

Motivated Recall in the Service of the Economic System: The Case of Anthropogenic Climate Change

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The contemporary political landscape is characterized by numerous divisive issues. Unlike many other issues, however, much of the disagreement about climate change centers not on how best to take action to address the problem, but on whether the problem exists at all. Psychological studies indicate that, to the extent that sustainability initiatives are seen as threatening to the socioeconomic system, individuals may downplay environmental problems in order to defend and protect the status quo. In the current research, participants were presented with scientific information about climate change and later asked to recall details of what they had learned. Individuals who were experimentally induced (Study 1) or dispositionally inclined (Studies 2 and 3) to justify the economic system misremembered the evidence to be less serious, and this was associated with increased skepticism. However, when high system justifiers were led to believe that the economy was in a recovery, they recalled climate change information to be more serious than did those assigned to a control condition. When low system justifiers were led to believe that the economy was in recession, they recalled the information to be less serious (Study 3). These findings suggest that because system justification can impact information processing, simply providing the public with scientific evidence may be insufficient to inspire action to mitigate climate change. However, linking environmental information to statements about the strength of the economic system may satiate system justification needs and break the psychological link between proenvironmental initiatives and economic risk.

Keywords: system justification, motivated information processing, climate change, recall, framing

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Surveys of the natural sciences have documented that as many as 97% of climate scientists believe that climate change is rapidly occurring, is primarily caused by human behavior, and endangers

the sustainability of our planet (Anderegg, Prall, Harold, & Schneider, 2010; Cook et al., 2013; Stocker et al., 2013). At the same time, only half of the American public—ranging from 10% of conservative Republicans to 78% of liberal Democrats—believes that the Earth is warming as a result of human activities (Pew Research Center, 2015a). Although levels of international concern about climate change vary considerably, ideological divides exist within other Western democratic nations, including Australia, Canada, and the United Kingdom. More interestingly, concern about climate change at the country level correlates, $r = -.54$, with the country's CO₂ emissions per capita (Pew Research Center, 2015b), suggesting that climate change skepticism may be linked to economic consumption practices.

In the United States, belief in anthropogenic climate change fell by 11% between 2007 and 2009 (Pew Research Center, 2013), even as a number of governmental and nongovernmental organizations spent hundreds of millions of dollars to promote environmental education and activism programs (e.g., National Aeronautics and Space Administration, 2011; National Oceanic & Atmospheric Administration, 2012; National Science Foundation, 2014). Analysis of 15 years' worth of data from public opinion

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surveys and the Bureau of Labor Statistics points to the 2008 global recession as partially responsible for the decline in climate change belief (Scruggs & Benegal, 2012). The economic context seemed to be an even stronger predictor of change in climate skepticism than other salient explanatory variables, such as skeptical media coverage (Krosnick, Holbrook, Lowe, & Visser, 2006) and conservative countermobilization (McCright & Dunlap, 2011b), and the effect of economic condition remained robust even after adjusting for person-level covariates such as party affiliation, ideology, gender, and education.

Together, these international trends suggest that when economic stability is threatened, individuals are unlikely to prioritize pro-environmental action such as emissions reduction, presumably because they assume that doing so could compromise the country's economic standing. Yet the economic recession not only reduced the *prioritization* of environmental problems, but the belief that these problems existed altogether. Many have written about “top-down” effects of organized efforts by corporations, politicians, and the media to spread misinformation and undermine the public's confidence in climate science, as well as “bottom-up” effects such as motivated avoidance of climate change information at the level of the individual (e.g., Iyengar & Hahn, 2009; Lau & Redlawsk, 2006; Shepherd & Kay, 2012; Stroud, 2008; see Jacquet, Dietrich, & Jost, 2014, for a review). We seek to complement existing research programs by investigating the possibility that, even when people are confronted with scientific evidence, they may process this information in a way that facilitates skepticism. We go beyond previous work focusing on the motivated evaluation of belief-inconsistent information (e.g., Lord, Ross, & Lepper, 1979) to examine whether concerns about the stability of the economic system may affect how environmental information is subsequently recalled. In addition, we investigate whether representing the economy as strong and stable can disrupt this process by satiating the goal of defending the economic system.

System Justification Theory and Motivated Information Processing

The proposition that threat to the legitimacy or stability of the system may reduce the acknowledgment of socioeconomic problems is consistent with psychological research indicating that people are motivated—often at a nonconscious level—to defend, justify, and bolster the social, economic, and political arrangements on which they depend (Jost & Banaji, 1994; Jost, Banaji, & Nosek, 2004). System justification motivation exists for most people to some degree, but its strength varies across individuals and situations. Some people—such as political conservatives—tend to be chronically higher in the tendency to perceive existing sociopolitical and economic institutions as fair and legitimate (Hennes, Nam, Stern, & Jost, 2012). System justification motivation can also be situationally heightened following exposure to events or stimuli that threaten the system, such as reminders of the terrorist attacks of September 11, 2001 (Ullrich & Cohrs, 2007).

Because acknowledging the existence of anthropogenic climate change would imply some recognition of problems with the economic system, and willingness to reform industrial and consumer practices under capitalism, we posited that skepticism should be greater among those who are dispositionally higher in *economic* system justification motivation in particular (Jost, 2015). Studies

conducted in the United States and Australia demonstrated that economic system justification was indeed associated with environmental attitudes and beliefs, even after adjusting for partisanship and political ideology (Feygina, Jost, & Goldsmith, 2010; Leviston & Walker, 2014). We predict, moreover, that in times of economic instability, such as recession, the motivation to defend the system from potential threats should be temporarily heightened. In contrast, in times of economic stability, system justification motivation may be more easily satisfied, and the impulse to protect the status quo should be less acute.

Although system justification is defined in largely cognitive-motivational terms—in that individuals seek to mentally represent the system as just, even if it objectively is not—previous studies have not pinpointed the mechanisms by which system justification motivation influences subsequent judgments, decisions, and behaviors. In other words, it is not known which psychological processes mediate the effect of system justification motivation on climate change skepticism. Most previous research on motivated social cognition has focused on self- and group-serving motives to preserve prior beliefs and to maintain positive views of the self and of one's social groups (see Helzer & Dunning, 2012, for a review), and has tended to overlook the possibility that information processing may also be affected by system-level motives. However, Shepherd and Kay (2012) observed that individuals avoid information that is threatening to the social system, and Ledgerwood, Mandisodza, Jost, and Pohl (2011) demonstrated that such system-relevant information is evaluated in a biased manner when it is encountered. Building on these findings, we examine whether system justification motivation may also lead to objectively inaccurate representations of sociopolitical issues by influencing how scientific information is recalled from memory.

Motivated Recall of Climate Change Information and Attitude Polarization

Assessing how individuals respond to objective information to which they have been exposed is of special importance when it comes to climate change attitudes, because much of the contemporary political debate centers on the quality of scientific evidence. In classic studies, Lord et al. (1979) demonstrated that exposure to novel information produced attitudinal polarization and increased extremity rather than increased consensus. Since that time, a plethora of studies have documented cases in which exposure to objective information not only fails to persuade but may even strengthen preexisting attitudes (e.g., Mutz, 2008; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007; see Byrne & Hart, 2009, for a review). In one study, the presentation of scientific information increased support for climate mitigation policies among Democrats, but it had the opposite effect among Republicans (P. S. Hart & Nisbet, 2012). Moreover, group polarization is, counterintuitively, sometimes most pronounced among those with *high* levels of scientific literacy and/or political sophistication (e.g., Kahan et al., 2012; Taber, Cann, & Kucsova, 2009). This suggests that climate change skepticism is not merely the result of ignorance or lack of exposure to climate science, but may have a motivational basis (see also Feygina et al., 2010; Jost, 2015).

In the current research program, we focus on one distinctive cognitive mechanism underlying attitude polarization in response to new information—namely, directionally biased recall. Most

previous research on motivated memory processes has examined either the selective retrieval of information stored in long-term memory (e.g., Sanitioso, Kunda, & Fong, 1990) or the susceptibility of memory to misleading information (Loftus & Hoffman, 1989). We focused instead on the mechanism of directionally biased recall of information. Specifically, we hypothesized that system justification motivation would lead individuals to misremember evidence of anthropogenic climate change in a way that minimizes the problem, and that biased recall would facilitate increased skepticism. This would be broadly consistent with prior demonstrations of recall biases that were linked to system justification processes (Haines & Jost, 2000) and the desire to believe in a just world (Callan, Kay, Davidenko, & Ellard, 2009). In the present studies, we expected that belief in climate change would increase among low system justifiers following exposure to new scientific evidence, whereas belief in climate change would decrease among high system justifiers. We theorized that one mechanism involved in this process would be directionally motivated (or selectively reconstructed) recall of scientific information in a manner that justifies one's desired conclusion about climate change.

