of Congress—with the two sides almost in parity during the 109th Congress. A total of 45 speakers spoke about this issue, and 64% of the statements claimed that regulating emissions would be harmful to the economy. Speakers in disagreement with this issue included businesses and business associations, one scientist, Republicans from the House and Senate, and administrative offices. There was also one Senate Democrat—Senator Barack Obama—who spoke about how regulating carbon dioxide emissions would harm the coal industry in Illinois. All Republicans and actors representing business and trade associations spoke on this side of this issue. In contrast, speakers who stated that regulating carbon dioxide would not harm the economy included environmental groups, businesses and business associations, one scientist, and Democrats from the House and Senate. All of the representatives from environmental groups spoke on this side of the issue.

This issue became somewhat less polarized in the 110th Congress. Here, 48 speakers spoke about this issue, and about 42% of the statements were in opposition. Those who spoke about the negative economic effects included businesses and Republicans. Those who supported the issue included Democrats and Republicans from both houses of the Congress, environmental groups, scientists, and an administrative office. Here again, all of the environmental groups that spoke on this issue, spoke on this side of the issue. Speaking moderately were one administrative office, one business, and one organization categorized as “other.” Although this issue was slightly less polarized in the 110th Congress, no clear consensus emerged.

Discussion and Conclusion

Overall, the results of our analysis of the content of the discussions in congressional hearings about climate change in the 109th and 110th sessions of the U.S. Congress provide interesting detail about political polarization and climate politics. In the

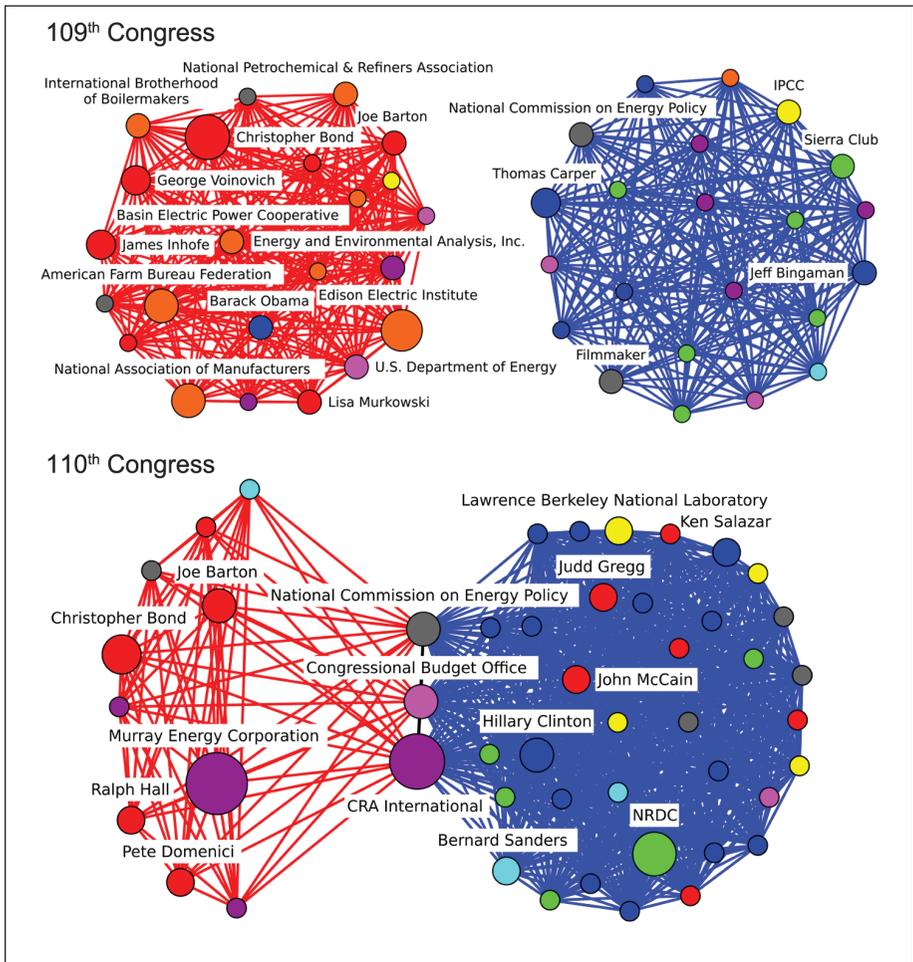


Figure 5. Network diagrams for the statement “legislation that regulates CO₂ emissions will not hurt the economy”
See note to Figure 2.