Satiating System Justification Motivation

To the extent that system justification shapes how information about anthropogenic climate change is processed—and does so in a way that moves citizens' perceptions away from the scientific consensus—it should be of value to design interventions that are capable of satiating this motivation. We therefore examined the possibility of satisfying system justification motivation by affirming the strength of the system (cf. Liviatan & Jost, 2014), emphasizing the success of the economic recovery rather than the recession. Much as self-affirmation interventions reduce self-serving biases in information processing (Cohen, Aronson, & Steele, 2000), we hypothesized that opportunities for system affirmation (such as the expression of national commitment or patriotic allegiance) would reduce biased information processing caused by system-defensive motivation (see also Liviatan & Jost, 2014). We posited, on one hand, that satiating system justification motivation (leading individuals to believe that the economy had recovered) would reduce defensive processing of climate change information, especially for those who are chronically high in system justification motivation. On the other hand, we expected that threatening the system (leading individuals to believe that the economy is still in a recession) would increase system justification motivation, especially for those who are chronically low in system justification (cf. Banfield, Kay, Cutright, Wu, & Fitzsimons, 2011).

Current Research

There were three primary goals of the current research program: In a pilot study, we sought to first establish that economic system justification motivation is an important antecedent of climate change attitudes. Second, we tested our primary hypothesis that economic system justification influences recall of scientific information about anthropogenic climate change, thereby facilitating skepticism (Studies 1 to 3). Third, we examined whether it was possible to satiate system justification motivation and attenuate its impact on information processing by exposing participants to encouraging information about the state of the economy (Study 3).

Pilot Study

Before investigating the influence of economic system justification motivation on cognitive processing, we sought to establish that it is indeed a robust predictor of climate change attitudes. Based on our theoretical framework, public opinion data, and previous studies by Feygina et al. (2010) and Leviston and Walker (2014), we conjectured that skepticism about climate change is at least partially the result of a desire to avoid or downplay threatening information about the economic system. We expected that the association between economic system justification and climate skepticism would be robust even after adjusting for general system justification; general, social, and economic conservatism; political partisanship; personal income; gender; and age. We also expected that economic system justification would mediate the association between political conservatism and climate change beliefs that has been observed in public polling data (e.g., McCright & Dunlap, 2011a; Pew Research Center, 2015a). We tested this hypothesis by conducting secondary analyses of data from a previously published study (Hennes et al., 2012).

Method

Full description of the method and participants can be found in Hennes et al. (2012). Participants were asked to complete the Economic System Justification Scale (Jost & Thompson, 2000), which includes items such as "Economic positions are legitimate reflections of people's achievements" and "There are many reasons to think that the economic system is unfair" (reverse-coded). Items were measured on 9-point Likert-type response scales ranging from 1 (*strongly disagree*) to 9 (*strongly agree*), and were coded such that higher scores represented stronger economic system justification ($\alpha = .87$). Participants also completed the General System Justification Scale (Kay & Jost, 2003; $\alpha = .86$), as well as single-item self-reports of their general, social, and economic political ideology. The dependent variable of interest was the participant's response on a 7-point scale to the question "Do you believe that global warming is anthropogenic (caused by human behavior)?"

Results

Descriptive statistics and intercorrelations for all study variables are summarized in Table 1. As expected, bivariate correlations revealed that economic system justification, general system justification, political ideology, and partisanship were significantly associated with skepticism about climate change.

To determine the extent to which economic system justification remained a robust predictor of anthropogenic climate change after accounting for other variables, we conducted a multiple regression analysis. Consistent with expectations, economic system justification was negatively associated with belief in anthropogenic climate change, even after adjusting for demographic and other ideological factors (see Table 2). We conducted a mediation analysis using the bootstrapping technique outlined by Preacher and Hayes (2008; see also Shrout & Bolger, 2002). Consistent with the multiple regression analysis, we retained all covariates. When economic system justification was included in the model, conservatism was no longer a significant predictor of belief in climate change, and

Table 1
Descriptive Statistics, Including Intercorrelations, of Study Variables (Pilot Study)

Variable	M	SD	1	2	3	4	5	6	7	8	9
1. Belief in anthropogenic climate change	5.31	1.53	—								
2. Economic system justification	4.29	1.28	-.53***	—							
3. General system justification	4.49	1.57	-.29***	.62***	—						
4. General conservatism	3.94	2.09	-.41***	.59***	.36***	—					
5. Economic conservatism	4.47	2.18	-.35***	.55***	.36***	.85***	—				
6. Social conservatism	3.70	2.41	-.43***	.60***	.35***	.88***	.66***	—			
7. Party (Democrat = 0, Republican = 1)	—	—	-.41***	.53***	.25**	.64***	.59***	.64***	—		
8. Income	2.33	1.07	.08	.05	.08	-.01	.04	-.01	.13	—	
9. Age	32.6	13.0	-.04	.03	.15*	.16*	.14	.11	.04	.02	—
10. Sex (female = 0, male = 1)	—	—	-.18*	.07	.02	.05	.06	.13	.08	-.04	-.09

Note. Construct 1 was measured on a 7-point scale; Constructs 2 to 6 were measured on 9-point scales. For ease of presentation, only participants selecting “Democrat” or “Republican” were included in the calculation of bivariate correlations with partisanship.
* $p < .05$. ** $p < .01$. *** $p < .001$.

the 95% unstandardized confidence interval of the indirect effect excluded 0 [-.30, -.10] indicating statistical mediation (see Figure 1).¹

Discussion

We know from prior research that political ideology, partisanship, general and economic system justification, gender, and age are correlated with environmental attitudes (Feygina et al., 2010; Leviston & Walker, 2014; McCright & Dunlap, 2011a). When all of these factors were entered into a multiple regression model, economic system justification remained a robust predictor of climate change beliefs, whereas political ideology and general system justification did not. A mediation analysis suggested that the tendency for conservatives to be more skeptical of climate change is consistent with a stronger motivation to justify the economic system. Having established economic system justification as a key variable of interest, we now turn to our primary research question:

Table 2
Multiple Regression of Belief in Anthropogenic Climate Change on Economic System Justification and Related Constructs (Pilot Study)

Predictor	Step 1		Step 2	
	b (SE)	β	b (SE)	β
Intercept	5.36 (.10)		5.57 (.19)	
Economic system justification	-.58 (.08)	-.50***	-.51 (.13)	-.43***
General system justification			.05 (.09)	.05
General conservatism			-.07 (.17)	-.09
Economic conservatism			.04 (.10)	.07
Social conservatism			-.04 (.11)	-.06
Independent			.09 (.24)	.03
Republican			-.34 (.37)	-.09
Income			.10 (.10)	.07
Age			.00 (.01)	.00
Male			-.45 (.21)	-.15*

Note. All predictors were grand-mean centered. For partisanship, “Democrat” was treated as the reference category, and responses of “Other” or “None” were treated as missing. SE = standard error.
* $p < .05$. *** $p < .001$.

Does economic system justification bias recall of information about anthropogenic climate change?

Study 1

In Study 1, we experimentally investigated whether economic system justification would bias recall of scientific evidence about climate change. We manipulated system justification motivation, presented participants with a news article about climate change, and then, without forewarning, asked them to recall information from the article. We expected that participants assigned to the high (vs. low) system justification condition would be more likely to exhibit recall biases that were consistent with skepticism about climate change.

Method

Participants. Fifty-seven undergraduates from New York University participated in this study for course credit. Participants provided informed consent and completed the study online.

System dependence manipulation. Participants were randomly assigned to either a high or low system dependence condition, in which they read a passage that emphasized the extent to which the American system either strongly or weakly determines major outcomes in citizens’ lives. Individuals made to feel more dependent on the system are expected to defend it more strongly; this procedure has been used successfully in previous research to manipulate system justification motivation (e.g., Kay et al., 2009; see Kay & Friesen, 2011, for a review). An excerpt from the article read,

Trends over the last 50 years show that federal government policies have *enormously broad* [very limited] effects on the life and well-being of Americans. In terms of financial well-being, for instance, the

¹ Our mediational model was guided by theory. At the same time, we also conducted additional analyses in which we treated economic system justification as the X variable and conservatism as the M variable. The indirect path in this model was not significant [-.52, .36]. However, the results of the alternative model should be interpreted with caution, because rearranging the order of the constructs in saturated models capitalizes on the relative variance of the variables and provides limited information about the “correct” directional pathway.

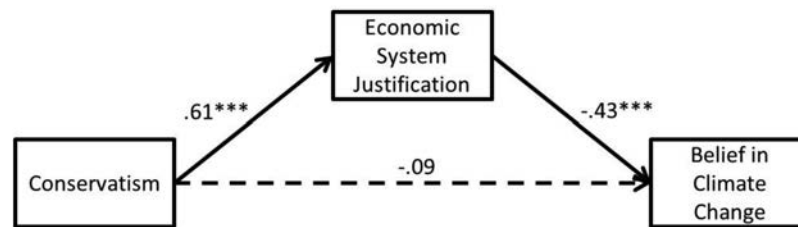


Figure 1. Mediation of general political conservatism on belief in climate change by economic system justification (Pilot Study). Numerical entries are standardized regression coefficients for the full model. Dashed lines indicate nonsignificant paths, $p > .05$. 95% unstandardized confidence intervals of the indirect effect $[-.30, -.10]$. *** $p < .001$.

taxes you pay, the job and investment opportunities made available to you, the general state of the economy—to a large extent, these things are *under the control of* [rarely affected by] the federal government.

Target article. Participants were then asked to read a two-page article adapted from an actual Associated Press news story (Associated Press, 2010). The article provided information regarding errors found in the 2007 IPCC report, statements by climate scientists supporting the credibility of climate science, and statements by prominent skeptics arguing that the errors reveal flaws in the research process. The article began,

Five glaring errors were discovered in one paragraph of the most authoritative report on global warming, forcing the Nobel Prize-winning panel of climate scientists who wrote it to apologize and promise to be more careful. The errors are in a 2007 report by the IPCC. All the mistakes appear in a subsection that suggests glaciers could melt away by the year 2035—hundreds of years earlier than the data actually indicate. The year 2350 apparently was transposed as 2035. The climate panel and even the scientist who publicized the errors said they are not significant compared with the entire report, nor were they intentional. And they do not negate the fact that glaciers are melting faster than ever . . . But the mistakes open the door for more attacks from climate change skeptics.²

The article was selected for a number of reasons. First, it contained several pieces of factual information. Second, it was authored by a relatively credible and politically neutral source, and participants learned that the story was reported through a variety of media outlets. It contained no references to political parties, officials, or policies. Third, it contained some information that supported and some information that challenged the occurrence of anthropogenic climate change.

Recall of the scientific evidence for climate change. Participants, without prior warning, were presented with two multiple-choice and two open-ended memory questions from the target article. Full text of the multiple-choice questions is shown in Tables 3 and 4. The open-ended questions were “According to the article on global warming, by what date did the IPCC erroneously report that the glaciers may be melted?” (correct answer = 2035) and “What is the accurate date?” (correct answer = 2350).

Manipulation check. To examine the degree to which participants felt dependent on the extant system, they were asked how much they agreed or disagreed with two items “The decisions and actions of the federal government affect me personally” and “Individual Americans’ success depends on the government making good decisions” (Kay et al., 2009). Answers were provided on

7-point scales ranging from 1 (*definitely not*) to 7 (*definitely*). The two items were averaged to create an index of system dependence, $r(55) = .35$, $p < .01$.

All participants then received a written debriefing, were thanked for their participation, and received course credit.

Results and Discussion

Manipulation check. Participants assigned to the high system dependence condition reported stronger agreement with the system dependence statements ($M = 4.47$, $SD = 0.87$) than did those assigned to the low system dependence condition ($M = 3.93$, $SD = 1.17$), $t(55) = -1.99$, $p = .05$.

Recall of the scientific evidence for climate change. As hypothesized, individuals assigned to the high (vs. low) system dependence condition exhibited recall biases consistent with climate change skepticism. Those assigned to the high system dependence condition were less likely to remember that three quarters of carbon emissions were estimated to be man-made, $\chi^2(7) = 18.01$, $p = .01$, Cramer’s $V = .58$ (see Table 3). Everyone assigned to the high dependence condition who answered this item incorrectly reported that the degree of carbon emissions was *less* than three quarters. Participants assigned to the high (vs. low) dependence condition were also less likely to recall that the date error in the IPCC report was discovered by the climate scientists themselves, $\chi^2(3) = 7.90$, $p < .05$, Cramer’s $V = .39$ (see Table 4). Planned comparisons revealed that individuals assigned to the high dependence condition were significantly more likely to answer (incorrectly) that “scientists who are skeptical of global warming, including an MIT professor” discovered the error than were those assigned to the low dependence condition ($p < .05$). Most participants were able to correctly recall both the erroneous (2035) and accurate (2350) dates by which the glaciers described in the article were expected to melt. However, those assigned to the high (vs. low) dependence condition were marginally less

² The article presented to participants was nearly identical to the original, with the exception of the removal or substitution of pieces of information that referred to governmental bodies or countries with information that was system-neutral. For instance, in the original, IPCC is spelled out as “Intergovernmental Panel on Climate Change” and the glaciers were specified to be Himalayan. As a strong test of our hypothesis that individuals see climate change as inherently system-threatening, we sought to remove reference to economic and governmental systems from the climate change target article as much as possible. Full materials are available in the online supplemental materials.

Table 3
Distribution of Responses to the Question “According to the Article on Global Warming, What Fraction of Carbon Emissions Are Believed To Be the Product of Power Plants, Cars, or Trucks?” as a Function of System Dependence Condition (Study 1)

Condition	1/5	1/4	1/3	1/2	2/3	3/4	4/5	None of the above
High system dependence	7.1%	14.3%	21.4%	7.1%	21.4%	21.4%	.0%	7.1%
Low system dependence	.0%	4.0%	8.0%	.0%	4.0%	64.0%	8.0%	12.0%

Note. Percentages are within condition; the correct answer is indicated in bold. $\chi^2(7) = 18.01, p = .01$.

likely to answer both questions correctly (80% vs. 96%, $\chi^2[1] = 3.03, p < .09$; and 65.2% vs. 87.5%, $\chi^2[1] = 3.25, p < .08$, respectively).

In summary, we found that situationally induced system justification motivation biased recall of climate change information. Individuals who were led to feel more dependent on the socioeconomic system were more likely to misremember information about climate change in a system-exonerating direction.

Study 2

In Study 2, we sought to establish whether one’s dispositional level of system justification motivation may also modulate recall. If so, it would provide evidence that individuals engage in biased processing of environmental information in their day-to-day lives, even in the absence of a discrete motivational trigger. Moreover, we investigated the possibility that low as well as high system justifiers would engage in motivated information processing when it comes to the existence of climate change, leading to attitude extremity.

We also made several methodological improvements in order to rule out alternative explanations. To better control for potential differences in exposure to the target stimulus that could have occurred from participants failing to read the news article or reading it multiple times,³ we exposed participants to clips taken from the televised newscast *The Agenda with Steve Paikin* (Blake, Paikin, & TVO, 2010). Exposure time to the video was fixed: Participants could not move to the next part of the experiment until the video was finished, and they could not rewind it or return to it later.

We also asked participants to answer a new set of recall items that used a continuous slider response scale with fixed minimum

and maximum values. This allowed us to vary, across items, where on the scale each correct answer was located. It also restricted responses so that extreme outliers could not artificially distort the results. Importantly, this procedure also allowed us to aggregate responses to all recall questions to test the hypothesis that participants would demonstrate a consistent or cumulative bias across items. This procedure is described in more detail in the Method section.

The Associated Press article used in Study 1 provided a reasonably balanced perspective of both the strengths and weaknesses of climate science, but it also highlighted genuine errors made by climate scientists. It is possible that simply reminding participants of potentially damaging information about the conduct of climate science influenced their responses. Therefore, in Study 2, we exposed participants to information in which neither “side” of the debate was reported to have engaged in faulty practices.