United States, this polarization is focused around not the science of the issue but perspectives on the policy instrument and the economic implications of the implementation of such an instrument. These results contribute to a more nuanced understanding about how the science of the issue is being used by political actors against the regulation of carbon dioxide to stymie progress in the Congress. On the science questions, skeptical scientists make up about half of the speakers who deny the existence of climate change or the accountability of humanity for causing it. In both science questions, climate skepticism was much less prevalent in the Democratic 110th Congress.

Although there was an overall trend toward consensus across these four issues from the 109th to the 110th sessions of Congress, there was still a good deal of polarization around the political aspects of the issue. Moreover, disagreement about the economic implications of the regulation of carbon dioxide fell only from 64% to 42% over this period. In more recent years, this polarization can be seen by the failure of the 111th Congress to pass climate legislation through both Houses of Congress. According to the research presented here, no comprehensive climate change policy could be enacted on the national level in the United States as long as scientific debates are allowed to continue to mask the true source of disagreement on climate change policy: the uncertain economic and political implications of climate change legislation.

In sum, by unpacking the content of discussions within congressional hearings on climate change, we learn a lot more about the source of political polarization. Although the literature has demonstrated that the American public is increasingly aware of climate change as a real phenomenon, is increasingly likely to attribute it to human activity, and fears for the future of the country as a result of calamitous change, that growing consensus does not translate up from the constituency to the political actors who can affect policy (Dunlap & McCright, 2008; also see McCright & Dunlap, 2011). In other words, the results presented here, which focus on the perspectives of political elites, do not reflect the situation in the larger public; rather, the story told in this article is one of polarization among the very people who have the greatest impact on the problem and the greatest capacity to make change.

Future research must continue this type of analysis to look more deeply into where political polarization is coming from and what issues are the focus of disagreement. In particular, this research would benefit from a longer time series, including more sessions of Congress, to expand on our knowledge of the agreement and polarization that occurs between political actors around issues of climate change, when there are different combinations of political party leadership in the Congress and the administration. Finally, research in this vein must continue to look beyond the numbers of speakers giving testimony to the *content* of what these political actors are saying. Doing so may help to isolate and elaborate on the effect of party politics as well as the influence wielded by scientific experts, the private sector, and environmental interests.

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Notes

1. <http://www.nationalacademies.org/about/whoweare/index.html>.
2. http://www.gpo.gov/help/about_congressional_hearings.htm.

3. <http://www.pewclimate.org/federal/congress/109>.
4. http://www.pewclimate.org/what_s_being_done/in_the_congress/110thcongress.cfm.
5. During the 109th session of the U.S. Congress, there was one independent member of the Senate and one independent member of the House of Representatives.
6. For more details, see www.senate.gov/reference/resources/pdf/RS22555.pdf.
7. For details, see <http://www.gpo.gov/fdsys>.
8. For details, see <http://thomas.loc.gov/>.
9. The Pew Center on Global Climate Change has been re-named the “Center for Climate and Energy Solutions.” For details, see <http://www.c2es.org/federal/congress> (Accessed 8 October 2012).
10. For example, Senate Hearing 109-448, the “US Foreign Policy, Petroleum, and the Middle East: Hearing Before the Subcommittee on Near Eastern and South Asian Affairs of the Committee on Foreign Relations, United States Senate,” came up in our search. On review of the content of the hearing, however, it was determined that climate change was only an element of the discussion, and it did not contain a significant discussion of the issue. As a result, this hearing was one of those removed from our analysis.
11. For the remainder of this article, we refer to these as *testimonies*.
12. Data collection and manipulation were completed using Discourse Network Analyzer software (Leifeld, 2012; see Leifeld & Haunss, 2012).
13. For a full discussion of these rules, see <http://lieberman.senate.gov/assets/pdf/crs/senate-hearings.pdf> for the Senate and http://www.house.gov/house/Tying_it_all.shtml for the House of Representatives.
14. The exception to this rule is found in Figure 3, where, because of its unique position in the 110th congressional map, Murray Energy Corporation is labeled despite making only one statement.

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