To summarize, in Study 2, participants watched clips from a newscast, recalled information from the video, reported on their belief in climate change, and completed the Economic System Justification Scale. We expected that participants who were higher (vs. lower) in economic system justification would misremember the scientific information as indicating less dramatic evidence of climate change and that this recall bias would be associated with increased skepticism about the existence of climate change.

Method

Participants. One hundred ninety-six U.S. residents were recruited through Amazon’s Mechanical Turk to participate in a study about current events in exchange for \$0.50. One individual was excluded from analysis because she reported taking notes during the video, and eight were excluded because the video did not play properly. The remaining 187 participants (56% female) ranged in age from 18 to 70 years ($M = 35, SD = 12$), and the modal income category was \$25,000 to \$50,000.

Practice video. We included a practice video to ensure that participants’ display and audio settings were adjusted so that they could see and hear the target video on their web browser as soon as it began to play. After providing informed consent, participants were shown a test video of human hands and the spoken word “hello.” They could replay this video as many times as necessary, but could not continue the study until they had correctly identified the image they saw and the word they heard. The target video

Table 4
Distribution of Responses to the Question “Who Discovered the Date Error in the IPCC Report?” as a Function of System Dependence Condition (Study 1)

Condition	A	B	C	D
High system dependence	32.1%	28.6%	35.7%	3.6%
Low system dependence	24.0%	4.0%	60.0%	12.0%

Note. Percentages are within condition; the correct answer is indicated in bold. $\chi^2(3) = 7.90, p < .05$. A = A scholar at the Cato Institute; B = Scientists who are skeptical of global warming, including an Massachusetts Institute of Technology professor; C = Scientists who believe global warming is occurring, including an IPCC co-author; D = A writer for the Associated Press.

³ Data regarding time spent reading the target article in Study 1 was unavailable; however, participants did not differ by condition in the time it took them to complete the experiment as a whole, $t(55) < 1$.

started automatically on the following page and could not be restarted.

Target video. Participants were exposed to 5 min of edited clips from *The Agenda with Steve Paikin*, which originally aired March 9, 2010 (Blake et al., 2010).⁴ In the video, host Steve Paikin asked guest Richard Lindzen, a professor of atmospheric physics at the Massachusetts Institute of Technology (MIT) and a climate change skeptic, to respond to video excerpts of a National Aeronautics and Space Administration (NASA) documentary regarding the scientific evidence of anthropogenic climate change. As an example, the host aired a brief excerpt of the NASA video, which reported that the Earth's temperature had risen roughly one third of a degree in the last decade. The host then asked Professor Lindzen to respond to this report, and he responded, in part, "We're not talking about anything very large. It's a magnitude that almost all of us experience oh, I would say, 30 times as much each day." The alternation between NASA clips and responses by Professor Lindzen continues for the remainder of the target video.

Recall of the scientific evidence for climate change. Participants were asked, without forewarning, to recall five specific pieces of information concerning the scientific evidence summarized in the video clip. For instance, participants were asked, "According to the NASA video clip, by how many degrees Fahrenheit has the Earth's global average temperature risen in the last decade?" The response scale ranged from 0 to 1 degree (correct answer = 1/3). Responses were coded such that higher scores indicated more serious evidence of climate change. Full text and response scales for the memory and attitude items for Studies 2 and 3 are shown in Appendices A and B. Because each item was measured on a different scale, items were standardized by subtracting the correct answer from each person's response and then dividing by the sample standard deviation for that item. We then created a composite measure of memory bias by averaging individuals' scores across the five standardized values. The resulting variable was normally distributed around a mean of .23 ($SD = .50$), ranging from -1.57 to 1.56 ; it represents the magnitude of positive versus negative bias across the five questions.

Belief in climate change. Participants answered seven items, randomly presented, that assessed their belief in climate change, such as "Do you believe that global warming is anthropogenic (caused by human behavior)?" Items were measured on 7-point response scales and were coded so that higher scores represented stronger belief in climate change. Reliability was excellent ($\alpha = .96$), so responses were averaged to create an index of belief in climate change.

Self-reported belief change. Participants reported the degree to which the target video had changed their own beliefs about climate change with the item "Did the video make you believe that man-made global warming is occurring MORE or LESS than you believed it before watching the video?" on a 7-point response scale that ranged from -3 (*believe in global warming much less now*) to 3 (*believe in global warming much more now*).

Economic system justification. Participants completed the Economic System Justification Scale (Jost & Thompson, 2000).⁵ Reliability was good ($\alpha = .88$), so responses were average to create an index of economic system justification.

Participants completed a basic demographic questionnaire, received a written debriefing, and were paid and thanked.

Table 5

Descriptive Statistics, Including Intercorrelations, of Study Variables (Study 2)

Variable	<i>M</i>	<i>SD</i>	1	2	3
1. Economic system justification	4.42	1.33	—		
2. Recall bias	.23	.50	-.15*	—	—
3. Belief in climate change	4.98	1.63	-.51***	.20**	—
4. Self-reported belief change	4.00	.93	-.15*	.21**	.37***

Note. Economic system justification was measured on a 9-point scale. Belief in climate change and belief change were measured on 7-point scales. Recall bias was a standardized score centered at accuracy, and higher scores indicate responses consistent with anthropogenic climate change being a more serious problem.

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

Results and Discussion

Descriptive statistics for all study variables, including intercorrelations, are summarized in Table 5. As hypothesized, individuals who scored higher on the Economic System Justification Scale recalled climate change information to be less serious, aggregating across all five items, $b = -.06$, standard error (SE) = .03, $\beta = -.15$, $t = -2.04$, $p < .05$. That is, high (vs. low) system justifiers recalled smaller increases in global temperatures, lower global sea levels, and less reliable historical data concerning climate change. Higher system justifiers were also more skeptical of climate change, $b = -.61$, $SE = .08$, $\beta = -.50$, $t = -7.78$, $p < .001$, and reported having become more skeptical about climate change after watching the target video, $b = -.10$, $SE = .05$, $\beta = -.15$, $t = -2.00$, $p < .05$. Individuals who were one standard deviation below the mean on economic system justification reported that watching the video led them to believe more in climate change (predicted value = 4.14), whereas individuals one standard deviation above the mean on economic system justification reported believing less in climate change after watching the video than before (predicted value = 3.86), indicating attitude polarization. A test of the indirect effect of economic system justification on self-reported belief change via recall of scientific evidence also indicated significant mediation (95% confidence interval of the indirect effect [$-.06$, $-.001$]; Figure 2).

The results of Study 2 provide additional evidence that system justification motivation influences cognitive processing of information regarding anthropogenic climate change. Individuals who were higher in economic system justification were more likely to misremember scientific evidence from the news video in a direction that facilitated skepticism. Recall bias, in turn, significantly predicted the degree and direction of self-reported belief change following exposure to the newscast, increasing polarization.

Study 3

The results of Study 2 suggest that individual differences in economic system justification motivation are associated with in-

⁴ The 5-min excerpt used for this study is archived by the authors at <https://player.vimeo.com/video/109090815>.

⁵ We asked participants to complete the Economic System Justification Scale at the end of the study to avoid priming economic concerns and, in doing so, artificially heightening the associations among constructs of interest.

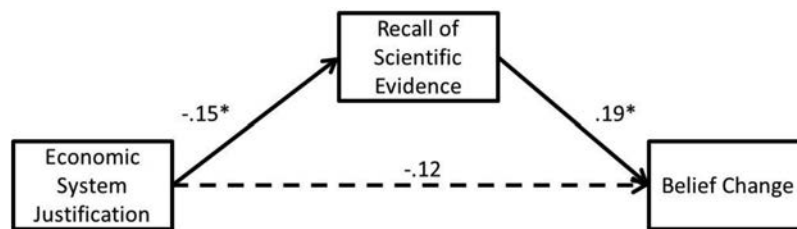


Figure 2. Mediation of economic system justification on self-reported change in belief in climate change by recall of scientific evidence (Study 2). Numerical entries are standardized regression coefficients for the full model. 95% unstandardized confidence interval of indirect effect $[-.06, -.001]$. Higher scores on “recall of scientific evidence” indicate responses consistent with anthropogenic climate change being a more serious problem. * $p < .05$.

formation processing about climate change, and that the processing of new scientific information can influence downstream attitude change. In Study 3, we sought to investigate more directly the psychological mechanism theorized to be responsible for the association between system justification and recall of information about climate change—namely, concerns about threats to the stability of the economy. This study also provided an opportunity to investigate a possible intervention strategy designed to break the link between system justification and biased information processing.

More specifically, we developed two versions of an audio podcast in which the host reported evidence suggesting that the U.S. economy was either still in—or had recovered from—economic recession. After participants listened to one of the podcasts (or were assigned to a no-podcast control condition), they were exposed to a video reporting information about climate change. As in Study 2, participants were asked, without forewarning, to recall evidence from the target video, report on their belief in climate change, and complete the Economic System Justification Scale.

Although providing “balanced” information about climate change in Studies 1 and 2 was useful in minimizing reactance to the information presented, it has been suggested that reporting evidence about climate change in this way may contribute to skepticism and perpetuate the perception that scientists are divided on this issue (e.g., Boykoff & Boykoff, 2004; Butler & Pidgeon, 2009; Corbett & Durfee, 2004; Malka, Krosnick, Debell, Pasek, & Schneider, 2009). Therefore, rather than showing the *The Agenda* video, which provided excerpts from a NASA documentary as well as comments by a climate change skeptic, in Study 3 we located the original NASA documentary and exposed participants to this 6-min video in full.

We expected that participants who were assigned to the control condition would demonstrate patterns of effects similar to those observed in Study 2. That is, we hypothesized that individuals who scored higher in economic system justification would misremember the scientific evidence as indicating that climate change is less severe, and this would be associated with more negative self-reported belief change. We hypothesized that participants who were exposed to the economic recession condition would exhibit an increase in system justification motivation, leading to recall that would downplay the severity of climate change, particularly among low system justifiers. By contrast, we hypothesized that exposure to the economic recovery message would satisfy system justification motivation and lead high system justifiers to recall the

evidence of climate change to be more severe than in the other conditions (cf. Banfield et al., 2011). In other words, we predicted that the economic recession condition would “turn low system justifiers into high system justifiers,” whereas the economic recovery condition would “turn high system justifiers into low system justifiers.”

Method

Participants. Two hundred twenty-four undergraduates from New York University participated in this study in exchange for course credit. Participants were informed that the researchers were interested in how people respond to information about current events from different types of sources, and that they would be asked to respond to some excerpts from newspaper, TV, and/or radio reports. Twenty-one individuals reported taking notes during the video and were therefore excluded from analysis. The remaining 203 participants (70% women) ranged in age from 18 to 24 years ($M = 19$, $SD = 1.15$), and their families’ modal household income category was \$100,000 to \$250,000.

Practice video. After providing informed consent, participants viewed the same practice video and responded to the same two questions used in Study 2 to ensure that their display and audio settings were properly adjusted.

State of the economy manipulation. Participants were randomly assigned to one of three state-of-the-economy conditions: economic recession, economic recovery, or a no-podcast control. Participants assigned to the noncontrol conditions listened to one of two versions of a podcast written and recorded for this study by the authors. In the podcast, the host discussed evidence that the U.S. economy was either still in a recession or had successfully recovered from it. In each case, the host reported actual data regarding the state of the economy and read an authentic quote from an individual regarding his job search experience (see Appendix C for full text and citations). The podcast started automatically and participants were unable to restart or rewind it. To ensure that participants had attended to the podcast, they were asked to summarize the main argument made by the host in one sentence. Participants assigned to the control condition did not listen to a podcast; instead, they proceeded directly from the practice video to the target video.

Target video. Participants were exposed to a 6-min video from NASA presenting evidence of anthropogenic climate change. The video, entitled *Piecing Together the Temperature Puzzle*, was

the same video excerpted by *The Agenda* and used as part of the target stimulus in Study 2. It is publicly available through NASA's website (NASA/Goddard Space Flight Center, 2010). Unlike Study 2, in which participants viewed clips of the NASA video mixed with a discussion between the TV host and a climate change skeptic, participants in Study 3 simply watched the NASA video in its entirety.

Manipulation check. To measure participants' perceptions of the state of the economy, we asked them to respond to three items. The first item was "How strong do you believe the current economy to be?" Answers were given on a 7-point scale that ranged from 1 (*extremely weak*) to 7 (*extremely strong*). The second item was "How stable do you believe the current economy to be?" Answers were given on a scale ranging from 1 (*extremely unstable*) to 7 (*extremely stable*). The third item was "What state best describes your perception of the current American economy?" Answers were given on a scale ranging from 1 (*still in a recession*) to 7 (*completely recovered*). Reliability was good ($\alpha = .82$), so responses were averaged to create an index of perception of the economy.

Recall of the scientific evidence for climate change. As in Study 2, participants were asked, without forewarning, to recall several specific pieces of information concerning the scientific evidence summarized in the video clip. The same questions asked in Study 2 were used in Study 3 (with the exception of the question about Professor Lindzen, who does not appear in the video presented in Study 3). Participants were also asked four additional questions from the NASA video, such as "According to the video, by how many square miles has arctic summer sea ice declined in the last decade?" The response scale ranged from 0 to 500,000 (correct answer = 300,000 square miles; Appendix A). Responses were coded so that higher scores indicated the evidence for climate change was more serious. As in Study 2, a composite standardized score was created, which ranged from $-.72$ to 1.75 ($M = .21$, $SD = .34$).

Self-reported belief change. Participants answered three items that assessed the degree to which they believed the target video had changed their climate-related beliefs, such as, "How did the video affect your belief that man-made global warming is occurring?" Answers were given on a 7-point scale that ranged from -3 (*I believe in global warming much less now than I did before I watched the video*) to 3 (*I believe in global warming much more now than I did before I watched the video*; see Appendix B). Reliability was good ($\alpha = .75$), so responses were averaged to form an index of self-reported belief change.

Finally, participants completed the Economic System Justification Scale ($\alpha = .81$),⁶ provided demographic information, and were asked if they had taken notes during the NASA video. Participants received a written debriefing and were given course credit and thanked.

Results and Discussion

Manipulation check. As expected, the manipulation significantly affected participants' perception of the state of the economy, $F(2, 201) = 5.87$, $p < .01$. Participants assigned to the economic recovery condition reported believing that the economy was significantly stronger, more stable, and had recovered more ($M = 4.20$, $SD = 1.00$) compared with those assigned to the

economic recession condition, ($M = 3.61$, $SD = 0.94$), $t(201) = 3.41$, $p = .001$, and somewhat stronger compared with those in the control condition ($M = 3.95$, $SD = .95$), $t(201) = 1.55$, $p = .12$. Participants assigned to the recession condition perceived the economy to be significantly weaker than did those assigned to the control condition, $t(201) = -2.07$, $p < .05$.⁷

Recall of the scientific evidence for climate change. We first examined the effect of the experimental manipulation on the association between economic system justification and recall of information presented in the NASA video by regressing participants' aggregate recall score on economic system justification (centered), condition (dummy coded with the control condition as the reference condition), and their interaction. Omnibus effects are summarized in Table 6. As hypothesized, we observed a significant interaction between economic system justification and experimental condition.

To interpret these effects, we examined simple slopes. For participants assigned to the control condition, results replicated Study 2: Economic system justification significantly predicted recall of scientific information to indicate that climate change is a less serious problem, $b = -.08$, $SE = .03$, $\beta = -.23$, $t = -2.32$, $p < .05$. Consistent with theoretical expectations, the effect of economic system justification on recall was attenuated by the presentation of messages stating either that the economy was in recession, $b = -.002$, $SE = .05$, $\beta = -.01$, $t < 1$, or in recovery, $b = .06$, $SE = .04$, $\beta = .16$, $t = 1.25$, $p = .21$. Examination of the simple effects at ± 1 standard deviation from the mean on economic system justification revealed that assignment to the economic recession (vs. control) condition significantly lowered recall scores for low system justifiers, $b = -.16$, $SE = .08$, $\beta = -.22$, $t = 2.00$, $p < .05$, but it had no effect on high system justifiers, $b = -.01$, $SE = .09$, $\beta = -.02$, $t < 1$. At the same time, assignment to the economic recovery (vs. control) condition significantly heightened recall scores for high system justifiers, $b = .15$, $SE = .08$, $\beta = .20$, $t = 1.99$, $p < .05$, but it had no effect on low system justifiers, $b = -.11$, $SE = .08$, $\beta = -.15$, $t = -1.36$, $p = .18$ (see Figure 3).

In summary, being led to believe that the economy was in a state of recession led low system justifiers to process information more like high system justifiers—recalling the evidence for climate change in a manner that decreased its severity. By contrast, being led to believe that the economy was in a healthy state of recovery appeared to be effective in leading high system justifiers to process information more like low system justifiers—recalling the evidence for climate change in a manner that increased its severity.

Effect of recall of scientific evidence on belief change. As in Study 2, we examined whether recall of the scientific evidence reported in the video mediated the association between economic system justification and self-reported belief change. We also examined whether exposure to messages about the state of the economy would moderate this process. To do so, we conducted a moderated mediation analysis. For participants who were assigned to the control condition, we replicated the pattern of effects from

⁶ Scores on the Economic System Justification Scale did not differ as a function of experimental condition, $F(2, 199) = 1.16$, $p = .32$.

⁷ Economic system justification did not moderate the effect of experimental condition on perception of the state of the economy, $t_s < 1$.

Table 6
Multiple Regression of Belief in Anthropogenic Climate Change on Economic System Justification and Experimental Condition (Study 3)

Predictor	<i>b</i> (<i>SE</i>)	β
Intercept	.22 (.04)	
Economic system justification	-.08 (.03)	-.23*
Recession condition	-.09 (.06)	-.12
Recovery condition	.02 (.06)	.03
Economic System Justification \times Recession	.08 (.06)	.10
Economic System Justification \times Recovery	.13 (.06)	.22*

Note. Economic system justification was grand-mean centered. The control condition was the reference condition. *SE* = standard error.

* $p < .05$. *** $p < .001$.

Study 2: Economic system justification significantly predicted recall of scientific information about climate change to be less serious, which in turn was associated with more negative self-reported belief change, 90% confidence interval $[-.13, -.002]$. For participants assigned to the recovery or recession conditions, by contrast, economic system justification was not significantly related to recall of scientific information about climate change, nor was recall associated with belief change. The effect of economic system justification on belief change was nonsignificant, and the 95% confidence interval of the indirect effect was also nonsignificant (recovery $[-.07, .02]$; recession $[-.05, .03]$; see Figure 4).

In Study 3, we replicated the pattern of effects observed in Study 2 for participants assigned to the control condition. Specifically, economic system justification predicted recall of recently learned information about climate change to be less serious, and this, in turn, was associated with an increase in skepticism about the existence of climate change. These associations were eliminated for participants led to believe that the economy was either in a state of recovery or still in a recession. Being told that the economy had recovered from the economic

recession had no significant effect on information processing for low system justifiers, but it led high system justifiers to recall the evidence for climate change to be more serious. In contrast, being told that the economy remained in a recession had no effect on high system justifiers, but led low system justifiers to recall the evidence as less serious. As a result, economic system justification no longer predicted belief change about the existence of climate change.

General Discussion

In three studies, we observed that individuals' levels of motivation to justify the economic system consistently affected memory for scientific evidence of climate change. This, in turn, was associated with increased climate change skepticism. However, when they were led to believe that the economy was strong and stable, high and low system justifiers no longer differed in their recall of information about climate change. Taken in conjunction, these findings suggest that individuals are not merely ignorant of the evidence for climate change (cf. Kahan et al., 2012). Rather, they may be motivated to manipulate their informational landscape in a manner that fulfills the need to maintain and justify the societal status quo (Jost, 2015). More broadly, this research suggests that one reason why individuals come to hold such different attitudes and beliefs about social and political issues may be because psychological motives lead them to process information about those issues differently. In this project, we sought to shed some light on why climate change education and activism programs are frequently ineffective when it comes to combating skepticism. Our findings point to several potential directions for intervention research aimed at fostering objective processing of scientific information.

Contributions of the Current Research

This research program aims to make basic and applied contributions to the literatures on political reasoning, motivated social cognition, system justification, science communication, and environmental attitudes. First, our analysis offers a nuanced consider-

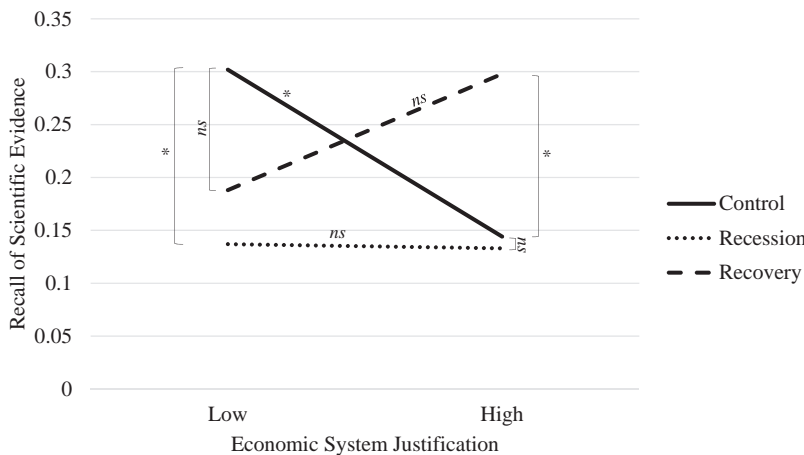


Figure 3. Effect of the perceived state of the economy on the association between economic system justification and recall of scientific evidence of climate change (Study 3). Higher scores on “aggregate recall of scientific evidence” indicate responses consistent with anthropogenic climate change being a more serious problem. Brackets indicate simple effect significance tests at ± 1 standard deviation from the mean.

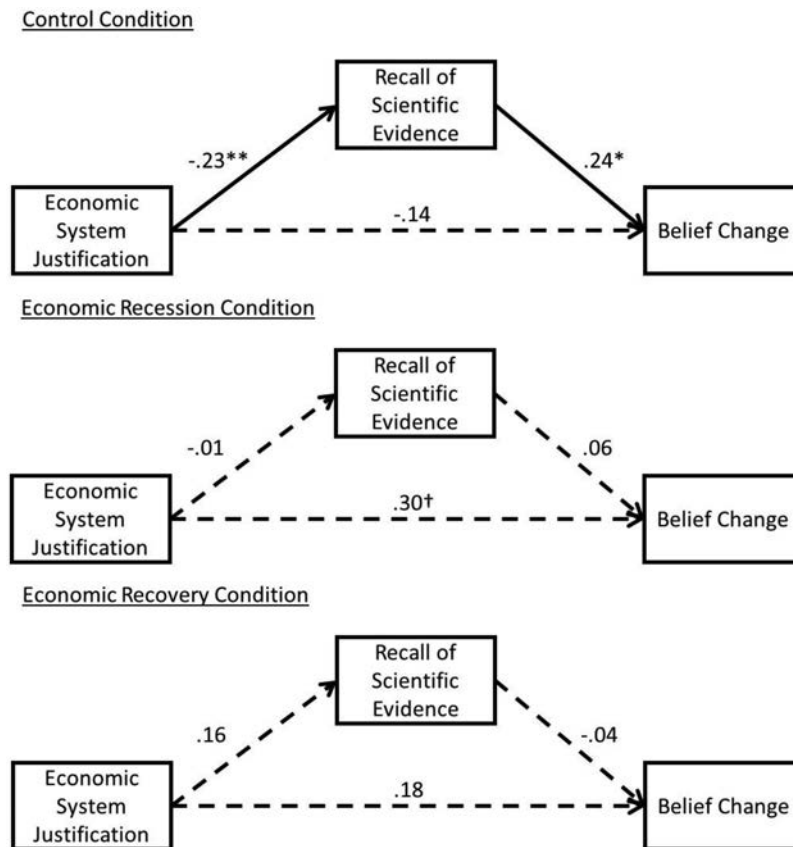


Figure 4. Mediation of economic system justification on self-reported change in belief in climate change by recall of scientific evidence, as moderated by perceived state of the economy (Study 3). Numerical entries are standardized regression coefficients. 90% unstandardized confidence interval of indirect effect for control condition [-.13, -.002]. 95% unstandardized confidence interval of indirect effect for recovery condition [-.07, .02]. 95% unstandardized confidence interval of indirect effect for recession condition [-.05, .03]. Higher scores on “recall of scientific evidence” indicate responses consistent with anthropogenic climate change being a more serious problem. † $p < .10$. * $p < .05$. ** $p < .01$.

ation of the psychological underpinnings of ideological variability in resistance to change (see also Jacquet et al., 2014). Although several previous studies have demonstrated that political ideology is linked to environmental attitudes (e.g., Allen, Castano, & Allen, 2007; Borick & Rabe, 2010; Guber, 2013; Heath & Gifford, 2006; McCright & Dunlap, 2011a, 2011b), there has been relatively little investigation into why this is the case. Previous work has proffered explanations such as the “top-down” persuasive impact of messages from party elites (see Guber, 2013, for a review) or efforts by conservative think tanks to undermine climate science (e.g., McCright & Dunlap, 2010), as well as “bottom-up” effects of the individual’s moral and cultural values on perceptions of environmental risk (e.g., Feinberg & Willer, 2013; Kahan, Jenkins-Smith, & Braman, 2011). The present research program offers a complementary, motivational analysis of climate change skepticism. This approach can account for the decline in climate change belief observed in public opinion polls during the economic recession (Scruggs & Benegal, 2012). It also helps to explain why, despite substantial political polarization, significant proportions of Democrats and liberals remain skeptical about anthropogenic climate change.

Second, the current research builds on findings by Ledgerwood et al. (2011) and Shepherd and Kay (2012), which suggest that situational threats to the legitimacy or stability of the social system influence selective exposure to and evaluation of information about the system. Furthermore, this research extends current conceptions of motivated social cognition as a self- and group-serving process by which people maintain prior beliefs and bolster their in-groups, to demonstrate that cognition may also be affected by both chronic and situational system-serving needs (Liviatan & Jost, 2014). This implies that individuals might engage in motivated information processing even when doing so conflicts with prior beliefs as well as individual or collective self-interest (see Jost, Hennes, & Lavine, 2013, for a review).

Third, although a good deal of research has documented instances in which motivation influences perceptual representation (e.g., Balcells & Dunning, 2006), information gathering (e.g., W. Hart et al., 2009), and the evaluation of information (e.g., Lord et al., 1979), there has been less attention devoted to the study of motivational biases in recall. Most studies of motivated processes in memory have focused on the selective retrieval of information from long-term memory (Sanitioso et

al., 1990), rather than on inaccurate, directionally biased recall. Fourth, our findings suggest another possible mechanism for attitude polarization in the context of anthropogenic climate change. In particular, we find evidence that individuals report belief change that is consistent with their processing of new information. In other words, so-called “boomerang” effects (Hart, P. S., & Nisbet, 2012) may result in part from biased recall of novel information in a manner that facilitates the maintenance or strengthening of desired conclusions.

This research program provides a psychological explanation for the relative ineffectiveness of climate change education and activism programs in combating skepticism. We find that system justification motivation may be activated even before new information is presented or processed. At the same time, emphasizing the strength of the economic system may be one way in which to preemptively assuage system-defensive motivation. Our research suggests that interventions focused only on exposing the public to new information are unlikely to be successful to the extent that individuals are motivated to reach a desired conclusion about anthropogenic climate change.

Limitations and Future Directions

Despite these contributions, there are several limitations of the current research that future studies should seek to overcome. First, although our findings indicate that system justification influences information recall, it is not clear whether it does so at the point of information gathering, encoding, and/or retrieval. Future research should attempt to isolate the point(s) at which system justification and other motives influence memory.

A primary goal of the current project was to better understand a possible mechanism underlying observed discrepancies between scientific and lay beliefs in anthropogenic climate change. Therefore, our focus was on information processing among high system justifiers, who are more likely to be skeptical of climate change (Feygina et al., 2010; Jost, 2015). However, our results suggested not only that high system justification was associated with recalling evidence about climate change to be relatively less serious, but that low system justification tendencies were associated with the opposite pattern, recalling the information to be *more* serious.

This raises the question of whether recall by low system justifiers might also be motivated by a desire to see the economic system as flawed. For the most part, individuals scoring on the low range of the Economic System Justification Scale have been conceptualized as being relatively low or lacking in system justification motivation (Jost et al., 2010). However, some of our findings raise the possibility that low system justifiers may possess an opposing motivation in favor of system criticism or system change, and this motivation, too, could bias information processing about climate change—in this case, facilitating the perception that climate change is a more severe and urgent problem than it actually is. Recent work suggests that motivated information processing may be useful in spurring goal-directed action (Cole, Riccio, & Balci, 2014); therefore, it may be the case that individuals who are low in system justification motivation (who may be highly motivated to change the system) may nonconsciously exaggerate structural problems to mobilize the resources that are necessary to take

effective action. Future research should continue to examine the possibility of a system change motivation as well as its potential influences on information processing (see also Johnson & Fujita, 2012).⁸

Care should be taken in drawing strong conclusions from these studies about information processing among very high system justifiers. Both urban university students and Mechanical Turk workers tend to score fairly low in system justification, and the mean level of belief in climate change in all studies was high relative to the general population. Consequently, the current findings may be especially informative insofar as they reflect the results of fairly conservative tests of our hypotheses, but they leave open the question of how those who are most strongly motivated to defend the status quo might process information. Future research is needed to investigate processes of biased recall with respect to a broader range of the population, especially those individuals who are committed skeptics of anthropogenic climate change.

Study 3 provides promising evidence that characterizing the economic system in favorable terms may help to satiate system justification motivation and attenuate biased information processing. Nevertheless, these findings should also be interpreted cautiously. Participants recruited for this study were college undergraduates, who may have less crystallized attitudes about the state of the economy, and they may also be more susceptible to persuasion and framing effects compared with older citizens. At the same time, young people play a pivotal role in shaping sustainability policy, and—according to some studies—they are surprisingly divided about the existence of climate change and the importance of taking action to mitigate it (Feldman, Nisbet, Leiserowitz, & Maibach, 2010). For these reasons, the utility of interventions that prove effective with this age group should not be discounted. Nevertheless, future research should investigate whether economic system affirmation messages such as the one we have developed are effective in reducing system justifying biases in a broader, and potentially more resistant, segment of the population.

Finally, in the current research program, we exposed participants to novel information and asked them to retrieve and form attitudes about this information shortly thereafter. Although our results suggest that individuals do engage in biased processing of scientific information they encounter in a relatively controlled setting, it remains to be seen how immediate, subtle biases in information processing, such as those observed here, might translate into long-term attitudes and behaviors.

Conclusion

Although many important questions remain for future investigation, the studies presented here provide evidence that economic system justification motivation influences the processing

⁸ An anonymous reviewer raised another possible interpretation, namely, that positive bias in the data reported here could simply have resulted from method variance. That is, the construction of response scales might have contributed to stronger likelihood of exaggerating (vs. minimizing) climate change. Future research should focus on the effects of test calibration on memory effects. With respect to our studies, it would be wise to emphasize relative differences between high and low system justifiers rather than absolute differences in judgmental accuracy.

of information concerning anthropogenic climate change. To the extent that climate change is a serious global concern that requires immediate attention, scientists and practitioners must devise methods to overcome public resistance to proenvironmental policies. Our findings suggest that system-defensive motivation may be activated before scientific information about climate change can even be processed. As a result, simply providing people with scientific evidence is unlikely to be effective in changing their minds. However, it may be possible to break the psychological link between proenvironmental initiatives and worries about economic risk by linking scientific information to statements about the strength and stability of the economic system.

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Appendix A

Recall Items (Studies 2–3)

Item	Minimum	Maximum	Correct answer
According to the NASA clip, by how many inches has the global sea level risen in the last decade? ^{2,3}	0	5	1
According to the NASA clip, how does the rate at which the global sea level is rising compare with the 20th century average? ^{2,3}	Three times as slow	Three times as fast	Twice as fast
According to the NASA video clip, by how many degrees Fahrenheit has the Earth's global average temperature risen in the last decade? ^{2,3}	0	1	1/3
According to the NASA video clip, by how many degrees Fahrenheit has the Earth's global average temperature risen since 1880? ^{2,3}	0	5	1.5
The temperature graph from NASA shows global average temperatures from the last 400,000 years. According to Richard Lindzen, however, the methods used to get those measurements are probably not accurate more than how many years in the past? ²	0	1,000	400
According to the video, over the last decade solar activity has been in a . . . ³	Deep lull in activity	Strong spike in activity	Deep lull in activity
According to the video, humans have been keeping temperature records for how many years? ³	0	500	150
According to the video, the warmest decade on record has been during what period? ³	January 1980 to January 1989	January 2009 to the present	January 2000 to January 2009

Note. Superscripts indicate the study in which the item was asked. Items indicated with (R) are reverse-coded.

(Appendices continue)

Appendix B
Attitude and Attitude Change Items (Studies 2–3)

Item	Minimum	Maximum
Do you believe that global warming is anthropogenic (caused by human behavior)? ²	1 (<i>Definitely not</i>)	7 (<i>Definitely</i>)
Do you believe that global warming is occurring? ²	1 (<i>Definitely not</i>)	7 (<i>Definitely</i>)
Do you believe that global warming is a hoax? (R) ²	1 (<i>Definitely not</i>)	7 (<i>Definitely</i>)
How likely do you think it is that, in your lifetime, the effects of global warming will be noticeable (species extinction, glacial melting, severe weather such as hurricanes, increased temperatures)? ²	1 (<i>Not likely at all</i>)	7 (<i>Extremely likely</i>)
How likely do you think it is that global warming is occurring? ²	1 (<i>Not likely at all</i>)	7 (<i>Extremely likely</i>)
How likely do you think it is that scientists will eventually discover that global warming is NOT man-made after all? (R) ²	1 (<i>Not likely at all</i>)	7 (<i>Extremely likely</i>)
How likely do you think it is that global warming is a hoax? (R) ²	1 (<i>Not likely at all</i>)	7 (<i>Extremely likely</i>)
Did the video make you believe that man-made global warming is occurring MORE or LESS than you believed it before watching the video? ^{2,3}	–3 (<i>I believe in global warming much less now than I did before I watched the video</i>)	3 (<i>I believe in global warming much more now than I did before I watched the video</i>)
How did the video affect your belief about the degree of scientific consensus that there is about global warming? ³	–3 (<i>I believe there's much less scientific consensus now than I believed there was before watching the video</i>)	3 (<i>I believe there's much more scientific consensus than I believed before watching the video</i>)
Did the video increase or decrease your belief about the amount of scientific evidence for global warming? ³	–3 (<i>The video strongly decreased my belief in the amount of scientific evidence there is regarding global warming</i>)	3 (<i>The video strongly increased my belief in the amount of scientific evidence there is regarding global warming</i>)

Note. Superscripts indicate the study in which the item was asked. Items indicated with (R) are reverse-coded.

(Appendices continue)

Appendix C

Script for the State of the Economy Podcast Manipulation (Study 3)

Note: *Italicized text varies by condition.*

Economic Recession Condition

[Intro music]

Welcome back to Capital Letters. Today we've been talking about the *so-called* "recovery" of the American economy. *Is the recession really over?* Let's look at some facts.

In the housing sector, *home price gains have continued to slow* according to Case-Shiller indices.⁹

The business and manufacturing sectors have also seen persistent *decline*. For instance, *wages in the automotive sector are down by 15% in the US since 2008 and continuing to drop*.¹⁰

According to Gallup, *job creation has stalled over the last quarter*.¹¹ Most Americans are *pessimistic, saying that they're worse off financially than they were a year ago*.¹²

I have in front of me an excerpt of one man's story about his search for a job in the present economy:

*"I was working as a firefighter for the state of California and was laid off in April, right at the beginning of fire season. At my age, I'm not going to be picked up by another fire department. They want younger guys. I've applied for everything from truck driver, to sales, to nonprofit work. I've sent out almost 400 resumes, and I've gotten nothing. I've done whatever I could to make ends meet. Through some connections, I got a temp job as a truck driver in Napa Valley—a 3-hour commute from where I live. I lived in my car."*¹³

According to the Bureau of Economic Analysis, economic growth in 2014 was *only 2.4%, well below forecasted expectations*.¹⁴ So has the economic recession really turned around? Looking at the facts, the answer is *no*.

[Fade out]

Economic Recovery Condition

[Intro music]

Welcome back to Capital Letters. Today we've been talking about the *hard-won* "recovery" of the American economy. *How do we know that the recession is over?* Let's look at some facts.

In the housing sector, *home prices have continued to improve* according to Case-Shiller indices.¹⁵

The business and manufacturing sectors have also seen persisting *growth*. For instance, *the US auto industry now employs more workers than it has since 2008, adding 6,700 jobs in January alone*.¹⁶

According to Gallup, *job creation is near its 7-year high*.¹⁷ Most Americans are *optimistic, expecting to become better off financially in the next year*.¹⁸

I have in front of me an excerpt of one man's story about his search for a job in the present economy.

"I was barely getting by on the salary I had, the company I was at was failing. Things just really weren't working out for me. A friend [said] 'if you look online you can get companies in a bidding war [for you],' and I remember thinking 'yeah right.' And six months later I was actually in that position, where I had two of my tier one companies

*pitching offers against each other . . . I'm making 4x what I was making just two years ago. Four dollars for every one dollar I was making before."*¹⁹

According to the Bureau of Economic Analysis, economic growth in 2014 was 2.4%, *the highest rate of growth since 2010*.²⁰ So has the economic recession really turned around? Looking at the facts, the answer is *yes*.

[Fade out]

⁹ S&P Dow Jones Indices. (2015, January 27). *Home price gains continue to slow according to the S&P/Case-Shiller Home Price Indices*. Retrieved from https://www.spice-indices.com/idpfiles/spice-assets/resources/public/documents/135542_cshomeprice-release-0127.pdf?force_download=true

¹⁰ Ruckelshaus, C., & Leberstein, S. (2014). *Manufacturing low pay: Declining wages in the jobs that built America's middle class*. Retrieved from <http://www.nelp.org/content/uploads/2015/03/Manufacturing-Low-Pay-Declining-Wages-Jobs-Built-Middle-Class.pdf>

¹¹ McCarthy, J. (2015, February 4). *U.S. job creation lingers near seven-year high*. Retrieved from http://www.gallup.com/poll/181472/job-creation-lingers-near-seven-year-high.aspx?utm_source=ECONOMY&utm_medium=topic&utm_campaign=tiles

¹² Dugan, A. (2014, January 15). *More Americans worse off financially than a year ago*. Retrieved from <http://www.gallup.com/poll/166850/americans-worse-off-financially-year-ago.aspx>

¹³ Kurtz, A. (2014, January 9). "I just want a job." CNN Money. Retrieved from <http://money.cnn.com/gallery/news/economy/2014/01/09/unemployed-workers/3.html>

¹⁴ Bovino, B. A. (2015, February 3). *U.S. weekly economic roundup: High spirits*. Retrieved from http://www.housingviews.com/2015/02/03/u-s-weekly-economic-roundup-high-spirits/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+HousingViews+%28HousingViews+-+S%26P%27s+Blog+on+the+Housing+Market%29

¹⁵ S&P Dow Jones Indices. (2015, January 27). *Home price gains continue to slow according to the S&P/Case-Shiller Home Price Indices*. Retrieved from https://www.spice-indices.com/idpfiles/spice-assets/resources/public/documents/135542_cshomeprice-release-0127.pdf?force_download=true

¹⁶ Snavely, B. (2015, February 7). *U.S. auto employment highest since 2008*. Detroit Free Press. Retrieved from http://www.thonline.com/news/business/article_32a16474-22f4-5049-8d86-4707ef42f292.html

¹⁷ McCarthy, J. (2015, February 4). *U.S. job creation lingers near seven-year high*. Retrieved from http://www.gallup.com/poll/181472/job-creation-lingers-near-seven-year-high.aspx?utm_source=ECONOMY&utm_medium=topic&utm_campaign=tiles

¹⁸ Dugan, A. (2014, January 15). *More Americans worse off financially than a year ago*. Retrieved from <http://www.gallup.com/poll/166850/americans-worse-off-financially-year-ago.aspx>

¹⁹ Clark, C. (2015). *Find your dream job: Success stories*. Retrieved from <http://www.iwillteachyoutoberich.com/success-stories/dreamjob/?u=chris-clark>

²⁰ Bovino, B. A. (2015, February 3). *U.S. weekly economic roundup: High spirits*. Retrieved from http://www.housingviews.com/2015/02/03/u-s-weekly-economic-roundup-high-spirits/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+HousingViews+%28HousingViews+-+S%26P%27s+Blog+on+the+Housing+Market%29

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